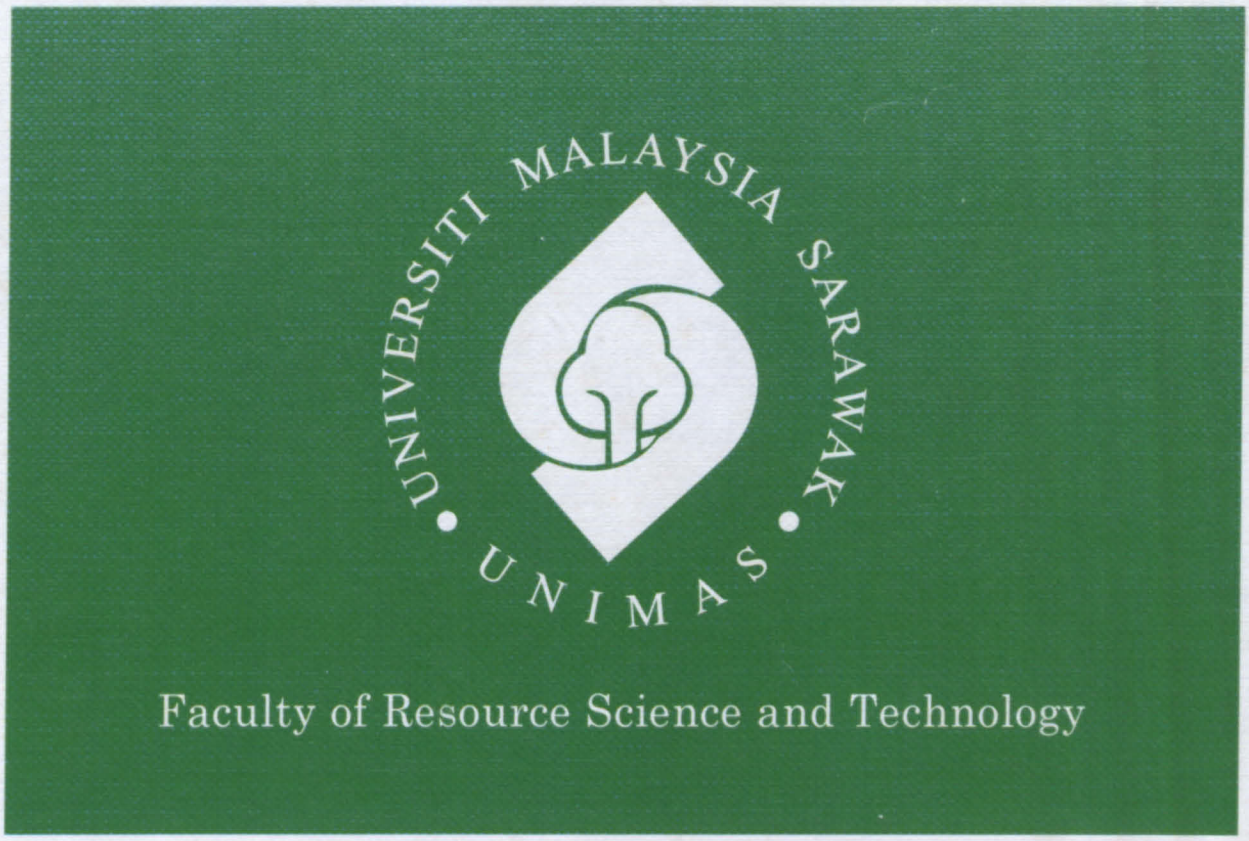


# Possible Causes Responsible for Green Sea Turtle Hatchlings Mortality in Captivity

**Norzuliana Zulkifli**
**37813**

**Bachelor of Science with Honours**
**(Aquatic Resource Science and Management)**
**2015**

Borang PTA4

**Borang Pengesahan**
**Laporan Projek Tahun Akhir (STF3015)**

Fakulti Sains dan Teknologi Sumber
Universiti Malaysia Sarawak

Saya NORZULIANA ZULKIFLI (nama) no. pelajar 37813 mengaku telah membuat perubahan yang perlu* / ~~tidak ada perubahan~~ terhadap Laporan Projek Tahun Akhir yang bertajuk:

possible causes responsible for Green Sea Turtle Hatchlings mortality in Captivity

Bersama ini saya kemukakan 3 salinan Laporan Projek Tahun Akhir dan 1 salinan 'softcopy' Laporan berkenaan.

Tandatangan Pelajar

( NORZULIANA ZULKIFLI )

Tandatangan Penyelia

(Nama & Cop rasmi)

Dr Rahana Hassan
Head of Department
Department of Aquatic Science
Faculty of Resource Science and Technology
Universiti Malaysia Sarawak
94300 Kota Samarahan

**Pengesahan**
Tandatangan Ketua Program

(Nama & Cop Rasmi)

Dr Rahana Hassan
Head of Department
Department of Aquatic Science
Faculty of Resource Science and Technology
Universiti Malaysia Sarawak
94300 Kota Samarahan

* - potong yang tidak berkaitan

**UNIVERSITI MALAYSIA SARAWAK**

Grade: A-

**Please tick (√)**

Final Year Project Report ☑

Masters ☐

*PhD* ☐

## DECLARATION OF ORIGINAL WORK

This declaration is made on the 1st day of July year 2015

**Student's Declaration**:

I NORZULIANA ZULKIFLI, 37813, FSTS

(PLEASE INDICATE NAME, MATRIC NO. AND FACULTY) hereby declare that the work entitled, Possible Causes Responsible for Green Sea Turtle Hatchlings Mortality in Captivity is my original work. I have not copied from any other students' work or from any other sources with the exception where due reference or acknowledgement is made explicitly in the text, nor has any part of the work been written for me by another person.

1 July 2015

~~2 June 2015~~

Date submitted

NORZULIANA ZULKIFLI (37813)

Name of the student (Matric No.)

**Supervisor's Declaration:**

I, Dr. RUHANA HASSAN (SUPERVISOR'S NAME), hereby certify that the work entitled, Possible Causes Responsible for Green Sea Turtle Hatchlings Mortality in Captivity (TITLE) was prepared by the aforementioned or above mentioned student, and was submitted to the "FACULTY" as a * partial/full fulfillment for the conferment of BSc (Hons) Aquatic Resource Science and Management (PLEASE INDICATE THE DEGREE TITLE), and the aforementioned work, to the best of my knowledge, is the said student's work

1 July 2015

Received for examination by: Dr. RUHANA HASSAN

(Name of the supervisor)

Date: ~~2 June 2015~~

I declare this Project/Thesis is classified as (Please tick (√)):

☐ **CONFIDENTIAL** (Contains confidential information under the Official Secret Act 1972)*
☐ **RESTRICTED** (Contains restricted information as specified by the organisation where research was done)*
☑ **OPEN ACCESS**

I declare this Project/Thesis is to be submitted to the Centre for Academic Information Services (CAIS) and uploaded into UNIMAS Institutional Repository (UNIMAS IR) (Please tick (√)):

☑ **YES**
☐ **NO**

**Validation of Project/Thesis**

I hereby duly affirmed with free consent and willingness declared that this said Project/Thesis shall be placed officially in the Centre for Academic Information Services with the abide interest and rights as follows:

- This Project/Thesis is the sole legal property of Universiti Malaysia Sarawak (UNIMAS).
- The Centre for Academic Information Services has the lawful right to make copies of the Project/Thesis for academic and research purposes only and not for other purposes.
- The Centre for Academic Information Services has the lawful right to digitize the content to be uploaded into Local Content Database.
- The Centre for Academic Information Services has the lawful right to make copies of the Project/Thesis if required for use by other parties for academic purposes or by other Higher Learning Institutes.
- No dispute or any claim shall arise from the student himself / herself neither a third party on this Project/Thesis once it becomes the sole property of UNIMAS.
- This Project/Thesis or any material, data and information related to it shall not be distributed, published or disclosed to any party by the student himself/herself without first obtaining approval from UNIMAS.

Student's signature _____ (Date)

Supervisor's signature: _____ (Date)

Current Address:
KM 23&9, JALAN SS13, TAMAN SRI SUTERA, PENGKALAN
78000, ALOR GAJAH, MELAKA

Notes: * If the Project/Thesis is **CONFIDENTIAL** or **RESTRICTED**, please attach together as annexure a letter from the organisation with the date of restriction indicated, and the reasons for the confidentiality and restriction.

[The instrument was prepared by The Centre for Academic Information Services]

# Possible Causes Responsible for Green Sea Turtle Hatchlings Mortality in Captivity

**Norzuliana Zulkifli**

**37813**

A thesis submitted in partial fulfillment of the

Final Year Project II (STF 3015) Course

**Supervisor: Dr. Ruhana Hassan**

Aquatic Resource Science and Management Programme

Department of Aquatic Science

Faculty of Resource Science and Technology

Universiti Malaysia Sarawak

28/05/2015

## ACKNOWLEDGEMENT

All praise to Allah the most gracious and the most merciful for lending me the outstanding strength to complete this final year project.

First and foremost, my highest gratitude goes to everyone who supports me throughout the course of this final year project especially to my courageous and ambitious supervisor, Dr. Ruhana Hassan. I am thankful for her aspiring guidance, invaluably constructive criticism and friendly advice during the project work. I am sincerely grateful to her for sharing his truthful and illuminating views on a number of issues related to the project.

I express my warm thanks to Madam Lucy anak Daru and Kak Tini for her support and priceless guidance during the completion of the course.

I would like to express my warm gratitude to my beloved parents, En. Zulkifli Mat Noor and Pn. Normah Nordin and all my family members for always giving me countless support on morale and materialistic from the day I was born up until the day where I stand today.

I would also like to thank my friends, Fatin Hasanah, Nur Azyan and Nur Darina; lab mates, Siti Sarah, Muhammad Farhan and Kak Su and all the people who provided me the facilities being required and conductive conditions for my final year project.

## DECLARATION

No portion of the work referred to in this dissertation has been submitted in support of an application for another degree qualification in this university or any other university or institution of higher learning.

Norzuliana Zulkifli

Aquatic Resource Science and Management Programme

Faculty of Resource Science and Technology

Universiti Malaysia Sarawak

## Table of Contents

**Tables of Figures**

# Possible Causes Responsible for Green Sea Turtle Hatchlings Mortality in Captivity

**Norzuliana Zulkifli**

Aquatic Resource Science and Management

Faculty of Resource Science and Technology

University Malaysia Sarawak

**Abstract**

Green sea turtle *Chelonia mydas* is classified as endangered species due to population declining over last 141 years. Many efforts had been carried out to conserve and protect *C. mydas* and one of them is head-starting program. *C. mydas* head-starting programs in Malaysia are still at the infancy stage. In Sarawak, the first systematic *C. mydas* head-starting program started in June 2014 and scheduled to end in May 2016. Lack of experience and information has led to problems related to handling of the hatchlings during the first stage of this project. Almost 50% of the hatchlings have died between June to October, due to unknown reason. Therefore, this project is designed to assess the possible causes of *C. mydas* hatchlings death in captivity during this head-starting program. A total of 70 individuals of *C. mydas* hatchling carcasses were examined. For all hatchlings (n=70), 86% died due to biting mark, 39% due to shrinking plastron, 33% due to blue or red mark, 16% due to bloated and 11% due bacterial infection on eye. Only small and medium ranks of characters (injuries or deformities) were found on the hatchlings. Mann-Whitney test showed that there is no significance differences between both Tank A and Tank B. This showed that deaths of the hatchlings are likely to occur by chance and not influenced by the characters and the size of the character intensity.

Keywords: *Chelonia mydas*, hatchlings, captivity, physical deformities.

***Abstrak***

*Penyu Hijau Chelonia mydas diklasifikasikan sebagai spesies terancam kerana penurunan kadar populasinya sejak 141 tahun yang lalu. Banyak usaha yang telah dijalankan untuk memulihara dan memelihara C. mydas dan salah satunya adalah program permulaan penyu. Di Malaysia, program permulaan penyu C. mydas masih di peringkat awal. Program permulaan penyu C. mydas yang pertama di Sarawak bermula pada Jun 2014 dan dijangka berakhir pada May 2016. Kurang pengalaman dan juga kemahiran dalam mengendalikan penyu ini telah menjurus kepada pelbagai masalah melibatkan pengendalian anak penyu pada peringkat awal projek ini. Hampir 50% daripada keseluruhan anak penyu yang mati di antara Jun dan Oktober, dan punca kematian tidak dikenalpasti. Oleh itu, projek ini direka bentuk untuk menilai sebab kematian mustahil semasa program permulaan penyu. Sebanyak 70 individu anak penyu C. mydas yang diperiksa. Bagi kesemua anak penyu, 86% mati kerana kesan gigitan, 39% mati kerana plastron mengecut, 22% kerana tanda biru dan merah, 16% kerana kembung, dan 11% mati kerana jangkitan bakteria pada mata. Hanya karakter bersaiz kecil dan sederhana yang didapati pada anak penyu. Ujian Mann-Whitney menunjukkan tiada perbezaan yang signifikan di antara Tangki A dan Tangki B. Hal ini menunjukkan kematian anak penyu berlaku secara kebetulan dan tidak dipengaruhi oleh karakter dan saiz keamatan karakter.*

*Kekunci: Chelonia mydas, anak penyu, kurungan, kecacatan fizikal.*

## 1.0 Introduction

*Chelonia mydas* is known as green sea turtle belonging to Phylum Chordata, Class Reptilia, Order Testudines, and Family Cheloniidae. According to International Union for Conservation of Nature, IUCN (2003), this species is classified as globally endangered. Extractive use of *C. mydas* for eggs, meat and other products is believed to be the major reasons for the decline (Seminoff, 2002). *C. mydas* are said to be long-lived and slow growing (Bjorndal et al., 2000; Chaloupka, 2002).

The size of *C. mydas* varies from the medium-sized to large. The weight of the adult *C. mydas* ranges from 135-150 kilograms while the hatchling's weight is up to 25 grams. The weight of *C. mydas* are said to be 230 kilograms in Atlantic and western Pacific Ocean, and less in the Indian Ocean and Carribean (Pritchard & Mortimer, 1999). The length of the adult *C. mydas* can be up to 1 meter while the hatchling is 55 millimeters with the straight carapace length to about 1.2 meters (Pritchard & Mortimer, 1999). The largest nesting female *C. mydas* can be up to 1.17 meters (Watson, 2006). The average lifespan of *C. mydas* is unknown but their sexual maturity occurs anywhere between 20-50 years.

Adult *C. mydas* are herbivorous that feed on sea grasses and algae while during the hatchlings, feed on invertebrates such as crabs, jellyfish and sponges. Ernst & Barbour (1989) claimed that the adult *C. mydas* is omnivorous, while the hatchlings are more carnivorous. Bjorndal (1980) stated that *C. mydas* is the major seagrass consumer in tropical and subtropical waters and it is the only reptilian seagrass consumer.

Subsequently, the importance of *C. mydas* in the seagrass ecosystem has decreased as its population have decline (Bjorndal, 1980).

Due to presumed high mortality of *C. mydas* in the small size classes during the hatchling years, largely from predation, it is argued that recruitment to wild breeding can be augmented by releasing larger sized turtles that are less subject to predation in a process termed "head starting" (Eckert et al., 1999). This program has been established in many countries such as Tamaulipas State, Mexico (Caillouet et al., 1987), Cayman Turtle Farm (Bell & Parsons, 2002) and French Frigate Shoals (Balazs et al., 2000). The main objective of this program is to conserve the wild turtle population from rapid decline. The hatchling are cared and raised to at least 2 years before they are released back to the sea. During these two years period, the hatchlings are allowed to grow to a size that could afford some of the protection level against the natural predators. Thus, the chances of survival of the new released hatchling are higher.

Turtle head starting program in Malaysia is still at the infancy stage. One of the latest head starting programs is currently being carried out in collaboration between Universiti Malaysia Sarawak (UNIMAS) and industrial partner of Pandan Gold Coast Holiday Villa, Lundu. Lack of experience and information usually lead to problems in handling the hatchlings and affects the success of the program. The number of mortality of the hatchlings is relatively higher during the first three months and the causes of death are still unknown. Thus, this study aims to examine and document the possible causes of

death of the *C. mydas* hatchlings in terms of physical deformities. Data obtain will help in future management of head-starting programs in Malaysia.

## 2.0 Literature Review

### 2.1 *Chelonia mydas*

The common name of this turtle is green turtle that is derived from the greenish colour of its body (Ernst & Barbour, 1989). *C. mydas* is by far the most extensively distributed sea turtle species in the Southeast Asian region (Talib et al., 2004). It is also the common sea turtle in Borneo and west Malaysia (Liat & Das, 1999). This species is listed in the IUCN Red List of Threatened Animals as 'Endangered', and in Appendix 1 of Convention on International Trade in Endangered Species (CITES).

#### 2.1.1 Taxonomy

The taxonomy of the green sea turtle is as follow (adapted from Ernst & Barbour, 1989):

Kingdom: Animalia

Phylum: Chordata

Order: Testudines

Family: Cheloniidae

Genus: *Chelonia*

Species: *C. mydas*

Local name of *C. mydas* are *Penyu agar, Penyu hijau, Penyu pulau* and *Penyu emegit.*

### 2.1.2 Morphology

The size of the *C. mydas* ranges from medium to large which is up to 153 cm (Ernst & Barbour, 1989). It has a single pair of prefrontal scales on the head and a serrated cutting edge at the lower jaw. The carapace of the *C. mydas* is broad, low and heart-shaped that lacks a vertebral keel and is serrated posteriorly. *C. mydas* comes with four pairs of pleurals where the first pleural does not touch the cervical. The carapacial scutes are olive to brown and may contain a mottled, radiating or wavy pattern (Figure 2.1). The bridge has four inframarginal scutes that lack pores. Ernst and Barbour (1989) stated that, the formula of the immaculate white or yellow plastron is abdominal, femoral, anal, gular, pectoral, humeral, intergular (Figure 2.2). All skin is brown or, sometimes, gray to black, and many head scales may have yellow margins. The horny inner surface of the upper jaw has well-developed vertical ridges, and the cutting edge of the lower jaw is strongly serrated. There are also presence of four postocular scales (Figure 2.3).

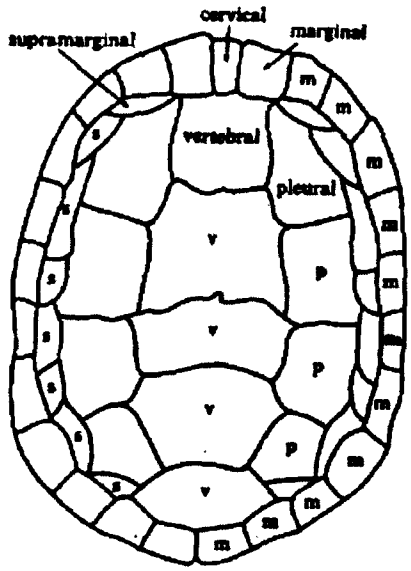


Figure 2.1: Carapacial scutes of turtles (adapted from Ernst & Barbour, 1989).

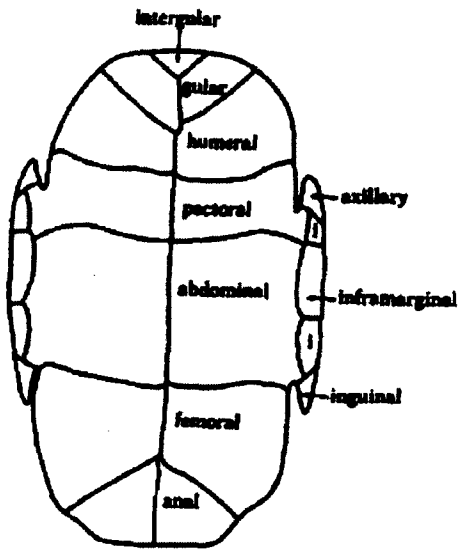


Figure 2.2: Plastral scutes of turtles (adapted from Ernst & Barbour, 1989).

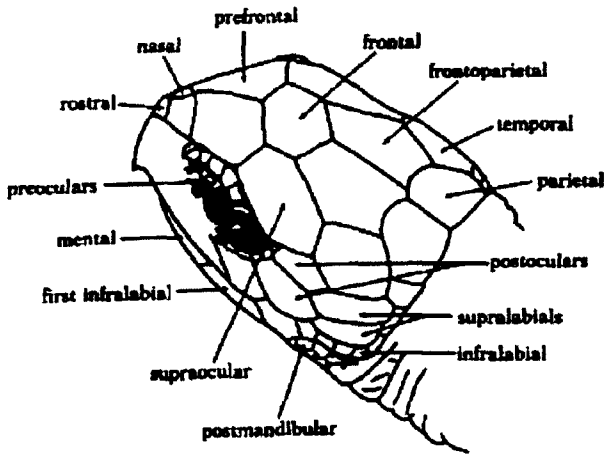


Figure 2.3: Head scalation of turtles (adapted from Ernst & Barbour, 1989).

Ernst & Barbour (1989) stated that, the carapace of *C. mydas* is more tapering posteriorly and the plastral hind lobe is narrower than in female. The male tails is strongly prehensile in a vertical plane, tipped with a heavy flattened nail and extends far beyond the posterior carapacial margin while in female; the tail barely reaches the margin (Ernst & Barbour, 1989). The male forelimb has a large, single and curved claw.

### 2.1.3 Distribution

*C. mydas* is globally distributed and generally found in tropical and subtropical waters along continental coasts and islands between 30° North and 30° South (Pritchard & Mortimer, 1999).The distribution of *C. mydas* ranges through the Atlantic, Pacific as well as Indian Ocean. Hodge (1981) stated that *C. mydas* can be found as far north in the Pacific such as Alaska while Brongersma (1972) mentioned that *C. mydas* also can be found in the Atlantic to Great Britain. Nesting occurs in over 60 countries throughout the year and inhabits coastal areas of more than 140 countries. In the United States for example, the *C. mydas* are found around the Virgin Islands and Puerto Rico while in the continental United States, *C. mydas* are found from Texas to Massachusetts.

### 2.1.4 Habitat

Green turtle occupy three different types of habitat: high-energy oceanic beaches, convergence zone in the pelagic habitat, and benthic feeding grounds in relatively shallow and protected areas. Mortimer (1982) stated that *C. mydas* inhabit the neritic zone, occurring in near shore and inshore waters where they forage primarily on sea grasses and algae. During migration from foraging areas to breeding areas and back, *C. mydas* will temporarily inhabit the oceanic zone (Mortimer, 1982). Some of these long-distance reproductive migrations are spectacular feats, with turtles swimming thousands of kilometers across the open ocean directly to beaches located on small, isolated oceanic islands (Carr, 1965; Luschi et al., 1998).

### 2.1.5 Migration

*C. mydas* are likely to migrate across the open seas but its feed in shallow water that contains variety of submerged vegetation. *C. mydas* feeds on algae and seagrass. Parsons (1962) mentioned that the correlation between the distribution of the green turtle and the seagrass has been noted. However, in some areas where the seagrass are lacking, *C. mydas* will feed on algae such as the coast of Brazil, the Galapagos Islands (Pritchard, 1971) and the Gulf of California (Felger & Moser, 1973). The importance of *C. mydas* in the seagrass ecosystem has decreased as its population has declined (Bjorndal, 1980).

Female *C. mydas* migrates from foraging areas to their natal beaches every 2-4 years and show a high degree of nesting site fidelity (Miller, 1997). Meylan et al. (1992) stated that mating may occur *en route* to the nesting beach, either far from the nesting beach (Limpus, 1993), or near shore the nesting beach (Godley et al., 2002). According to Miller (1997), the females oviposit an average of three clutches at 10-17 days intervals, and remain near the nesting beach during the inter-nesting period (Dizon & Balazs, 1982).

### 2.1.6 Nesting Sites in Malaysia

*C. mydas* is known to nest on the beach of all countries of the region (Talib, 2004). The major nesting sites found in Peninsular Malaysia are on Redang Island, Paka and Geliga in Terengganu. In Pahang, Chendor is the main green turtle rookery even though nesting is also reported on the offshore islands and other remote beaches at Pekan and Rompin.

The population of *C. mydas* at Pantai Segari in Perak constitutes the only significant nesting aggregation along the west coast of the Peninsular.

In East Malaysia, *C. mydas* nestings are concentrated on the Sarawak Turtle Islands of Talang Talang Besar, Talang Talang Kecil, Satang Besar and Turtle Islands of Sabah that is Bakkungaan Island, Selingaan Island and Gulisan Island. The annual nesting of *C. mydas* in Malaysia is estimated to be about 15,500 (Talib, 2004).

### 2.1.7 Threats to *C. mydas*

#### 2.1.7.1 Natural

##### 2.1.7.1.1 Biting

Fighting among the hatchlings is manifested as a progressive escalation of aggression (Ernst & Barbour, 1989). An aggressive turtle will follow another turtle, often at a distance at the bottom or below the surface. The distance soon closes, and the pursued turtle accelerates its swimming pace to gain distance and will followed by the aggressive turtle to match with the pursued turtle's speed. In an attempt to elude the aggressive turtle, the lead turtle will start to circle. The aggressive turtle will bite at the posterior carapace of the lead turtle, and will progress to biting at the rear flippers (Ernst & Barbour, 1989).In attempt to escape the aggressive turtle, the pursued turtle will come to the surface where the aggressive turtle will try to bite the front flippers and neck of the pursued turtle by coming up and over carapace.

#### 2.1.7.1.2 Bacterial and Viral Infections

The most common bacteria species isolated from sea turtles infections include *Vibrio, Aeromonas, Pseudomonas* and *Cryptophaga-Flavobacterium* (Glazebrook, 1990; Leong et al., 1989; George, 1997). *Streptococcus, Salmonella* and coliform bacteria have also been identified as pathogens in sea turtles (Glazebrook, 1990; Leong et al., 1989; George, 1997). According to Glazebrook (1990), many opportunistic bacteria such as *Vibrio* and *Flavobacterium* are naturally present in seawater and become pathogenic only when the animals are stressed, injured, or the environmental conditions are compromised while *Aeromonas*and *Pseudomonas* may be natural opportunistic flora of the sea turtle, becoming pathogenic when the turtle's health is compromised. Bacterial infections of sea turtles can be reduced to an occasional occurrence or even eliminated through careful attention to water quality, independent isolated rearing and a suitable diet (Ernst & Barbour, 1989). The infection can be worse especially to hatchlings in captivity because the hatchlings are exposed to the infection and can be directly infected by other hatchlings.

#### 2.1.7.1.3 Carapace Lesions

Leong et al. (1989) describes two forms of carapace lesions; dull-white suture (DWS) syndrome and shiny-white suture (SWS) syndrome. Both DWS and SWS are described as ribbons of white material along the suture line. Microscopic examination of the white ribbon material identified debris, bacteria and *Fusarium*-like fungal spores.