

SILENT TURTLE DWELLERS: BARNACLES ON RESIDENT GREEN (*CHELONIA MYDAS*) AND HAWKSBILL TURTLES (*ERETMOCHELYS IMBRICATA*) OF MABUL AND SIPADAN ISLANDS

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ABSTRACT. *Barnacles are sessile organisms that attach themselves permanently to the surface of hard or living substrates. Marine turtles are one example of living substrates colonised by barnacles. A survey was conducted from August 2010 to February 2011 to observe the barnacles on resident green (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*) of Mabul and Sipadan Islands, located on the East Coast of Sabah. This survey intended to produce a list of barnacle species occurring on turtles in these islands and the specific location of the barnacles on the bodies of turtles. One barnacle species, *Chelonibia testudinaria* (diameter 20.11 ± 8.15 mm from 291 specimens) was identified from 64 turtles – 2 hawksbills and 62 greens. The colonisation site for most of the barnacles was on the plastron of the turtles. From the observation in present study, turtles were cleaned by dusky surgeonfish, *Acanthurus nigrofuscus* and striated surgeonfish, *Ctenochaetus striatus* in two dive sites (Staghorn Crest and Barracuda Point) of Sipadan Island. Turtles inhabit and forage near to these turtles cleaning stations consequently having smaller number of barnacles while turtles inhabiting non-cleaning station environments have larger numbers of barnacles.*

KEYWORDS. Turtles, barnacles, surgeonfish, Mabul, Sipadan

INTRODUCTION

According to Wahl (1989), epibionts are organisms that grow attached to the surface of living substrates. The most common epibionts attached on the body of marine turtles are the barnacles (Epibiont Research Cooperative (ERC), 2007). They are commensal which do not gain nutrients from the turtles. However, a high number of barnacles can create drag stress on the turtles (Frazier *et al.*, 1985). Green (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*) are commonly colonised by commensal barnacles (Bugoni *et al.*, 2001; Schärer, 2003; Dobbs and Landry Jr., 2004; Pereira *et al.*, 2006).

Various studies on barnacles associated with green and hawksbill turtles were carried out in Brazil (Bugoni *et al.*, 2001; Pereira *et al.*, 2006), Mona Island of Puerto Rico (Schärer, 2003) and Northern Great Barrier Reef of Australia (Dobbs and Landry Jr., 2004). From these studies, various barnacle species have been recorded and most of the barnacles were found on the carapace of the turtles. However, until today, no study is being done to investigate the barnacles on resident green and hawksbill turtles in Mabul and Sipadan Islands since these islands sustain high population of marine turtles. Therefore, this study is to record data on the barnacles that are found on resident green and hawksbill turtles of these islands. Barnacles found on the turtles were identified to the lowest taxonomic level possible and specific location of the occurrence of barnacles on the body of turtles was recorded.

The turtles can remove the barnacles by rubbing themselves against corals or sponges in the reef. In addition, cleaner organisms which occurred in cleaning stations can control the abundances of the larvae of barnacles by grazing on the body of turtles (Losey *et al.*, 1994). A cleaning station is a specific site in the coral reef with the occurrence of cleaner organisms cleaning other organisms. According to Wong (1991) and Isley *et al.* (2005), cleaning stations for marine turtles can be found in Sipadan Island. Thus, cleaning stations in Mabul and Sipadan Islands was observed in this study. The number of barnacles occurred on turtles inhabit near to cleaning stations was compared with those inhabit in non-cleaning station areas.

MATERIALS AND METHODS

Study Area

Barnacle survey was conducted on resident green and hawksbill turtles of Mabul (4°14' N, 118°37'E) and Sipadan Islands (4°14' N, 118°37'E) in East Coast of Sabah (Figure 1a). The sampling dive sites for this survey are Borneo Divers Jetty, Paradise II, Ray Point and Lobster Wall of Mabul Island (Figure 1b) and Barracuda Point, Coral Garden, Whitetip Avenue, Mid Reef, Turtle Patch, Staghorn Crest, Lobster Lair, Hanging Garden, Drop Off and Turtle Cavern of Sipadan Island (Figure 1c).

Species of marine turtles that can be found in Mabul and Sipadan Islands are green (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*). The specimens of barnacle were collected from resident turtles in these islands. Field sampling on these islands was carried out every two months from August 2010 to February 2011.

Data Collection

Turtles of Mabul and Sipadan Islands were captured and brought onboard the boat where scaled photographs were taken to record the specific location of the barnacles found on the body of turtles. Specimens of barnacle were gently removed from the turtles by using a hammer and scraper. The specimens were placed in separate zip lock bags with labels and preserved in 10% formalin. The turtles were released after data and specimens collected. Later, the specimens were identified to the lowest taxonomic level possible according to the specific shell morphology of barnacle species in laboratory. The widest length of each barnacle was measured as the diameter. To observe cleaning stations in Sipadan Island, SCUBA dives were carried out and photographs were taken. The cleaner organisms which occur to clean on the marine turtles were identified.

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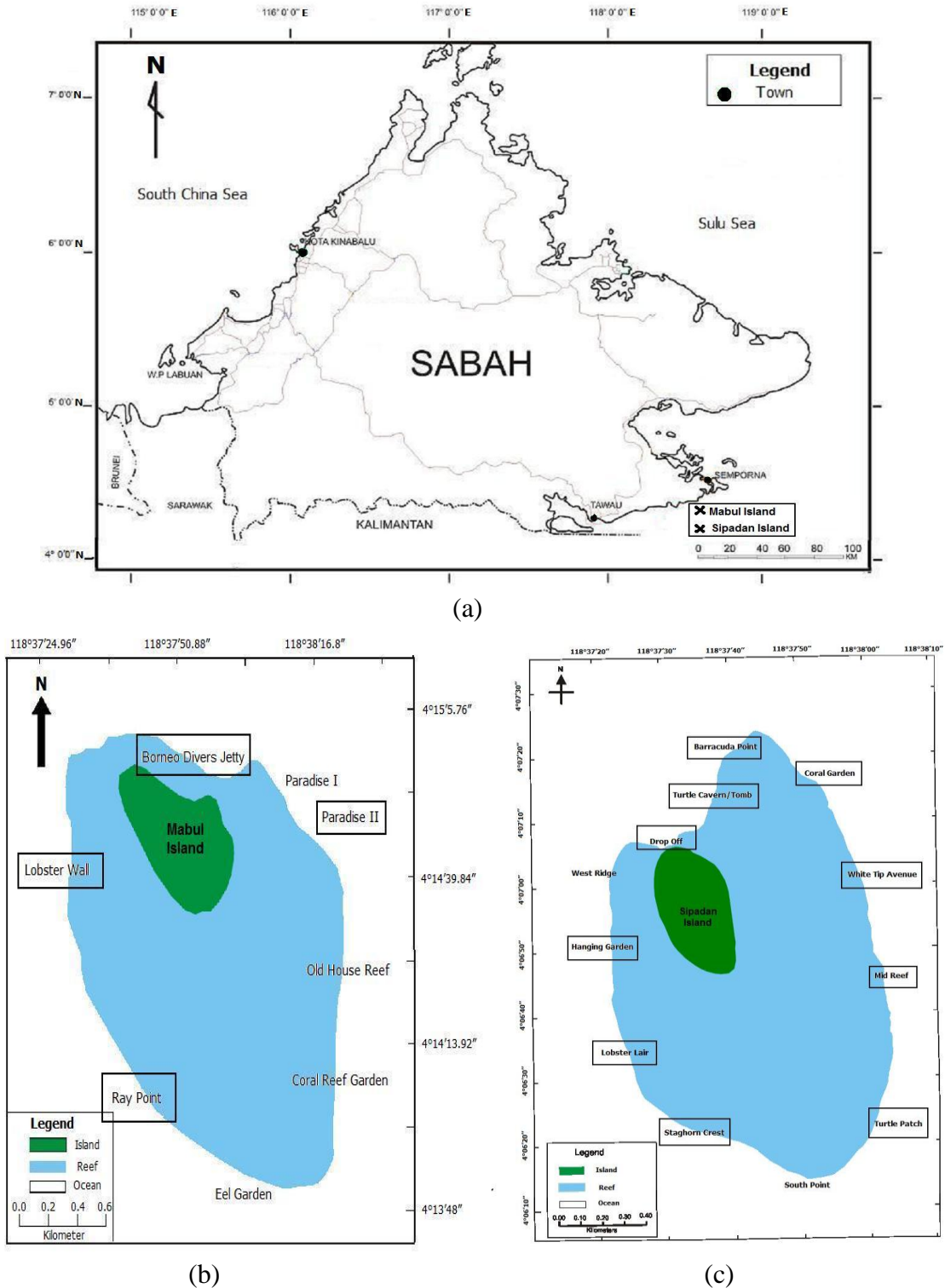


Figure 1. Map showing the study area [(a): Mabul and Sipadan Islands located in East Coast of Sabah, Malaysia. (b): Map of Mabul Island with all the dive sites' name and location. The sampling dive sites of the barnacle survey are shown in boxes. (c): Map of Sipadan Island with all the dive sites' name and location. Turtles were captured and released in ten dive sites (in box) of Sipadan Island].

RESULTS AND DISCUSSION

A total of 260 resident green (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*) were studied in this survey and 64 (24.6%) of them were found to have barnacles on their bodies. On the 64 turtles – 2 hawksbills and 62 greens, 291 specimens of barnacle were collected.

From the survey, only one barnacle species, *Chelonibia testudinaria* was sampled from the resident turtles of Mabul and Sipadan Islands. *Chelonibia testudinaria* is dome-shaped and made up of six plates of smooth wall which has shown in Figure 2. The mean of diameter recorded from the barnacle specimens was 20.11 ± 8.15 (SD) mm and the largest barnacle has a diameter of 40.0 mm.



Figure 2. Barnacles collected in this survey were consisted of one species, *Chelonibia testudinaria*. The external shell morphology of this barnacle species is made up of six wall plates.

The finding of *Chelonibia testudinaria* as the only barnacle species found on the green turtles, *Chelonia mydas* was consistent with other studies carried out by Bugoni *et al.* (2001) and Pereira *et al.* (2006) where this species was mostly found on green turtles. However, based upon the studies by Schärer (2003) and Dobbs and Landry Jr. (2004), the most frequent barnacle species recorded on hawksbill turtles, *Eretmochelys imbricata* was *Chelonibia caretta* and this was contradicted in the present study. Also, previous studies conducted by Bugoni *et al.* (2001), Schärer (2003), Dobbs and Landry Jr. (2004) and Pereira *et al.* (2006) documented variety of barnacle species found on the turtles. According to Frazier *et al.* (1985) and Schärer (2003), the

external morphology, habitat and behaviour of the marine turtles may influence the variety and abundance of epibionts occurred on the turtles.

The barnacles were collected from both carapace and plastron of the turtles. The colonisation for most of the barnacles in this study was found on the pectoral and abdominal scutes of the plastron. Pereira *et al.* (2006) and ERC (2007) documented that the occurrence of barnacles were on the carapace of the turtles. The distribution of barnacles on the body of turtles could be affected by the hydrodynamic flows (Pfaller *et al.*, 2006) which may influence the settlement and food sources of barnacles.

All the resident green and hawksbill turtles (n=260) were caught in 4 dive sites of Mabul Island (Table 1) and 10 dive sites of Sipadan Island (Table 2). In Mabul Island, 15 (45.45%) turtles out of 33 turtles were found to have barnacles on their bodies. In Sipadan Island, 49 (21.59%) turtles out of 227 turtles have barnacles attached on their bodies. The ratio of turtles with barnacles over turtles caught in Mabul Island was higher than that in Sipadan Island. This suggested that there are less cleaning stations in Mabul Island. According to the observation by dive masters from these islands, they also reported that there are absences of cleaning stations in Mabul Island.

Table 1. Number of turtles which have barnacles and number of barnacles occurred on the turtles in each dive sites of Mabul Island.

No.	Dive sites of Mabul Island	Number of turtles caught	Number of turtle with barnacles	Frequency of turtles caught in each site with barnacles (%)	Number of barnacles occurrence
1	Borneo Divers Jetty	6	4	66.67	8
2	Ray Point	12	3	25.00	9
3	Paradise 2	5	3	60.00	8
4	Lobster Wall	10	5	50.00	49

According to Isley *et al.* (2005), cleaning stations can be found in Sipadan Island where marine organisms are cleaned by cleaner organisms such as cleaner shrimp and fishes. Marine turtles were documented to be cleaned by two-spot bristletooth (*Ctenochaetus binotatus*) and surgeonfish (*Acanthurus* sp.) at cleaning stations in Sipadan Island (Wong, 1991 and Isley *et al.*, 2005). In this study, cleaning stations were observed in Staghorn Crest and Barracuda Point of Sipadan Island (Figure 1c). The turtles were grazed both the hard shell and soft parts by dusky surgeonfish, *Acanthurus nigrofuscus* and striated surgeonfish, *Ctenochaetus striatus*.

The result in present study suggested that the occurrence of cleaning stations influenced the number of barnacles attached on the turtles. The number of barnacles on turtles caught in Staghorn Crest and Barracuda Point was compared with that in Drop Off because cleaning stations were observed in Staghorn Crest and Barracuda Point. The number of barnacles on turtles caught in these two dive sites is smaller than in Drop Off (Table 2). Therefore, marine turtles which inhabit and forage near to cleaning stations have smaller number of barnacles as compared to those that inhabit in non-cleaning station. According to Caine (1986), epibionts attached on turtles can be influenced by the occurrence of cleaning agent. In addition, the abundance and distribution of barnacles on turtles is affected when turtles are rubbing their bodies on hard objects such as corals and barrel sponges (Caine, 1986 and Losey *et al.*, 1994).

This was evidenced in present study and Isley *et al.* (2005) whereby barrel sponges in Sipadan Island were observed to be worn smooth by the rubbing activities of turtles.

Table 2. Number of turtles which have barnacles and number of barnacles occurred on the turtles in each dive sites of Sipadan Island.

No.	Dive sites of Sipadan Island	Number of turtles caught	Number of turtle with barnacles	Frequency of turtles caught in each site with barnacles (%)	Number of barnacles occurrence
1	Hanging Garden	28	7	25.00	21
2	Staghorn Crest	59	7	11.86	19
3	Lobster Lair	28	8	28.57	21
4	Drop Off	29	8	27.59	112
5	Mid Reef	47	13	27.66	32
6	Turtle Patch	15	1	6.67	3
7	Whitetip Avenue	5	1	20.00	1
8	Turtle Cavern	1	1	100.00	3
9	Barracuda Point	11	3	27.27	5
10	Coral Garden	4	0	0.00	0

Chelonibia testudinaria was the only barnacle species found on the resident green (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*) of Mabul and Sipadan Islands. These barnacles occurred mainly on the plastron of the turtles which was opposed to previous studies. Surgeonfish, *Acanthurus nigrofuscus* and *Ctenochaetus striatus* were found to clean on the body of turtles at the cleaning stations. The occurrence of cleaning stations affected the number of barnacles on the turtles. Barnacles on marine turtles were recorded in other places such as Brazil and Puerto Rico but no previous study has been conducted in Mabul and Sipadan Islands of Malaysia. Therefore, this study recorded the data of barnacles found on marine turtles of Mabul and Sipadan Islands, Malaysia.

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