

**PATTERNS OF NESTING DISTRIBUTION
AT THE
RANTAU ABANG TURTLE SANCTUARY
DURING THE 1989 NESTING SEASON
AND IMPLICATIONS
FOR MANAGEMENT OF
NESTING TURTLES**

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by

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EXECUTIVE SUMMARY

Major Findings

During the 1989 nesting season, beach surveys on foot were made within the Rantau Abang Turtle Sanctuary to determine:

- 1) patterns of nesting density that occurred along the 13.5 km of Sanctuary Beach; and
- 2) the relative amount of nesting by each species of turtle.

Green turtles and olive ridleys accounted for 21-50% of the total nesting emergences; the remainder were made by leatherbacks. The following patterns of nesting density were apparent for all three species of turtles:

- 1) The highest nesting density occurred along the 2.5 km just south of Hatchery A (see Figures 1 and 2), and in the vicinity of Hatchery C (see Figure 3).
- 2) Overall, the lowest nesting density occurred along the beach adjacent to Kg. Rantau Abang. Statistical analysis showed that nesting density along that portion of shoreline was significantly lower than on the beach to the north and to the south of Kg. Rantau Abang.

Historically, the highest nesting density occurred in the center of the beach where Kg. Rantau Abang is now situated. However, the data gathered during this study indicate that during the 1989 nesting season, the turtles concentrated their nesting activity to the north and south of Kg. Rantau Abang. This suggests that coastal development within the boundaries of the sanctuary has had a significant impact on the behavior of the nesting turtles.

Recommendations

- 1) To prevent further disturbance to the nesting turtles, no additional coastal development should be allowed within the boundaries of the Turtle Sanctuary.
- 2) During the coming season, efforts should be made to intensify the Fisheries Department campaign to shade lights in the vicinity of the nesting beach--particularly those from structures located on the seaward side of the ditch at Kg. Rantau Abang and at the Merantau Inn.
- 3) To ensure that all egg clutches laid at the Rantau Abang Sanctuary are transferred to the hatcheries for reburial, it is recommended that daily beach surveys, using either an ATV or motorcycle, be conducted each morning along the entire 13.5 km of coastline within the boundaries of the Turtle Sanctuary.
- 4) The eggs of all species of marine turtles including green turtles and olive ridleys deposited within the Rantau Abang Sanctuary should receive legal protection.

1. INTRODUCTION

By surveying a nesting beach and examining the tracks and nest pits left by breeding female turtles, one can determine the relative density of nesting that occurs along the length of the beach, and also the relative amount of nesting by the various turtle species. Such information can help decision makers determine which portions of the beach merit the greatest degree of protection and can be useful for zoning a sanctuary--for example, when deciding which sections of beach should become Public Use Areas, Restricted Access Areas, or Strict Reserve Areas. Beach surveys when conducted daily can enable management personnel to determine the fate of all egg clutches laid on a protected beach.

During the 1989 nesting season, beach surveys were made within the Rantau Abang Turtle Sanctuary. This paper is a report on the findings.

2. METHODS

The surveys were conducted by walking at a steady pace along the upper beach platform where nest pits excavated by the turtles were most visible. Personnel of the Fisheries Department facilitated the survey by placing marker stakes at 500 m intervals along the Turtle Sanctuary beach. The time was noted at the start and finish of each survey, and also whenever landmarks, markers stakes, or nest pits were encountered. For all nest pits, the following information was also recorded*:

- 1) what species of turtle constructed the nest pit;
- 2) whether the nest pit was fresh enough for it to be associated with a visible set of tracks leading between it and the sea;
- 3) the estimated age of any tracks present, according to the following criteria:
 - a) very fresh (made during the previous night);

* Measurements were taken of other characteristics of the tracks and nest pits, and these data will be presented in a future report.

- b) fairly fresh (about two to four days old); or
- c) old (about five or more days old).

Precise records were kept of the time spent walking the length of the beach, and this information combined with data on the location of landmarks and beach markers was used to plot the position of each nest pit along the length of the beach.

The following describes when beach surveys were made along each segment of beach:

- 1) On 14 June 1989--between the northern border of the sanctuary and Hatchery A.
- 2) On 4 May 1989, 17 May 1989, 12 June 1989, 23 June 1989, 21 July and 18 August 1989--between Hatchery A and Kg. Rantau Abang.
- 3) On 13 June 1989 and 1 August 1989--between Kg. Rantau Abang and Hatchery C.
- 4) On 2 August--between the Merantau Inn and Kg. Kuala Abang.

3. RESULTS

The data obtained and presented in the accompanying Figures show patterns of nesting density along the beach. Two figures are used to portray the data, because some segments of the beach were surveyed more frequently or on different dates than others. No attempt is made to show the total numbers of nestings that occurred during the entire season. Although some nest pits were recorded during more than one survey, no nest pit is represented more than once in each Figure.

Figure 1 shows the positions of beach front development and also the three hatcheries within the the Rantau Abang Sanctuary. Figure 2 shows the positions of nest pits that were recorded between Hatchery A and Rantau Abang during surveys conducted on 4 May 1989, 17 May 1989, 12 June 1989, 23 June 1989, and 18 August 1989. Figure 3 shows the positions of the nest pits of each species encountered between Kg. Rantau Abang and Kg. Kuala Abang during surveys conducted on 1 and 2 August 1989.

In order to compare the levels of nesting activity of the three turtle species, only very fresh and

fairly fresh tracks were considered. (Older tracks made by green turtles and olive ridleys disappear more quickly than those made by the heavier-bodied leatherback turtles.) Green turtles and olive ridleys combined accounted for 50% of total nesting emergences recorded in May, 35% in June, 21% in July and 23% in August.

Green turtle nesting emergences were about five times more abundant than those of olive ridleys. Note, however, that the proportion of nesting emergences that resulted in egg laying is higher for the leatherback than it is for the green turtle.

The nesting density for all species of turtles appears lowest in the vicinity of Kg. Rantau Abang (Figures 1-3). A chi square test (Siegel, 1956) was used to determine whether the apparent difference was statistically significant. For the analysis, two sets of data were examined in the following manner:

- 1) The northern portion of the Sanctuary beach extending from Hatchery A south to the boundary separating Zones F and G was divided into two equal sections of beach, each 3.5 km in length--labeled "Area I" and "Area II" in Figure 2. A comparison of the distribution of nest pits recorded in these two areas (Figure 2) determined that nesting density in the more northern "Area I" was significantly higher than that in "Area II" adjacent to Kg. Rantau Abang ($\chi^2 = 8.8$; $N = 125$; $df = 1$; $\alpha = 0.01$).
- 2) The southern portion of the Sanctuary beach extending from its southernmost end to the boundary separating Zones C and D was divided into three equal sections of beach, each 1.9 km in length--labeled "Area III," "Area IV" and "Area V" in Figure 3. A comparison of the distribution of nest pits recorded in these three areas (Figure 3) determined that leatherback nesting density was not evenly distributed in the three areas. ($\chi^2 = 10.2$; $N = 43$; $df = 2$; $\alpha = 0.01$). The greatest number of nesting emergences occurred in Area IV.

4. DISCUSSION

Historically, the highest nesting density occurred in the center of the beach where Kg. Rantau Abang is situated (Chan, 1988). The shift in nesting density to the north and south of the village away

from the center of the beach is apparently a response to the disturbance caused by the beach development and tourism which are centered at Kg. Rantau Abang. The presence of artificial light is probably a major factor discouraging turtle nesting (Raymond, 1984).

Figures 2 and 3 show the relative amounts of turtle nesting that occurred along the 13.5 km of beach within the Rantau Abang Turtle Sanctuary during the 1989 nesting season. The following patterns are apparent:

- 1) Along the northern half of the beach, the highest nesting density occurred along the 2.5 km just south of Hatchery A (see Figures 1 and 2).
- 2) Along the southern half of the beach, the highest nesting density occurred in the vicinity of Hatchery C (see Figure 3).
- 3) Overall, the lowest nesting density was recorded along the beach adjacent to Kg. Rantau Abang. Statistical analysis showed that nesting density along that portion of shoreline was significantly lower than on beaches to the north and to the south of Kg. Rantau Abang.

5. RECOMMENDATIONS

- 1) To prevent further disturbance to the nesting turtles, no additional coastal development should be allowed on the seaward side of the highway within the boundaries of the Turtle Sanctuary.
- 2) Because the Fisheries Department installed shades on artificial light sources located adjacent to the nesting beach, the amount of light shining onto the beach during the 1989 season was much reduced compared to levels during previous seasons. Unfortunately, the problem of light pollution was not completely eliminated.

Vendors still set up brightly lit stalls and tourists still built campfires on the beach in front of Kg. Rantau Abang. During the coming season, efforts should be made to further reduce the amount of light shining onto the nesting beach --particularly from structures located on the seaward side of the ditch in Kg. Rantau Abang and at the Merantau Inn.

- 3) During the coming season, if possible, daily beach surveys should be made by Fisheries personnel along the entire 13.5 km of coastline within the boundaries of the Turtle Sanctuary, using either an ATV (all terrain vehicle) or a motorcycle. (See Appendix 1 for recommended methodology.) Such a survey would enable the staff of the Fisheries Department to determine the following:
 - a) whether all the egg clutches laid during the previous night were in fact taken to the hatcheries for reburial; and
 - b) the exact distribution of nesting activity along the coastline within the boundaries of the turtle sanctuary.
- 4) The eggs of all species of marine turtles (including the green turtle and the olive ridley) laid within the Rantau Abang Sanctuary should be legally protected to ensure that they are incubated in the hatcheries rather than sold for human consumption.

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APPENDIX 1.

SUGGESTED METHODOLOGY FOR DAILY BEACH SURVEYS

Each morning before about 09:00 a.m., while the turtle tracks are still damp, a member of the Fisheries staff should drive a vehicle--either an ATV (all terrain vehicle) or a motorcycle--along the entire length of the Sanctuary Beach. The mileage on the gauge of the vehicle should be recorded at the start and at the finish of the survey. Whenever the driver encounters a fresh track, he should stop the vehicle and record the following information:

- 1) Species of turtle;
- 2) Mileage reading on the gauge of the vehicle at the point the turtle emerged from the sea;
- 3) Whether or not the turtle laid eggs;
- 4) If eggs were laid, whether or not they were taken to one of the Hatcheries for reburial.

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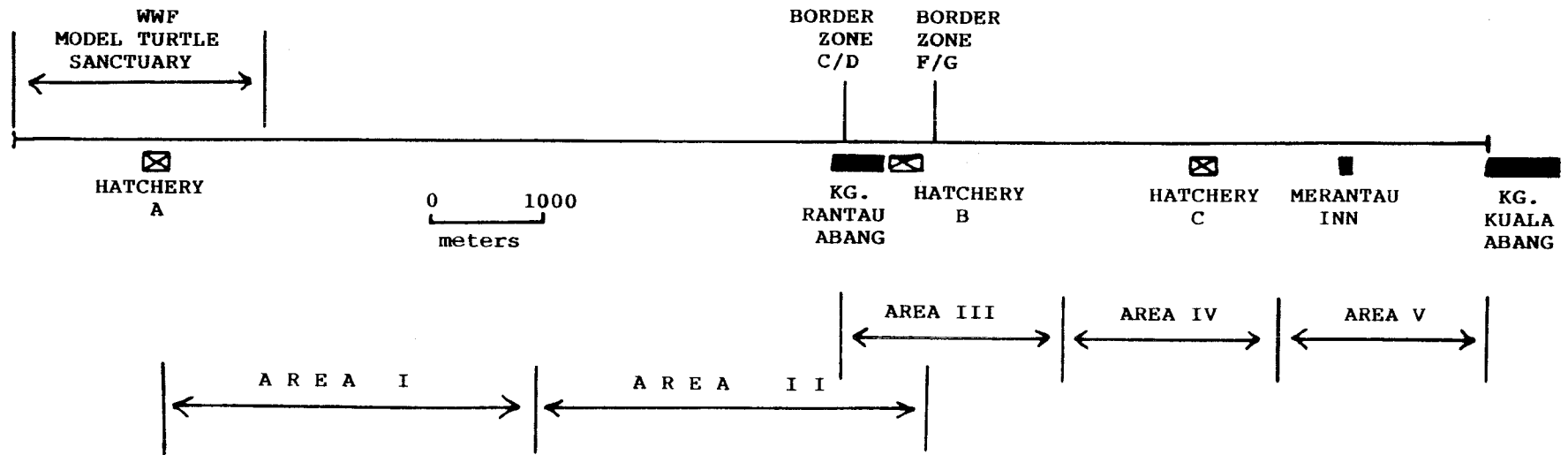


Figure 1. A map of the Rantau Abang Sanctuary beach indicating the locations of the three hatcheries, the WWF Model Turtle Sanctuary beach, areas that have been developed adjacent to the beach and also the five study areas.

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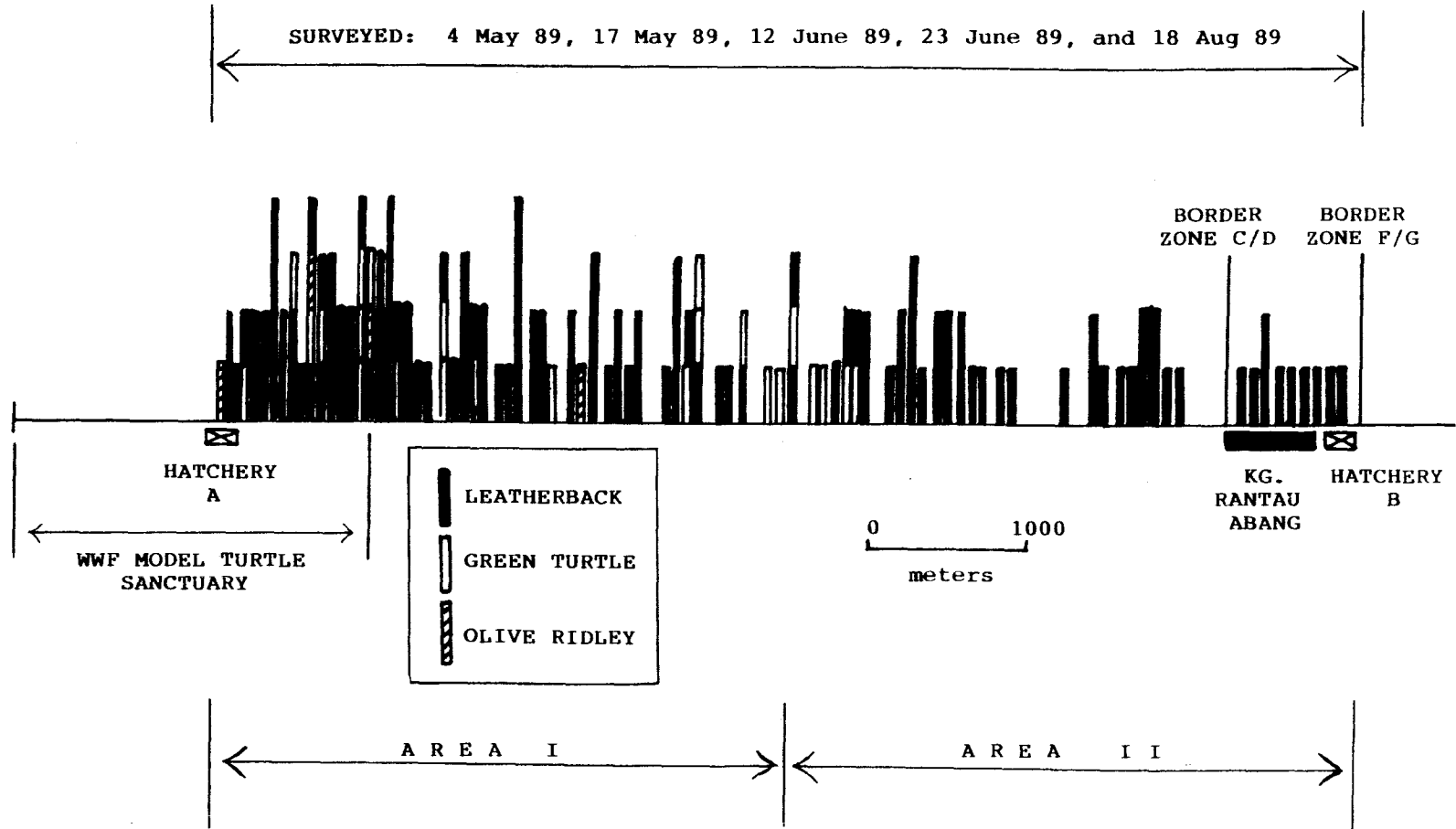


Figure 2. The positions of nest pits (of three turtle species) encountered within the Rantau Abang Turtle Sanctuary, between Hatchery A and Kg. Rantau Abang, during five surveys conducted on 4 May 1989, 17 May 1989, 12 June 1989, 23 June 1989 and 18 August 1989. Study areas I and II are also indicated.

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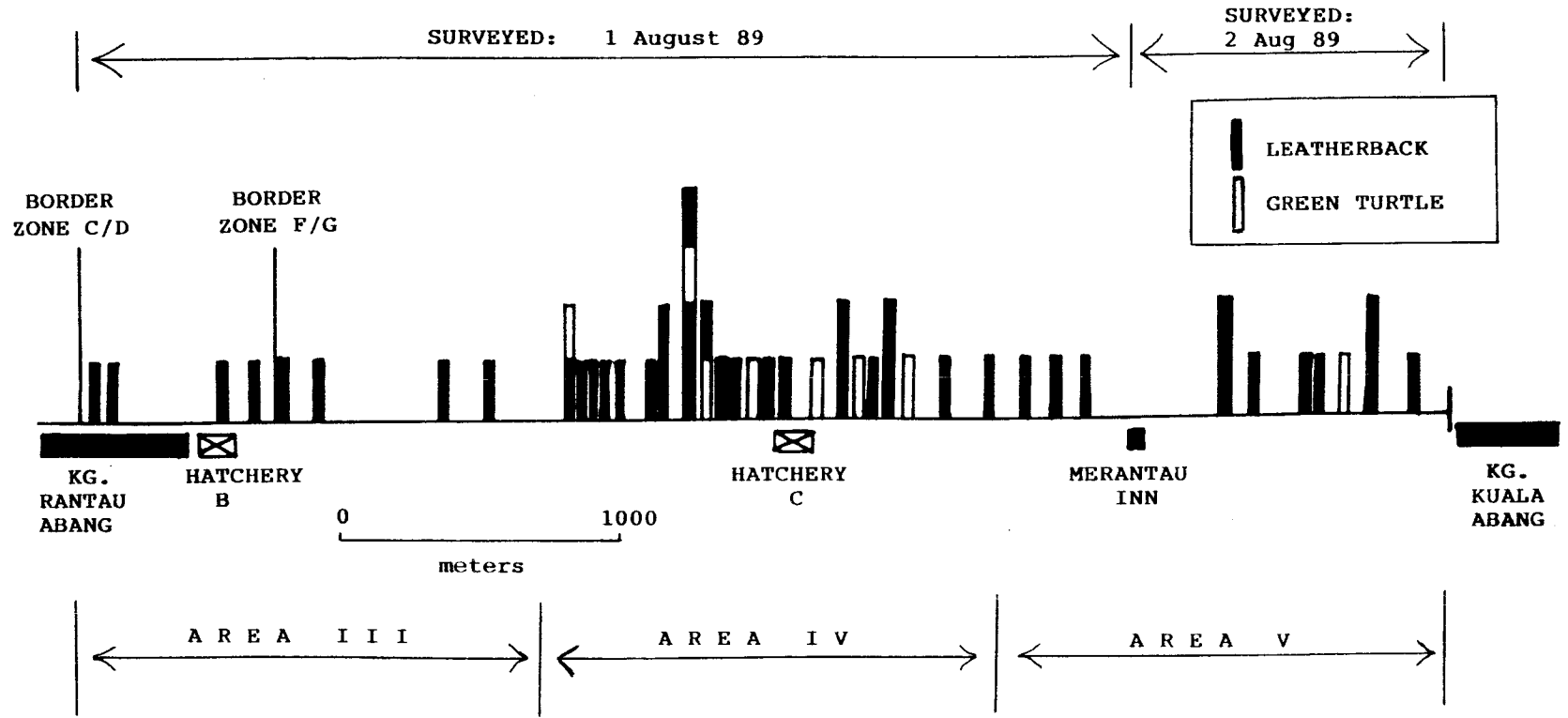


Figure 3. The position of nest pits of each species encountered within the Rantau Abang Turtle Sanctuary, between Kg. Rantau Abang and Kg. Kuala Abang at the southern boundary of the Sanctuary, during a single survey conducted 1-2 August 1989. Study areas III, IV and V are also indicated.