

A 16-year record of green and hawksbill turtle nesting activity at Chagar Hutang Turtle Sanctuary, Redang Island, Malaysia

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Introduction

Redang Island (5° 44' – 5° 50' N and 102° 59' – 103° 5' E) is located in the South China Sea, off the east coast of Peninsular Malaysia (Fig. 1). It has a land area of about 25 square km and is 45 km north northeast of Kuala Terengganu. It is a popular tourist destination and also home to the largest aggregation of nesting green turtles in Peninsular Malaysia. However, overall nesting density in Peninsular Malaysia is low, compared to the Sabah Turtle Islands Park (STIP) in East Malaysia. Average annual nesting density over the last five years for green turtles in the STIP was 6,500 and 2,300 for Terengganu (Chan, 2009). Total number of egg clutches deposited on Redang Island account for 50-60% of the total recorded for the whole of Terengganu State.

Turtle nesting beaches in Redang Island (Fig. 1) were declared sanctuaries only as recently as 2005. Chagar Hutang is one of the major nesting beaches and accounts for about half the total egg clutches deposited on the island. The author co-initiated a tagging and nesting research program here under University Malaysia Terengganu in 1993 and sustained the program until 2009 when she retired from the university. Prior to 1993, all egg clutches deposited in Chagar Hutang were collected by local villagers for sale and consumption.

This paper presents data on nesting activity in the Chagar Hutang Turtle Sanctuary from 1993 to 2008 and attempts to analyze the nesting data over the 16-year period. The other turtle sanctuaries in Redang Island that are managed by the Department of Fisheries are not considered in this paper as the data available are not complete.

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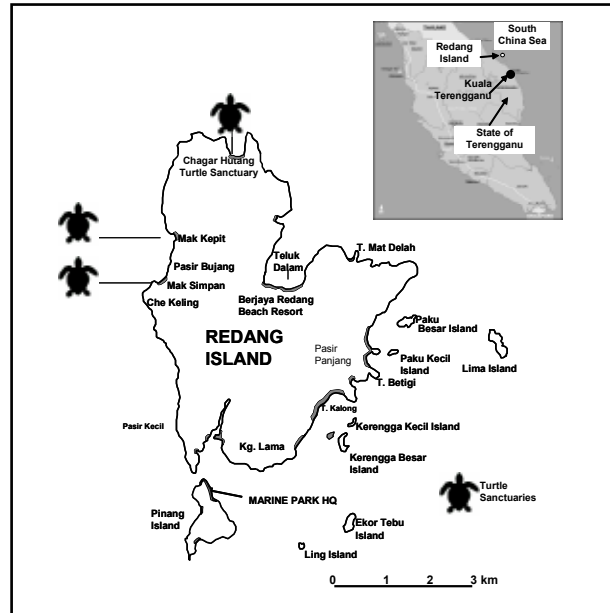


Figure 1: Map of Redang Island showing the location of turtle sanctuaries in the northern and north-western part of the island. Most of the resorts are located on the eastern part of the island.

Methods

Study Area

The Chagar Hutang Turtle Sanctuary (5° 48.778' N and 103° 0.502' E) is located in the northernmost part of Redang Island. It has a length of 350 m and is backed by virgin forest, with rocky promontories at its extreme western and eastern ends creating a secluded bay in front of the beach (Fig. 1). A stream occurs at each end of the beach and flows into the sea only after heavy rainfall.

Monitoring of Nesting Activity

Beach patrols have been conducted nightly in Chagar Hutang since 1993 by project staff assisted by a team

of volunteers. The patrols started at 2000 hours and lasted till 0600 hours the following morning. The monitoring period commenced in June and was terminated in September in 1993, but the duration was progressively prolonged over the years till 2008 when monitoring was carried out from January until December. The total number of clutches recorded in the period January to December in 2008 was used to calculate the proportion (of the yearly total) of clutches laid in each month of the year, and these monthly proportions were used to back calculate clutch data for the months in which monitoring was not carried out in the earlier years. The adjusted annual number of clutches obtained provided a better basis for trend analysis.

Turtles encountered were allowed to nest undisturbed. Nests were marked by labeled wooden stakes and covered with a 1.5 x 1.5 m square netlon mesh to afford some protection from monitor lizards. Hourly day patrols were carried out by volunteers to keep

monitor lizards at bay and to check for signs of predation by ants or crabs. If a nest was found to have been infiltrated by ants, it was excavated and eggs that were still intact were relocated. All hatched nests were excavated to determine hatching success. Hatching data will be reported in a separate paper.

Data on both actual number of clutches deposited and recorded during the monitoring period of each year and the adjusted data (calculated as described earlier) for the entire year are presented in this paper.

Results and Discussion

Data on monitoring period, actual number of green and hawksbill turtle clutches deposited over the duration of the monitoring period, and data adjusted for each entire year from 1993-2008 are presented in Table 1. The adjusted data for green and hawksbill turtles are shown in bar charts with polynomial trend lines fitted using Microsoft Excel (Figs. 2 & 3).

Table 1: Monitoring duration, number of nests recorded and number of clutches calculated for the entire year for the Chagar Hutang Turtle Sanctuary.

Year	Monitoring Period	No. of Green Turtle Clutches Deposited During the Monitoring Period	No. Green Turtle Clutches Extrapolated for Entire Year	No. of Hawksbill Turtle Clutches Deposited During the Monitoring Period	No. Hawksbill Turtle Clutches Extrapolated for Entire Year
1993	Jun - Sep	633	1002	12	21
1994	May - Oct	299	366	7	8
1995	May - Oct	576	705	4	5
1996	May - Oct	512	627	21	24
1997	May - Oct	473	579	6	7
1998	Apr - Oct	443	481	10	10
1999	Apr - Oct	687	746	11	11
2000	Apr - Oct	272	295	4	4
2001	Apr - Oct	440	478	5	5
2002	Apr - Oct	428	465	2	2
2003	Apr - Oct	240	260	0	0
2004	Apr - Oct	502	545	7	7
2005	Apr - Oct	221	240	7	7
2006	Mar - Oct	269	279	4	4
2007	Mar - Oct	358	371	9	9
2008	Jan - Dec	594	594	16	16
Total		6947	8033	125	140

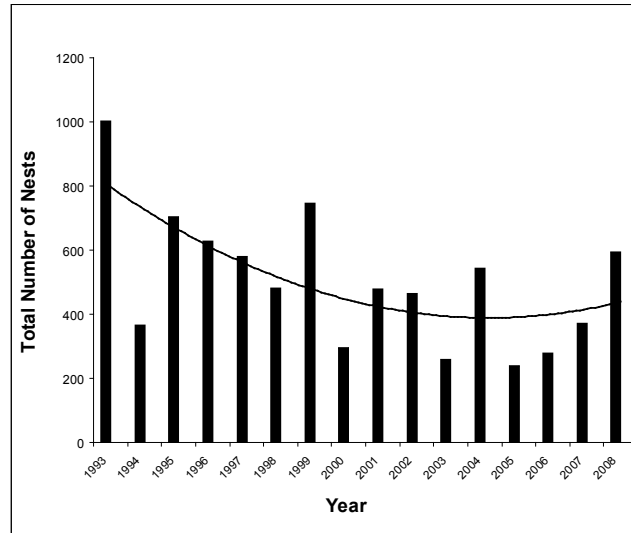


Figure 2: Total (adjusted) number of green turtle nests deposited per annum in the Chagar Hutang Turtle Sanctuary from 1993 - 2008.

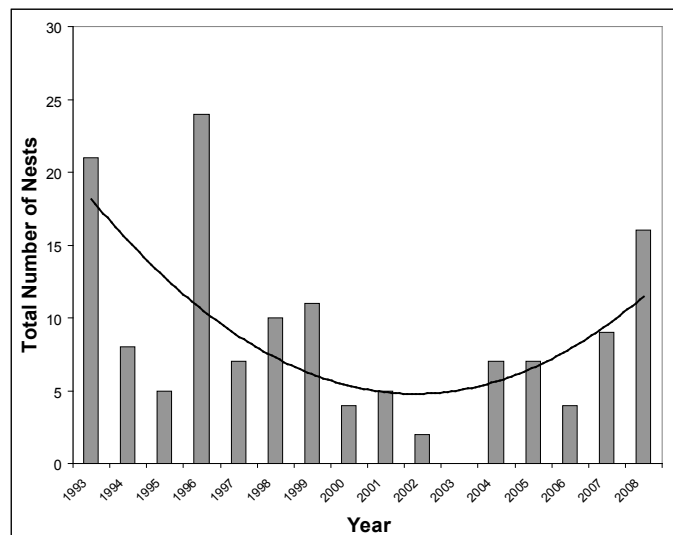


Figure 3: Total (adjusted) number of hawksbill turtle nests deposited per annum in the Chagar Hutang Turtle Sanctuary from 1993 - 2008. The figures have been extrapolated from actual number of nests deposited for periods ranging from four to 12 months each year.

The nesting data collected from 1993 to 2008 indicate that green turtles are by far the major species that nest in Redang Island. Of the total of 7072 nests that were recorded during the monitoring period from 1993 to 2008, 6947 (98.2%) were green turtle nests while 125 (1.8%) were hawksbill nests (Table 1).

The monthly nesting data that was collected for the entire year in 2008 for the first time in the 16 years

of monitoring work is given in Table 2. Green turtle nests were deposited all year round, but more activity was registered from April to September. The nesting season peaked in June and July, with these two months accounting for 40% of the nests deposited in the entire year. Hawksbill nesting occurred only from April to June and this has been found to be typical for the previous years, except for 2007 when the first hawksbill nest was deposited in August and the last in October.

Table 2. Monthly nesting data for the Chagar Hutang Turtle Sanctuary in 2008. NB: 2008 was the only year in which monitoring was carried out from January to December.

Monitoring Period	No. of Green Turtle Clutches Deposited	No. of Hawksbill Turtle Clutches Deposited	Total No. of Clutches Deposited
Jan	8	0	8
Feb	7	0	7
Mar	25	0	25
Apr	62	4	66
May	95	6	101
Jun	121	6	127
Jul	120	0	120
Aug	83	0	83
Sep	50	0	50
Oct	16	0	16
Nov	3	0	3
Dec	4	0	4
Total	594	16	610

The number of green turtle clutches deposited per year over the 16-year period ranged from 240 to 1002, with the highest density recorded in 1993, the year the project was initiated. Inter-annual variation in nesting numbers was evident, but the biennial pattern (high nesting in one year followed by a low year) of nesting numbers said to be characteristic for green turtles (Weishampel *et al.*, 2003) was not clear. Instead, years that exhibited high nesting density (1993, 1995, 1999, 2004 and 2008) were separated by intervals of one to four years (Fig. 2). This latter pattern was also observed in data presented by Broderick *et al.* (2001), Chaloupka (2001) and Sims *et al.* (2008).

The polynomial trend line fitted into the nesting trends shows a decline in the first ten years (1993 to 2003). However, an inflexion occurs in 2003, after which the curve starts to turn slowly upwards. It is too early to attribute the apparent trend reversal to the previous 10 years of dedicated nest protection on the beach. Monitoring work and nest protection must be continued over a longer term before conclusions on their effects on nesting trends can be made.

A small number of hawksbill nests are also deposited in the Chagar Hutang Turtle Sanctuary, with clutch

numbers ranging from 0 (2003) to 21 per year (Table 1). A polynomial trend line fitted into the nesting trends from 1993 to 2008 shows an inflexion point in 2001 - 2003 (Fig.3). The decline from 1993 to 2001 is quite steep, but from 2004 to 2008, a steady increase in nesting numbers is registered. The 16 clutches deposited in 2008 is the highest number seen since 1996.

Protection at the nesting beach has been recognized as an effective way to rehabilitate over-exploited sea turtle populations and has produced significant increases in nesting females in many nesting areas such as Tortuguero in Costa Rica, Archie Carr Refuge in Florida, Hawaii, Seychelles (Mortimer, 2006) and in the Sabah Turtle Islands Park (Chan & Liew, 1996; Chaloupka *et al.*, 2007). However, it must not be taken to be the only way in which sea turtles are to be protected. The life of a sea turtle is spent almost entirely in the ocean and the greatest threats logically occur in marine habitats. In recent years, the direct capture of marine turtles in South East Asian waters by illegal fishing vessels originating from neighbouring countries has emerged as the single-most serious threat that can negate all efforts in protecting nesting beaches (Pilcher *et al.*,

2008). This threat must be addressed and requires the urgent attention of marine turtle conservationists and governments in the region.

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