

Leatherback Turtle, *Dermochelys coriacea*, Nesting at Tortuguero, Costa Rica, in 1995

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ABSTRACT. — We monitored leatherback turtle, *Dermochelys coriacea*, nesting in Parque Nacional Tortuguero on the Caribbean coast of Costa Rica during the 1995 nesting season. Between 8 April and 11 May, leatherbacks deposited an estimated 702 clutches along 35 km of beach between the mouths of the Tortuguero and Parismina rivers. Comparison of our data with those from previous studies indicate a probable decline in numbers of nesting turtles, possibly caused by the high levels of egg harvest which have occurred during recent decades. Public awareness campaigns and programs to encourage community participation in conservation efforts are needed in addition to more stringent enforcement of existing laws protecting leatherback turtles and their eggs. We advocate that ground surveys of the nesting beach be conducted throughout the nesting season complemented by occasional aerial surveys of the entire coastline to assess overall distribution of nesting leatherbacks.

KEY WORDS. — Reptilia; Testudines; Dermochelyidae; *Dermochelys coriacea*; sea turtle; conservation; nesting; status; beach surveys; Costa Rica

The leatherback, *Dermochelys coriacea*, the largest and most wide ranging of the marine turtles, is classified as an endangered species by the World Conservation Union (IUCN) (Groombridge, 1982). During recent times, leatherback breeding populations have declined in much of the world (Eckert, 1991; Spotila et al., 1996) apparently in response to a variety of human impacts. These include the purposeful harvest of eggs and adults, destruction of nesting habitat, ingestion of plastic debris at sea, and entanglement in fishing gear including the float lines of squid traps (J.A. Mortimer, pers. obs.), lobster pots, and squid drift nets (O'Riordan, 1980; Balazs, 1982; Eckert, 1991; Spotila et al., 1996).

Significant populations of nesting leatherbacks and green turtles (*Chelonia mydas*) occur along the Caribbean coast of Costa Rica. While leatherback nesting is widely dispersed along the Caribbean coastlines of both Costa Rica and Panama (Fig. 1) (Carr et al., 1982; Meylan et al., 1985; Hirth and Ogren, 1987), its highest density occurs on the 80 km of beach between Tortuguero and Matina, Costa Rica. In contrast, virtually all the green turtle nesting is concentrated along 35 km of coastline between Tortuguero and Parismina, Costa Rica (Carr et al., 1978).

The Tortuguero green turtle rookery, the largest in the Atlantic Ocean, has been the subject of extensive scientific research and the focus of protective efforts that culminated in the creation of the Tortuguero National Park in 1975. Today, nesting green turtles and their eggs are relatively well protected within the park boundaries from July – September. The leatherback population, on the other hand, although legally protected, has received relatively little attention from scientists and resource managers. When the importance of the leatherback population was first recognized in 1957 (Carr and Ogren, 1959), nearly all of the egg clutches laid were being harvested. The harvest of leatherback eggs reportedly declined during the 1960s and 1970s (A. Carr III,

pers. comm.), but during the 1980s and early 1990s studies conducted by Hirth and Ogren (1987), Leslie (1993), and Leslie et al. (1996) indicated that egg harvest had again become a major threat to the population.

The Caribbean Conservation Corporation (CCC) initiated the present study during the 1995 season in an effort to focus attention on the status of the leatherbacks nesting on the Caribbean coast of Costa Rica. Field work was coordinated on site by C.L. Campbell and C.J. Lagueux. Our intention was to launch a long-term program that would employ teams of volunteers to monitor the spatial and temporal distribution of nesting activity on the study beach, to collect biometric data in order to evaluate trends in body size and reproductive output over time, and to record evidence of illegal exploitation.

MATERIALS AND METHODS

Study Site. — Our study site includes the 35.2 km of beach extending between the mouths of the Tortuguero and Parismina rivers (Fig. 1), 27 km of which are located within the Parque Nacional Tortuguero. Because the northern five miles (8 km) of beach were previously marked at 0.5 mile (0.8 km) intervals, locations on the beach are referred to in miles. The placement of the remainder of the markers was determined using the Garmin 40 Global Positioning System.

Four species of marine turtles nest at Tortuguero. The leatherback season extends from February through July, with a peak in April. Green turtles nest primarily from July to September. Small numbers of hawksbill turtles (*Eretmochelys imbricata*) and the occasional loggerhead (*Caretta caretta*) also nest.

Beach Surveys. — From 8 April to 11 May 1995, teams of two to eight people conducted early morning beach surveys on foot between 0400 hr and 1000 hr along the 35.2

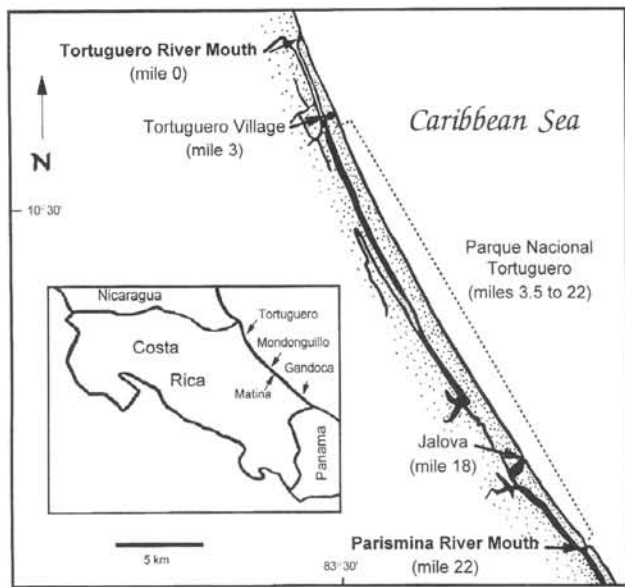


Figure 1. Map of study site on the Caribbean coast of Costa Rica between the mouths of the Tortuguero and Parismina rivers, 27 km of which are located within the Parque Nacional Tortuguero (located from just south of Tortuguero village to the Parismina River mouth). Inset shows sites in Costa Rica where leatherback nesting is monitored at Tortuguero, Mondonguillo, and Gandoca.

km beach. Surveys were conducted every three days during 8–28 April and 6–11 May, and daily during 29 April–5 May. We conducted a total of 16 surveys during the 34-day study period.

During each survey we recorded only data on tracks from the previous night. We categorized each set of tracks according to: the species of turtle, its position along the length of the beach relative to the mile markers, and whether or not the track was associated with a clearly formed body pit. A body pit is the excavation produced when the turtle scrapes away sand using her forelimbs. At Tortuguero, emergences associated with body pits generally culminate in egg deposition. Tracks not associated with body pits represent abandoned nesting attempts. Survey data were analyzed using linear regression to estimate the total number of clutches deposited during the study period. The model allowed for autocorrelated residuals rather than following the traditional assumption that residuals are independent of each other. The model was also used to determine the trend in nesting density during the study period.

We also conducted nocturnal beach patrols on a daily basis depending on availability of volunteers. We tagged nesting animals on the rear flippers using numbered monel metal tags, and gathered biometric data. These data included two measurements of carapace length using a flexible tape: a mid-line measurement from the nuchal notch to the posterior tip, and a maximum carapace length measured from either nuchal tip to the posterior tip of the carapace. During oviposition, we counted the number of eggs in 20 clutches (each laid by a different turtle). We measured egg diameters for 10 randomly selected yolkeggs from each of 14 clutches. Egg diameters were measured to the nearest 0.1 mm with dial calipers.

We did not systematically record poaching activities, however, we did record incidents of poaching observed during our regular surveys. We also communicated with park personnel on a regular basis about survey results and poaching activities.

RESULTS

Spatial and Temporal Nesting Distribution. — The number of nesting emergences associated with body pits ranged from 9 to 36 per night (Table 1; Fig. 2). Of all emergences recorded, 18% were not associated with body pits. Nesting intensity was highest at the beginning of our study (early April) and declined significantly during late April and early May ($r = -0.8662$; $P < 0.0001$). Based on predicted values from our linear regression model (average number of clutches on day $x = 32.06 - 0.69y$, where $y =$ days elapsed) we estimate that 702 leatherback clutches were laid on the 35.2 km of nesting beach during the 34-day study period. Nesting was most intense on the southern part of the study beach between miles 13.5 and 20. In that section, 52% of the total recorded nesting occurred on only 29.5% of the study beach (Fig. 3).

Biometric Data. — Among the nesting leatherbacks, the mean mid-line carapace length was 152.8 cm (SD = 8.9; range = 138.0–179.1 cm; $n = 41$), and the mean maximum carapace length was 159.9 cm (SD = 9.0; range = 143.5–181.3 cm; $n = 41$). Mean clutch size was 80.2 yolkeggs (SD = 17.6; range = 48–117; $n = 20$) and 28.4 yolkeless eggs (SD = 10.3; range = 11–47; $n = 20$). The mean diameter of yolkeggs from 14 clutches was 52.36 mm (SD = 2.27; range = 45.40–57.65; $n = 140$).

Illegal Egg Harvest. — Quantitative data on egg poaching were difficult to obtain because some poachers camouflaged their nest excavations and also because clutches could be excavated up to several days after they were deposited.

Table 1. Number of leatherback emergences by survey date on the Tortuguero, Costa Rica, nesting beach from 8 April to 11 May 1995. Two types of emergences were distinguished, those associated with a "Body Pit" indicating the probability that eggs were deposited and "No Body Pit" indicating abandoned nesting attempts.

Survey Date	Number of Emergences	
	Body Pit	No Body Pit
8 April	26	5
11	36	12
14	24	6
17	27	7
20	29	3
23	28	5
26	15	3
29	17	2
30	15	4
1 May	14	3
2	15	2
3	19	5
4	13	5
5	9	1
8	11	4
11	12	2

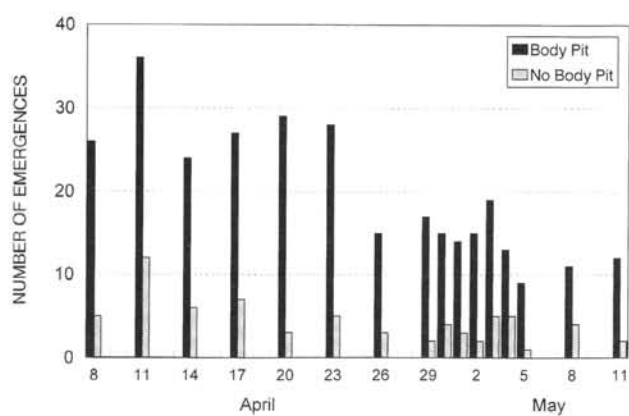


Figure 2. Number of leatherback emergences by survey date on the Tortuguero, Costa Rica nesting beach from 8 April–11 May 1995. See Table 1 for definition of “Body Pit” and “No Body Pit” emergences.

Nevertheless, we obtained evidence that illegal harvest of leatherback eggs is a serious threat to the nesting population. We frequently observed people on the beach carrying sacks of eggs and probing sticks, particularly in the southern part of the study area near Jalova and Parismina. At the northern end of the beach in the vicinity of Tortuguero Village, the majority of egg clutches were poached. Although we did not rigorously monitor poaching activity, we recorded at least 28 nests that had either been probed, excavated, or both, within the study area. Park personnel reported that on a single night approximately 3000 eggs were illegally harvested between miles 12 and 22, and they expressed frustration that their limited staffing made adequate protection of the beach impossible. Only three to five guards patrolled the 35 km beach on any given night. We estimate that in the heavily poached areas, i.e., near Tortuguero, Parismina, and Jalova, at least 75% of all clutches were harvested.

DISCUSSION

Aerial surveys of the 35.2 km study beach were conducted by Hirth and Ogren (1987) in 1985, and by Berry

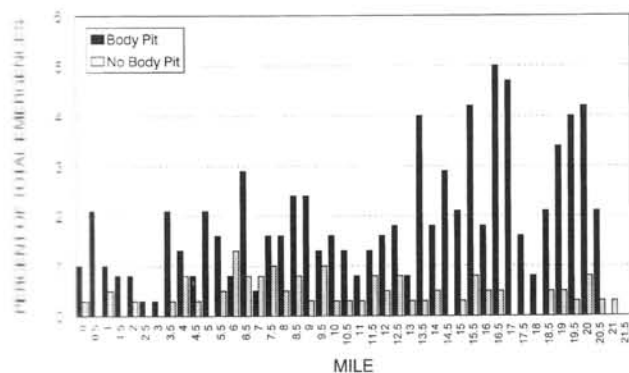


Figure 3. Spatial distribution of leatherback emergences within the study area between 8 April–11 May 1995. The village of Tortuguero is located near mile 3, the beach boundaries of the Parque Nacional Tortuguero are from miles 3.5 to 22, and Jalova is located at mile 18 within the park boundaries. See Table 1 for definition of “Body Pit” and “No Body Pit” emergences. See map (Fig. 1) for geographic details.

(1989) in 1987. In 1985, estimates of the number of clutches laid per night were the following: 33 on 8 April (an underestimate due to a storm), 100 on 15 May, and 102 on 9 June. In 1987, the following numbers of nests were recorded: 38 on 17 March, 23 on 17 April, and 33 on 12 May. Although methodologies differed between these surveys and ours, a comparison of survey counts suggests that the Tortuguero leatherback population has suffered a decline. During only one of the six surveys conducted in 1985 and 1987 were fewer than 33 nests recorded, even though most of the surveys were conducted late in the nesting season when lower levels of nesting might be expected. In contrast, in 1995, on only a single night did we record more than 30 nests, and on most nights, fewer than 20. The difference between 1995 and the 1985 and 1987 seasons may even be greater given that the authors of the earlier studies believed their figures underestimated the actual number of clutches laid.

Our measurements of carapace length, clutch size, and egg diameters are consistent with those recorded during previous studies of nesting leatherbacks in the region within the last ten years (Hirth and Ogren, 1987; Leslie, 1993; Chaves et al., 1994; Leslie et al., 1996) suggesting there has not yet been a shift in turtle sizes or reproductive output. We believe that the relatively sparse leatherback nesting recorded at the Tortuguero beach in 1995 may reflect a decline in the nesting population caused by the overharvest of eggs during recent decades. High intensities of egg poaching in this region were reported by Carr and Ogren (1959) and later by Hirth and Ogren (1987), Leslie (1993), and Leslie et al. (1996). There are other possible explanations for the low number of clutches deposited during our study: 1) population decline could be caused by mortality from fishing activities (O’Riordan, 1980; Balazs, 1982; Eckert, 1991; Spotila et al., 1996); 2) our figures may reflect natural fluctuations in nesting densities from year to year as observed in the leatherback population at Playa Grande, Costa Rica (Steyermark et al., 1996); or 3) some nesting females may have shifted from within our study area to nesting sites further south.

We advocate that, insofar as possible, nesting leatherbacks all along the Caribbean coast of Costa Rica be monitored using ground survey techniques, preferably during the entire nesting season, and occasional aerial surveys of the entire coastline. In recent years, such programs have been conducted at Mondonguillo beach (Chaves et al., 1994) and at Gandoca beach (Chacon, 1995) (Fig. 1). Park personnel expressed appreciation to us for our presence on the nesting beach which provided them moral support and may also have discouraged poaching.

We strongly recommend that the Costa Rican government intensify efforts to protect leatherbacks along the entire Caribbean coast of Costa Rica. The focus of this effort should continue to be in the areas south of Parismina where nesting density is highest. Protection of leatherback nests within the Parque Nacional Tortuguero, however, should also be a priority. A public awareness campaign and pro-

grams to encourage community participation in conservation efforts are also urgently needed to complement efforts to enforce the laws protecting the leatherback turtle. Because of its large size, unusual morphological characteristics, and placid temperament, the leatherback turtle is a particularly suitable attraction for eco-tourists. If the illegal harvest of leatherback eggs continues, however, the population may face extirpation.

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RESUMEN

Monitoreamos las tortugas baulas, *Dermochelys coriacea*, anidando en el Parque Nacional Tortuguero en la costa del Caribe de Costa Rica, durante la estación de anidamiento de 1995. Las tortugas baulas depositaron un estimado de 702 nidadas a lo largo de los 35 km de costa, que están ubicados entre la barra del río Tortuguero y la del río Parímina, desde el 8 de abril al 11 de mayo. Comparando estos datos contra los de estudios anteriores nos encontramos que hay una probable reducción en el número de tortugas anidando, posiblemente causado por el alto nivel de huevos cosechados durante las décadas anteriores. Programas y campañas de concientización para estimular la participación de la comunidad en la conservación de la tortuga baula son necesarios en adición a la aplicación firme de las leyes que protegen a las tortugas baulas y sus huevos. Proponemos que los censos en las playas de anidación sean conducidos durante toda la temporada de anidación complementados con censos aéreos ocasionales en toda la línea costera para evaluar la distribución total de la anidación de la tortuga baula.

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