

# The Living Fossil (Horseshoe crab)

**Kamaruzzaman Yunus**

**Akbar John**

**Ahmed Jalal Khan Chowdhury**

**Zaleha Kassim**



**IIUM PRESS**

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

# **The Living Fossil (Horseshoe crab)**

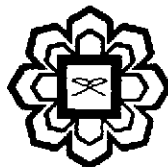
**Editors,**

**Kamaruzzaman Yunus**

**Akbar John**

**Ahmed Jalal Khan Chowdhury**

**Zaleha Kassim**



**IIUM Press**

Published by:  
IIUM Press  
International Islamic University Malaysia

First Edition, 2011  
© IIUM Press, IIUM

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without any prior written permission of the publisher.

Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

Kamaruzzaman Yunus  
The Living Fossil (Horseshoe crab)  
Kamaruzzaman Yunus  
Include index  
Bibliography: p.  
ISBN

ISBN: 978-967-418-042-3

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM  
(Malaysian Scholarly Publishing Council)

Printed by :  
IIUM PRINTING SDN.BHD.  
No. 1, Jalan Industri Batu Caves 1/3  
Taman Perindustrian Batu Caves  
Batu Caves Centre Point  
68100 Batu Caves  
Selangor Darul Ehsan

# Table of Contents

Chapters	Titles	Page No
1.	Global distribution and Taxonomy of extant horseshoe crabs..... (5410/18557)	1
2.	Limiting factors on the global distribution of horseshoe crabs..... (5410/18558)	11
3.	Site selection and nesting behaviour of horseshoe crabs with special reference to <i>Limulus polyphemus</i> ..... (3575/18560)	19
4.	Distribution of horseshoe crabs at their nesting grounds, East coast of Peninsular Malaysia..... (5410/18560)	27
5.	Hydrology of horseshoe crab nesting ground at Pahang coast –Part 1..... (3575/18563)	35
6.	Hydrology of horseshoe crab nesting ground at Pahang coast –Part 2..... (3575/18566)	47
7.	Physicochemical parameters relationship at the horseshoe crab nesting grounds of Pahang coast, Malaysia..... (5410/18567)	57
8.	Macrobenthic diversity at the Horseshoe Crab nesting ground, Balok station, Pahang, Malaysia – Part 1 ..... (3575/18568)	69
9.	Macrobenthic diversity at the Horseshoe Crab nesting ground, Balok station, Pahang, Malaysia – Part 2 ..... (3575/18570)	83
10.	Macrobenthic diversity at the Horseshoe Crab nesting ground, Pekan station, Pahang, Malaysia – Part 1 ..... (5410/18571)	95
11.	Macrobenthic diversity at the Horseshoe Crab nesting ground, Pekan station, Pahang, Malaysia – Part 2 ..... (3575/18573)	109
12.	Influence of physicochemical parameters on the macrobenthic diversity and abundance in horseshoe crab nesting grounds, East coast of Peninsular Malaysia. .... (5410/18574)	127
13.	<i>In-vitro</i> study on the effect of salinity on the hatching success of Malaysian Horseshoe crab eggs..... (3575/18575)	137
14.	Effects of salinity on the early growth of <i>Tachypleus gigas</i> larvae - An <i>In-vitro</i> study..... (3575/18577)	147

15. Sediment characteristics of horseshoe crabs nesting ground at Balok station, Pahang, Malaysia .....	(5410/18579)	155
16. Sediment Profiling of the Estuarine Nesting Ground of Horseshoe Crabs at East Peninsular Malaysia .....	(3575/19587)	165
17. Bioaccumulation of some essential metal concentration in Malaysian horseshoe crabs ( <i>Tachypleus gigas</i> ).....	(5410/18584)	175
18. Cu and Cd Bioaccumulation in Malaysian Horseshoe Crab .....	(5410/18585)	183
19. Metal concentration in horseshoe crab nesting ground along Pahang coast, Malaysia.....	(5410/18586)	193
20. Bionomics of Malaysian horseshoe crabs <i>Tachypleus gigas</i> .....	(5410/19718)	203
21. Feeding Ecology of Mangrove horseshoe crab <i>Carcinoscorpius rotundicauda</i> .....	(5410/19717)	213
22. Emerging interest on DNA barcoding technology and its application for high-tech biodiversity studies using COI gene as a reference sequence .....	(3575/19716)	225
23. Can DNA barcode accurately delineate living fossil (Horseshoe crab) and its different developmental stages?.....	(5410/19715)	237
24. Revision on the molecular phylogeny of horseshoe crabs – Part 1.....	(5410/19717)	251
25. Revision on the molecular phylogeny of horseshoe crabs – Part 2.....	(5410/19720)	267
26. Genetic Diversity of <i>Tachypleus gigas</i> Population from West coast of peninsular Malaysia .....	(3575/19727)	275
27. Does continental drift influence in the genetic variability among the horseshoe crab population? .....	(3575/19727)	287
28. Evolution of horseshoe crabs – paleontological and Molecular viewpoint.....	(3575/19731)	297
29. Factors involving in the clot formation of horseshoe crab blood.....	(5410/19711)	307
30. Methods for bacterial endotoxin quantification in reference to horseshoe crab blood studies .....	(5410/19740)	317
31. ENDO SENSOR (TAL) production from Malaysian Horseshoe crab blood.....	(5410/19744)	325
32. Characterization of <i>Tachypleus</i> Amebocyte Lysate (TAL).....	(3575/19759)	333

33. Environmental and Pharmaceutical applications of Amebocytes Lysate (LAL/TAL) from Horseshoe crabs .....	(5410/19751)	343
34. <i>Tachypleus gigas</i> mortality due biomedical bleeding process .....	(3575/19756)	351
35. Conservation measures on horseshoe crab population – A global view.....	(5410/19759)	359
Glossary.....		369

## CHAPTER – 35

### Conservation measures on horseshoe crab population – A global view

Kamaruzzaman, B.Y., Akbar John, B., Jalal, K.C.A.

*Institute of Oceanography and Maritime studies (INOCEM), Kulliyah of Science, International Islamic University Malaysia, Jalan Sultan Ahmad Shah, Bandar Indera Mahkota, 25200, Kuantan Pahang, Malaysia*

#### Abstract

Numbers of studies were conducted/being carried out to preserve the dwindling horseshoe crab population around the world. Various managemental measures such as horseshoe crabs protected areas, and horseshoe crab sanctuaries are very effectively helping in reducing the anthropogenic pressure on horseshoe crab population. Present paper was aimed to address various conservational measures and major stake holders involved in sustainable fishery management of horseshoe crab population around the world. Present paper also gives some insight on the major studies carried out to conserve the horseshoe crab population in Malaysia.

**Key words:** horseshoe crab, conservation, protected areas, Malaysia.

#### Introduction

It is widely postulated that the global horseshoe crab population is declining in an alarming rate. Significant reduction in the number of spawning individuals of *L. polyphemus* in Delaware Bay was observed (Eagle, 2001), and a drop of 90% in egg intensity was recorded at the same place in the 1990s (Loveland, 2001). Decline in abundance was also noted at Chesapeake Bay (Bell and Henderson, 1993, Morton and Lee, 2003). *T. tridentatus* had been eliminated from many parts of western Japan, the northernmost latitude of their distribution, over the past half century, and the remaining population was approaching extinction (Sekiguchi, 1988; Itow, 1993, Botton, 2001). In China, it is now rare to see major communities of *T. tridentatus* north of Xiamen (Liao and Ye, 2000). Most of the populations are found in the southern provinces, in particular at Gulf of Tonkin north of Hainan, where the biggest population of *C. rotundicauda* in China was found