

STUDIES OF STOLING ON MARINE PRESETTLING
FROM LARVAE OF TERENGGANU

HONG HEEI @ FONG HEEI

DEPARTMENT OF MARINE SCIENCE
FACULTY OF SCIENCE AND TECHNOLOGY
UNIVERSITI SAINS DAN TEKNOLOGI MALAYSIA
(USTM)
2004

1100028941

PERPUSTAKAAN KOLEJ UNIVERSITI SAINS & TEKNOLOGI MALAYSIA (KUSTEM)			
Pengarang Hang Irece @ Fong Irece		No. Panggilan 410 FOT	
Judul Studies of otoliths on marine pre-settling.			
Tarikh	Waktu Pemulangan	Nombor Ahli	Tanda tangan
13/7/05	4.00 pm	UK9177	tiara
14/07/05	4.00 pm	UK7877	me

31/3/10

STUDIES OF OTOLITHS ON MARINE PRESETTLING FISH LARVAE OF
TERENGGANU

By

Hong Irece @ Fong Irece

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

FACULTY OF SCIENCE AND TECHNOLOGY
KOLEJ UNIVERSITI SAINS DAN TEKNOLOGI MALAYSIA
2004

120000011

This project report should be cited as:

Irece, H. 2004. Studies of otoliths on presettling marine fish larvae of Terengganu. Undergraduate thesis, Bachelor of Science in Marine Biology, Faculty of Science and Technology, College University of Science and Technology Malaysia, Terengganu. 127p.

No part of this project report maybe 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 supervisor(s) of the project.

1100028941



**JABATAN SAINS SAMUDERA
FAKULTI SAINS DAN TEKNOLOGI
KOLEJ UNIVERSITI SAINS DAN TEKNOLOGI MALAYSIA**

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

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk: **Studies of Otoliths on Presettling Marine Fish Larvae of Terengganu** oleh **Hong Irece @ Fong Irece, UK 5563** telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Samudera sebagai memenuhi sebahagian daripada keperluan memperoleh Ijazah Sarjana Muda Sains Biologi Marin, Fakulti Sains dan Teknologi, Kolej Universiti Sains dan Teknologi Malaysia.

Disahkan oleh:

Penyelia Utama : U
Nama: Prof. Madya Liew Hock Chark

Cop Rasmi:
LIEW HOCK CHARK
Fakulti Sains dan Teknologi
Kolej Universiti Sains dan Teknologi Malaysia
(KUSTEM)
21030 Kuala Terengganu, MALAYSIA

Tarikh:

Ketua Jabatan Sains Samudera

Nama:

Cop Rasmi:

ASSOC. PROF. DR. KAMARUZZAMAN B. YUNUS
Head

Department of Marine Science
Faculty of Science and Technology Malaysia
Kolej Universiti Sains dan Teknologi Malaysia
(KUSTEM)
21030 Kuala Terengganu.

Tarikh: 05-04-04

ACKNOWLEDGEMENTS

First of all I would like to thank God for all the blessings that He has granted on to me during the whole process of this project. Without His blessing, this project would not have been completed.

My greatest appreciation goes to my supervisor, Prof. Madya Liew Hock Chark for the effort and guide for me in this project. His ideas and suggestions has always been a good solution in times of difficulty of my project.

My next gratitude goes to Mdm Kartini, Mr. Che Zan and the rest of the lab assistant who has been generous enough to lend their helping hand during the laboratory process of this project.

Besides that, I would also like to send my thanks to Mr. Rahim for his kindness to provide me with accommodation and transportation during my sampling period and the staff of Fisheries Department of Terengganu for their help and assistance during my sampling time. Without their help, my sampling would not have been done easily.

Next, my greatest thanks and love goes to my parents, Mr. Hong Kain Leong and Mdm Yow Yin Lan, for their continuous support and words of love in everything that I have been doing. I love you both!

Last but not least, special appreciation to my friends especially Wei Min, Kian Weng, Kim Chuan, Audrey, Natt and the rest of them who have been much help to me during the whole process of this project.

-Irece-

TABLE OF CONTENTS

	Page
Approval form	ii
Acknowledgements	iii
Table of Contents	iv
List of Tables	vii
List of Figures	viii
List of Appendices	xii
Abstrak	xiii
Abstract	xiv
1.0 Introduction and Objectives	1
2.0 Literature Review	
2.1 Larval Ecology	4
2.2 Presettling Larvae	4
2.3 Labyrinth	7
2.4 Otolith	10
2.4.1 Otolith Structure	10
2.4.2 Growth of Otolith in Relation to Body Growth	11
3.0 Methodology	
3.1 Sampling	13
3.2 Sorting Fish Larvae	13

3.3	Removals and Storage of Larval Otoliths	14
3.4	Preparing Otoliths for Reading with the Light Microscope	14
3.5	Counting Growth Increments	15
3.6	Taking Photo of Otoliths	15

4.0 Results

4.1	Relationship between Otolith Diameter and Number of Otolith Rings	19
4.2	Relationship between Number of Otolith Rings and Total Length	29
4.3	Relationship between Total Length and Otolith Diameter	40
4.4	Comparison between the Families	
4.4.1	Otolith Diameter versus Number of Otolith Rings	50
4.4.2	Number of Otolith Rings versus Total Length	51
4.4.3	Total Length versus Otolith Diameter	53
4.5	Age at Presettling	54
4.6	Growth Rates of Presettling Fish Larvae	56

5.0 Discussion

5.1	Growth Rates	65
5.2	Age at Settling	69
5.3	Techniques	70

6.0 Conclusion	73
References	75
Appendices	79
Curriculum Vitae	127

LIST OF TABLES

Table 4.1	Data of otolith analysis of Scombridae presettling fish larvae.	78
Table 4.2	Data of otolith analysis of Gerreidae presettling fish larvae.	79
Table 4.3	Data of otolith analysis of Gobiidae presettling fish larvae.	80
Table 4.4	Data of otolith analysis of Lutjanidae presettling fish larvae.	81
Table 4.5	Data of otolith analysis of Carangidae presettling fish larvae.	82
Table 4.6	Data of otolith analysis of Nemipteridae presettling fish larvae.	82
Table 4.7	Data of otolith analysis of Apogonidae presettling fish larvae.	83
Table 4.8	Data of otolith analysis of Leiognathidae presettling fish larvae.	84
Table 4.9	Data of otolith analysis of Mullidae presettling fish larvae.	85
Table 4.10	Data of otolith analysis of Holocentridae presettling fish larvae.	86

LIST OF FIGURES

Figure 2.1	The labyrinth of cod, <i>Gadus morhua</i> (Blacker, 1964)	9
Figure 3.1	Sampling location at Redang Island, Terengganu.	16
Figure 3.2	Sampling location at Perhentian Island, Terengganu.	17
Figure 4.1	Otolith diameter versus number of otolith rings counted in Gobiidae presettling fish larvae of Redang Island and Perhentian Island.	19
Figure 4.2	Otolith diameter versus number of otolith rings counted in Scombridae presettling fish larvae of Redang Island and Perhentian Island.	20
Figure 4.3	Otolith diameter versus number of otolith rings counted in Gerreidae presettling fish larvae of Redang Island and Perhentian Island.	21
Figure 4.4	Otolith diameter versus number of otolith rings counted in Lutjanidae presettling fish larvae of Redang Island and Perhentian Island.	22
Figure 4.5	Otolith diameter versus number of otolith rings counted in Carangidae presettling fish larvae of Redang Island and Perhentian Island.	23
Figure 4.6	Otolith diameter versus number of otolith rings counted in Apogonidae presettling fish larvae of Redang Island and Perhentian Island.	24
Figure 4.7	Otolith diameter versus number of otolith rings counted in Leiognathidae presettling fish larvae of Redang Island and Perhentian Island.	25
Figure 4.8	Otolith diameter versus number of otolith rings counted in Nemipteridae presettling fish larvae of Redang Island and Perhentian Island.	26

Figure 4.9	Otolith diameter versus number of otolith rings counted in Mullidae presettling fish larvae of Redang Island and Perhentian Island.	27
Figure 4.10	Otolith diameter versus number of otolith rings counted in Holocentridae presettling fish larvae of Redang Island and Perhentian Island.	27
Figure 4.11	Number of otolith rings counted versus total length of Gobiidae presettling fish larvae of Redang Island and Perhentian Island.	29
Figure 4.12	Number of otolith rings counted versus total length of Scombridae presettling fish larvae of Redang Island and Perhentian Island.	30
Figure 4.13	Number of otolith rings counted versus total length of Gerreidae presettling fish larvae of Redang Island and Perhentian Island.	31
Figure 4.14	Number of otolith rings counted versus total length of Lutjanidae presettling fish larvae of Redang Island and Perhentian Island.	32
Figure 4.15	Number of otolith rings counted versus total length of Carangidae presettling fish larvae of Redang Island and Perhentian Island.	33
Figure 4.16	Number of otolith rings versus total larvae length of Apogonidae presettling fish larvae of Redang Island and Perhentian Island.	34
Figure 4.17	Number of otolith rings counted versus total length of Leiognathidae presettling fish larvae of Redang Island and Perhentian Island.	35
Figure 4.18	Number of otolith rings counted versus total length of Nemipteridae presettling fish larvae of Redang Island and Perhentian Island.	36
Figure 4.19	Number of otolith rings counted versus total length of Mullidae presettling fish larvae of Redang Island and Perhentian Island.	37
Figure 4.20	Number of otolith rings counted versus total length of Holocentridae presettling fish larvae of Redang Island and Perhentian Island.	38
Figure 4.21	Otolith diameter versus total length of Gobiidae presettling fish larvae of Redang Island and Perhentian Island.	40
Figure 4.22	Otolith diameter versus total length of Scombridae presettling fish larvae of Redang Island and Perhentian Island.	41

Figure 4.23	Otolith diameter versus total length of Gerreidae presettling fish larvae of Redang Island and Perhentian Island.	42
Figure 4.24	Otolith diameter versus total length of Lutjanidae presettling fish larvae of Redang Island and Perhentian Island.	43
Figure 4.25	Otolith diameter versus total length of Carangidae presettling fish larvae of Redang Island and Perhentian Island.	44
Figure 4.26	Otolith diameter versus total length of Apogonidae presettling fish larvae of Redang Island and Perhentian Island.	45
Figure 4.27	Otolith diameter versus total length of Leiognathidae presettling fish larvae of Redang Island and Perhentian Island.	46
Figure 4.28	Otolith diameter versus total length of Nemipteridae presettling fish larvae of Redang Island and Perhentian Island.	47
Figure 4.29	Otolith diameter versus total length of Mullidae presettling fish larvae of Redang Island and Perhentian Island.	48
Figure 4.30	Otolith diameter versus total length of Holocentridae presettling fish larvae of Redang Island and Perhentian Island.	49
Figure 4.31	Number of otolith rings counted versus otolith diameter of all presettling fish larvae family caught in Redang Island and Perhentian Island.	50
Figure 4.32	Number of rings counted in sagittae otolith versus total larvae length of all presettling fish larvae family caught from Redang Island and Perhentian Island.	52
Figure 4.33	Total larvae length versus otolith diameter of all presettling larvae family caught in Redang Island and Perhentian Island.	53
Figure 4.34	28 days old sagittae otoliths (diameter 265 μm) of 6.5 mm Gobiidae larvae mounted in Epoxy resin.	58
Plate 4.35	37 days old sagittae otoliths (diameter 252.5 μm) of 7.8 mm Nemipteridae larvae mounted in Epoxy resin	58
Plate 4.36	34 days old sagittae otoliths (diameter 252.5 μm) of 11.6 mm Gerreidae larvae mounted in Epoxy resin.	59

Plate 4.37	36 days old sagittae otoliths (diameter 250 μm) of 10.8 mm Lutjanidae larvae mounted in Epoxy resin.	59
Plate 4.38	36 days old sagittae otoliths (diameter 252.5 μm) of 8.8 mm Apogonidae larvae mounted in Epoxy resin.	60
Plate 4.6	39 days old sagittae otoliths (diameter 205 μm) of 5.8 mm Leiognathidae larvae mounted in Epoxy resin.	60
Plate 4.40	Presettling fish larvae of Redang and Perhentian Island	61

LIST OF APPENDICES

Appendix 1	Data analysis of otolith on presettling fish larvae from Redang Island and Perhentian Island.	79
Appendix 2	Regression analysis between size of sagittae otolith and number of otolith rings according to location.	88
Appendix 3	Regression analysis between number of otolith rings and total length of presettling fish larvae according to location.	97
Appendix 4	Regression analysis between otolith diameter and total larvae length according to location.	106
Appendix 5	Regression analysis of diameter of sagittae otolith and number of otolith rings according to family.	114
Appendix 6	Regression analysis between number of otolith rings and larvae length according to family.	119
Appendix 7	Regression analysis between larvae length and diameter of sagitta According to family.	123

ABSTRAK

Sebanyak 200 larva ikan disampel daripada tempat yang berlainan di kawasan perairan Pulau Redang dan Pulau Perhentian, Terengganu. Sampel larva ini dikutip dengan menggunakan jaring skop dan cahaya lampu. Sebanyak 10 famili telah dikenalpasti daripada jumlah sampel yang dikutip. Famili yang telah dikenalpasti daripada larva yang disampel adalah Gerreidae, Gobiidae, Holocentridae, Mullidae, Carangidae, Leiognathidae, Lutjanidae, Nemipteridae, Scombridae dan Apogonidae. Julat umur larva yang disampel adalah antara 23 hingga 44 hari. Julat ini diperolehi berpandukan teori bahawa satu gelang dihasilkan untuk satu hari pada otolit. Manakala julat panjang larva bagi sampel yang diperolehi daripada kedua-dua kawasan kajian ialah 4.8 mm hingga 11.7 mm.

ABSTRACT

A total of 200 presettling fish larvae were collected from different places in the waters of Redang Island and Perhentian Island, Terengganu. The samples were collected using scoop net together with light attraction. A total of 10 families were identified from the total larvae caught. Families of larvae that are identified are of Gerreidae, Gobiidae, Holocentridae, Mullidae, Carangidae, Leiognathidae, Lutjanidae, Nemipteridae, Scombridae and Apogonidae. The range of larvae age is between 23 to 44 days old. Meanwhile, larvae length of samples collected from both places is 4.8 mm to 11.7 mm.