

ASSESSMENT OF TAG LOSS AND PHOTOGRAPHIC
IDENTIFICATION OF SEA TURTLES AT CHAGAR HUTANG,
REDANG ISLAND

VICKI CHEW YII CHING

FACULTY OF MARITIME STUDIES AND MARINE SCIENCE
UNIVERSITI MALAYSIA TERENGGANU

2011

**ASSESSMENT OF TAG LOSS AND PHOTOGRAPHIC IDENTIFICATION OF
SEA TURTLES AT CHAGAR HUTANG, REDANG ISLAND**

By

Vicki Chew Yii Ching

**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
2011**

This project report should be cited as:

Chew, V.C.Y. 2011. Assessment of tag loss and photographic identification of sea turtles at Chagar Hutang, Redang Island. Undergraduate thesis, Bachelor of Science in Marine Biology, Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu, Terengganu. 77p.

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 supervisor(s) of the project.

LP
62
EMAP
3
2011



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

**DECLARATION AND VERIFICATION REPORT
FINAL YEAR RESEARCH PROJECT**

It is hereby declared and verified that this research report entitled:

Assessment of Tag Loss and Photographic Identification of Sea Turtles at Chagar Hutang, Redang Island by Vicki Chew Yii Ching, Matric No. UK16956 have been examined and all errors identified have been corrected. This report is submitted to the Department of Marine Science as partial fulfillment towards obtaining the Degree of **Bachelor of Science (Marine Biology)**, Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu.

Verified by:

Principal Supervisor

Name: Assoc. Prof. Liew Hock Chark

Official stamp: **MADYA LIEW HOCK CHARK**

Pensyarah
Jabatan Sains Marin
Fakulti Pengajian Maritim Dan Sains Marin
Universiti Malaysia Terengganu
21030 Kuala Terengganu

Date: 23/4/2011

Second Supervisor (where applicable)

Name: Dr. Juanita Joseph

Official stamp:

DR. JUANITA JOSEPH
Lecturer
Institute Of Oceanography
Universiti Malaysia Terengganu
21030 Kuala Terengganu, Terengganu.

Date: 23/4/2011

Head of Department of Marine Science

Name: Dr. Razak bin Zakariya

Official stamp:

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

Date: 23/4/2011

ACKNOWLEDGEMENTS

First and foremost, I would like to thank my supervisors, Assoc. Prof. Liew Hock Chark and Dr. Juanita Joseph for their invaluable guidance, advices and constructive comments on the entire duration of the study. Besides that, this research project would not have been possible if it were not for SEATRU and Laguna Redang Beach Resort. I sincerely thank SEATRU for sponsoring my meals and accommodation at Chagar Hutang, and Laguna Redang Beach Resort for sponsoring my ferry trips into and out of the island. I would also like to express my deep appreciation to the SEATRU staff at Chagar Hutang, Mann, Mahadi and Fifi, the 2010 volunteers and my friends Faezah Noor, Nor Azri Shah and Randymiller Marcus for helping me continuously during my field sampling. It was an honor for me to work alongside with them. To Lim Puay Aun, my heartfelt gratitude goes to you for patiently helping me with the Adobe Photoshop CS4 software. I am also grateful to my lecturers, friends and course mates in UMT for the endless encouragement and moral support they have given me throughout these three years. Finally, yet importantly, I would like to express my heartfelt thanks to my family members for their continuous support and for standing by me through thick and thin.

TABLE OF CONTENTS

| | Page |
|--|-------------|
| ACKNOWLEDGEMENTS | ii |
| LIST OF TABLES | vi |
| LIST OF FIGURES | vii |
| LIST OF ABBREVIATIONS | ix |
| LIST OF APPENDICES | x |
| ABSTRACT | xi |
| ABSTRAK | xiii |
| | |
| CHAPTER 1: INTRODUCTION | 1 |
| 1.1 Research Problem and Justification | 1 |
| 1.2 Objectives | 6 |
| | |
| CHAPTER 2: LITERATURE REVIEW | 7 |
| 2.1 Tagging | 7 |
| 2.2 Types of tags | 9 |
| 2.2.1 Plastic tags | 9 |
| 2.2.2 Monel tags | 10 |
| 2.2.3 Inconel tags | 11 |
| 2.2.4 Titanium tags | 12 |
| 2.2.5 Passive Integrated Transponder (PIT) | 12 |
| 2.2.6 Satellite Telemetry | 14 |
| 2.2.7 Radio Telemetry | 15 |
| 2.2.8 Photographic Identification | 16 |
| 2.3 Tag Loss | 17 |

| | |
|--|----|
| CHAPTER 3: METHODOLOGY | 19 |
| 3.1 Study Area | 19 |
| 3.2 Method | 21 |
| 3.2.1 Tagging | 21 |
| 3.2.1(a) Tag application | 22 |
| 3.2.1(b) Tagging position | 23 |
| 3.2.2 Tag loss estimation | 24 |
| 3.2.2(a) Intra-seasonal assessment | 24 |
| 3.2.2(b) Inter-seasonal assessment | 25 |
| 3.2.3 Photographic Identification | 26 |
| 3.2.3(a) Comparisons between individual sea turtles based on scute patterns as adapted from Reisser <i>et al.</i> (2008) | 27 |
| 3.2.3(b) Comparisons between individual sea turtles by a coding system adapted from Jean <i>et al.</i> (2010) | 28 |
| 3.2.4 Statistical Analysis | 31 |
| CHAPTER 4: RESULTS | 32 |
| 4.1 Tag Loss Assessments | 32 |
| 4.1.1 Intra-seasonal assessment | 32 |
| 4.1.2 Inter-seasonal assessment | 37 |
| 4.1.2(a) Inconel tag loss | 37 |
| 4.1.2(b) Titanium tag loss | 37 |
| 4.2 Photographic Identification | 40 |
| 4.2.1 Comparisons between individual sea turtles based on scute patterns as adapted by Reisser <i>et al.</i> (2008) | 41 |
| 4.2.1(a) Images catalogued for the 1 st sighting | 41 |

| | | |
|---|---|----|
| 4.2.1(b) | Images catalogued for returning/re-sighted sea turtles (2 nd and 3 rd sighting) | 42 |
| 4.2.1(c) | Determination of symmetry between the left and right profiles | 43 |
| 4.2..2 | Comparisons between individual sea turtles by a coding system adapted from Jean <i>et al.</i> (2010) | 44 |
| CHAPTER 5: DISCUSSION | | 49 |
| 5.1 | Tag Loss Assessments | 49 |
| 5.1.1 | Intra-seasonal assessment | 49 |
| 5.1.2 | Inter-seasonal assessment | 51 |
| 5.1.2(a) | Inconel tag loss | 51 |
| 5.1.2(b) | Titanium tag loss | 52 |
| 5.2 | Photographic Identification | 55 |
| 5.2.1 | Comparisons between individual sea turtles based on scute patterns as adapted from Reisser <i>et al.</i> (2008) | 57 |
| 5.2.1(a) | Images catalogued for the 1 st sighting | 57 |
| 5.2.1(b) | Images catalogued for returning/re-sighted sea turtles (2 nd and 3 rd sighting) | 59 |
| 5.2.1(c) | Determination of symmetry between the left and right profiles | 60 |
| 5.2..2 | Comparisons between individual sea turtles by a coding system adapted from Jean <i>et al.</i> (2010) | 60 |
| CHAPTER 6 : CONCLUSION AND RECOMMENDATIONS | | 62 |
| REFERENCES | | 65 |
| APPENDICES | | 74 |
| CURRICULUM VITAE | | 77 |

LIST OF TABLES

| Table | Page |
|---|------|
| 4.1 Early group (1993 and 1994) intra-seasonal probability of tag loss, arcsine transformation and standard deviation, SD for <i>Chelonia mydas</i> . | 33 |
| 4.2 Mid-group (2000 and 2001) and most recent group (2009 and 2010) intra-seasonal probability of inconel tag loss, arcsine transformation and standard deviation, SD for <i>Chelonia mydas</i> . | 34 |
| 4.3 Intra-seasonal probability of inconel tag loss, arcsine transformation and standard deviation, SD for <i>Chelonia mydas</i> for all six years combined. | 36 |
| 4.4 Inter-seasonal tag loss probability, arcsine transformation and standard deviation, SD for <i>Chelonia mydas</i> from years 1993 till 2010. | 38 |
| 4.5 Number of individuals photographed and number of profiles used for the validation tests of the photographic identification method for green and hawksbill turtles. | 40 |
| 4.6 Coding for each individual sea turtle profile. | 46 |

LIST OF FIGURES

| Figure | Page |
|--|------|
| 3.1 Sampling site at Chagar Hutang Turtle Sanctuary, Redang Island, Terengganu. | 20 |
| 3.2 Inconel tag with tag applicator (a) and serial number on inconel tags (b) used by SEATRU in their long-term sea turtle conservation at Chagar Hutang. | 22 |
| 3.3 Inconel tag applied between the second and third scale of a green turtle. | 23 |
| 3.4 Profile of the sea turtle being photographed using a digital camera (SONY DSC-T2 – 8.1 Megapixels). | 26 |
| 3.5 The coding profile of a green turtle’s left profile (a) and a hawksbill turtle’s right profile (b) based on the position and shape of the scutes. The white dotted lines represents the limits of the profile (Jean <i>et al.</i> , 2010). | 29 |
| 3.6 A series of 3-digit codes assigned for each profile based on the position and shape of the scutes. The first number of the 3-digit code represents the row (R) number. The second number represents the position (P) of the scute in that row and the third represents the number of sides of the scute. | 30 |
| 4.1 Intra-seasonal probability of tag loss, (arcsine transformation) p_s' , of titanium and inconel tags. | 35 |
| 4.2 Intra-seasonal probability of tag loss, (arcsine transformation) p_s' , of inconel tags for six years combined. | 36 |
| 4.3 Inter-seasonal probability of tag loss, (arcsine transformation) p_i' , of titanium and inconel tags from years 1993 – 2010. | 39 |
| 4.4 Left profiles of two different individuals of <i>Chelonia mydas</i> (G1 and G2) and <i>Eretmochelys imbricata</i> (H1 and H2). | 42 |
| 4.5 Two right profiles of the same <i>Chelonia mydas</i> individual photographed within a time interval of 18 days. Tag ID: 1414(left).1313(right). | 43 |
| 4.6 The right facial scute patterns of a green turtle (a) and the left profile which has been flipped horizontally (b). Both sides of the facial scute shapes and arrangements are not symmetrical. Tag ID: 1741(left).1742(right). | 43 |

- 4.7 Left profile code of two different green turtles showing similar 3-digit series. They were distinguished after comparison with their right profile codes. 45
- 5.1 A green turtle exhibiting an incomplete side to a scute. 58

LIST OF ABBREVIATIONS

| | | |
|--------|---|--|
| IUCN | - | International Union for Conservation of Nature |
| PIT | - | Passive Integrated Transponder |
| SEATRU | - | Sea Turtle Research Unit |

LIST OF APPENDICES

| Appendix | | Page |
|----------|---|------|
| 1 | SEATRU data sheet on turtle nesting and tagging. | 74 |
| 2 | Intra-seasonal paired <i>t</i> -test on the arcsine transformed data to compare tag loss between titanium and inconel tags for the early group (1993 and 1994). | 75 |
| 3 | Inter-seasonal paired <i>t</i> -test on the arcsine transformed data to compare tag loss between titanium and inconel tags. | 76 |

ABSTRACT

Sea turtle tagging enables us to obtain valuable information regarding various aspects of sea turtle biology. However, there is the problem of tag loss which causes bias in sea turtle studies. Photographic identification (photo-ID) would help alleviate this problem from occurring as it utilizes the natural facial markings to identify individuals. This study was carried out to estimate the extent of tag loss in green turtles of Chagar Hutang for both intra-seasonal and inter-seasonal, as well as to test the feasibility of photo-ID technique along-side inconel tagging. For tag loss assessment, tagging data from the Sea Turtle Research Unit (SEATRU) database was assessed using the model of Limpus (1992). Field sampling for photo-ID of the sea turtles was conducted between 13th May 2010 and 21st June 2010 at Chagar Hutang, Redang Island. The scute patterns were drawn using Adobe Photoshop CS4 and later compared manually. Assessment of tag loss was done for 951 green turtle individuals. Intra-seasonal analysis showed higher tag retention for inconel tags compared to titanium tags which could be attributed to tag design. The highest probability of inconel and titanium intra-seasonal tag loss was recorded at 0.037 and 0.068 respectively. Inter-seasonal inconel tag loss (highest tag loss probability = 0.500) exhibited a decline in tag retention rates with increase in tag years while titanium tag loss (highest tag loss probability = 0.231) indicated that titanium tag retention for green turtles of Chagar Hutang is independent of tag age. Positive results were obtained for photo-ID as all 43 green and 2 hawksbill turtles were correctly identified. Some individuals were observed to display incomplete sides to a scute which contributes to the diversity of patterns that can be found on sea turtles. Each sea turtle did not display similar symmetry between the left and right facial scutes while

profiles of green turtles which were re-sighted (9 – 30 day interval) did not display any changes in facial scute patterns. Photographic identification is a non-invasive method which utilizes natural facial markings to identify individuals. Besides reducing stress on the animals, this method is less costly. Most importantly, by implementing photo-ID as a complement to the flipper tagging method for the sea turtles of Chagar Hutang, problems of misidentification of individual sea turtles due to tag loss would be alleviated.

**Kajian Penganggaran Kadar Kehilangan “Tag” Dan Foto-ID Penyu Agar
(*Chelonia mydas*) dan Penyu Karah (*Eretmochelys imbricata*) Di Chagar Hutang,
Pulau Redang**

ABSTRAK

Penandaan penyu membantu dalam mendapatkan maklumat berguna dalam pelbagai aspek biologi penyu. Akan tetapi, terdapat masalah kehilangan “tag” yang menyebabkan ralat berlaku dalam kajian ke atas penyu. Teknik foto-ID dijangka dapat membantu dalam mengatasi masalah ini di mana tanda-tanda semula jadi yang terdapat di badan haiwan digunakan untuk mengenalpasti setiap individu penyu. Kajian ini dijalankan untuk menganggar kadar kehilangan “tag” pada penyu agar di Chagar Hutang antara dan dalam satu musim serta menguji kerbekesanan menggunakan foto-ID bersama dengan penandaan tag inconel. Untuk penilaian kadar kehilangan tag, data-data diperolehi daripada pengkalan data Sea Turtle Research Unit (SEATRU) dan dinilai menggunakan model Limpus (1992). Kerja lapangan untuk foto-ID ke atas penyu dijalankan dari 13 Mei 2010 sehingga 21 Jun 2010 di Chagar Hutang, Pulau Redang. Corak sisik wajah dilukis menggunakan Adobe Photoshop CS4 dan kemudian dibanding secara manual. Penilaian kadar kehilangan “tag” dijalankan ke atas 951 individu penyu. Analisis intra-musim (dalam masa jangka satu musim) menunjukkan kadar kehilangan yang lebih tinggi bagi tag inconel berbanding dengan tag titanium yang boleh dikaitkan dengan rekaan tag. Kebarangkalian tertinggi untuk kehilangan tag intra-musim bagi inconel dan titanium yang dicatat masing-masing adalah 0.037 dan 0.068. Bagi inter-musim (antara musim), kadar kehilangan tag inconel (kebarangkalian tertinggi = 0.500) menunjukkan penurunan kadar retensi dengan peningkatan usia tag manakala kadar

kehilangan tag titanium (kebarangkalian tertinggi = 0.231) menunjukkan kadar retensi tag titanium bagi penyu agar di Chagar Hutang tidak dipengaruhi dengan usia tag. Keputusan positif diperolehi untuk foto-ID kerana kesemua 43 ekor penyu agar dan 2ekor penyu karah dapat dikenalpasti dengan betul. Terdapat beberapa individu penyu yang menunjukkan corak yang tidak lengkap. Ini menyumbang kepada kepelbagaian corak yang terdapat pada penyu. Corak sisik di kedua-dua belah wajah juga adalah berbeza dalam setiap individu penyu. Selain itu, profil sisik penyu agar yang kembali (antara 9-30 hari) tidak menunjukkan perbezaan dalam corak sisik. Foto-ID merupakan kaedah bukan invasif yang menggunakan corak sisik semulajadi penyu untuk pengenalpastian. Di samping mengurangkan tekanan ke atas penyu, kaedah ini juga adalah lebih jimat dari segi kewangan. Yang paling penting, dengan pelaksanaan foto-ID sebagai pelengkap kepada penandaan tag pada flipper penyu di Chagar Hutang, masalah kesalahan pengenalan individu penyu dapat dielakkan.