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Sea Turtle Nesting Activity on Northeast Coast Beaches of Curaçao, 1993

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ABSTRACT. – Ten pocket beaches of the northeast coast of Curaçao were monitored daily for sea turtle nesting activity, April- November 1993. Fort y-two turtle crawls were recorded on seven beaches, with two beaches accounting for the majority (74%) of crawls. Most crawls took place in July-October. Nine nests were found (one double nest), and nesting was documented for the Loggerhead Turtle (*Caretta caretta* L.), the Hawksbill Turtle *(Eretmochelys imbricata* L.) and the Green Turtle *(Chelonia mydas* L.). Nests were often laid at less than ideal spots due to the paucity of sand and abundance of rubble on these generally marginal nesting beaches. Of the 1484 eggs laid (all nine nests), 747 hatchlings left the nests (50.3%). The small northeast coast beaches of western Curaçao appear to be some of the main sea turtle nesting habitat of the island, and of the Netherlands Antilles.

INTRODUCTION

The sea turtles of the Caribbean are endangered resources which have not been granted legal protection in Curaçao, Netherlands Antilles. While at least five species of sea turtle have been reported from the waters surrounding the island, and nesting activity for some has been indicated, little is known about the extent of current sea turtle nesting on the island (Sybesma, 1992). Following recommendations of the WIDECAST Sea Turtle Recovery Action Plan for the Netherlands Antilles (Sybesma, 1992) and in light of a recent record of Loggerhead Turtle nesting (Sybesma and Hoetjes, 1992), it was decided to collect more information on sea turtle nesting activity for the beaches of the western section of the northeast coast of Curacao— an area indicated as a traditional nesting place by local elders.

This section of Curaçao, stretching roughly from Boka Ascención to West Punt (Fig. 1), is similar to the rest of the wave-exposed northeast coast of the island in having steep, rocky, wave-swept shores. The coastal zone is characterized by an emergent, arid, coralline-rock terrace rising about 5 m above sea level. On its seaward fringe the terrace is traversed by gullies which carry the seasonal run-off to sea. Small pocket beaches set back typically 80-100 m from the wave-exposed coast are found in all but the smallest gullies. Compared to the rest of the northeast coast, the western section has by far the highest concentration of pocket beaches.

METHODS

From 31 March to 26 November 1993, the rangers of the Christoffel National Park, Curaçao, conducted daily morning patrols (0800-1000 h) on eight of the larger beaches most likely to be suitable for turtle nesting (extending eastwards up to and including Boka Braun). In the first week of May, Boka Bergantin and Boka Patrick were added as possible nesting beaches based on accounts by local fishermen. While other beaches are found in the area, these beaches were not monitored because they possessed very little sand. Since during morning patrols no turtles were encountered on land, the activity reported represents activity from the night before. With evidence of turtle digging, a search was made for the nest, digging by hand. Eggs found were immediately reburied and marks were placed along the gully walls for easy nest relocation. After hatching, the site was visited to collect data such as number of eggs laid, hatching success, species identifica-

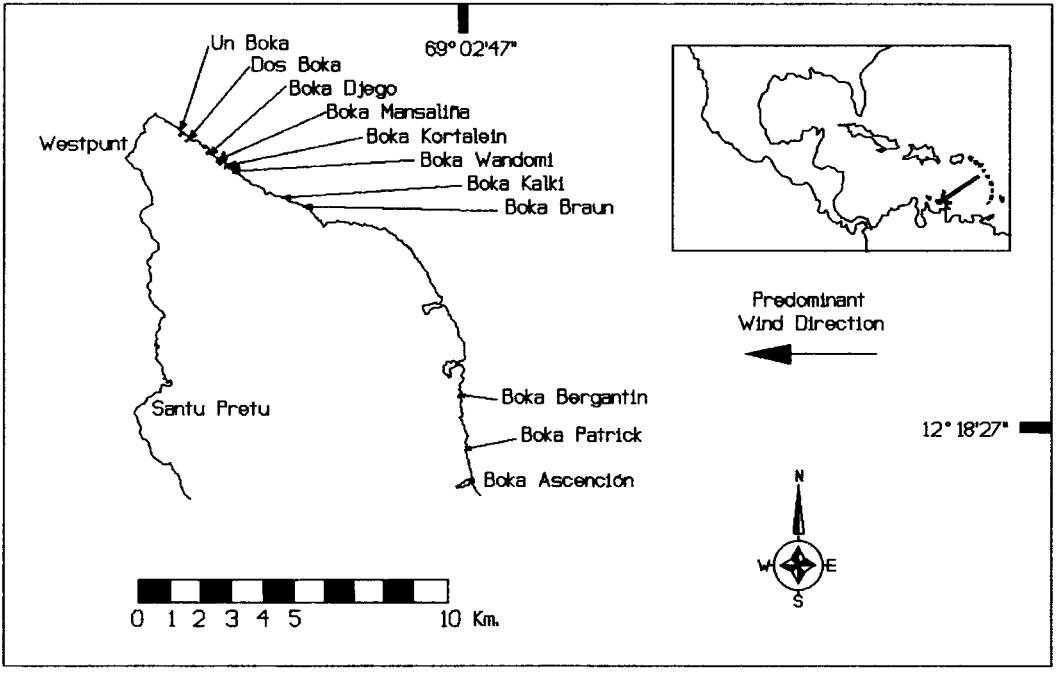

FIG. 1. Map of the western section of **Curaçao,** with arrows indicating the northeast coast beaches monitored for sea turtle nesting in 1993.

tion and the developmental stage for unhatched young.

A basic physical description of the beaches was obtained by measuring beach length, beach width, beach setback (from the outer coast), the percentage of beach fringed by beach rock, an estimate of the potentially usable nesting area, a measure of the rubble content of the sand, and sand depth (either to the water table or to underlying rock). -Beach width was defined as the distance from the mean high tide mark to areas with permanent vegetation, or to where sand gave way to terrestrial soils and rock. Potentially usable nesting area was defined as all areas with loose sand above the high water mark. Areas of solid soil or rock were excluded. Rubble content and sand depth were measured at 2-10 random spots in sandy areas on each beach. For the assessment of rubble content a 35 cm diameter hole was dug 40 cm deep at each spot. The combined volume of all rubble (maximum diameter ≥ 15 cm) was expressed as a percentage of the material excavated. As rubble extending sideways outwards from the hole was also included, the index values obtained are higher than actual percentage rubble content.

RESULTS

Table 1 provides the total number of turtle crawls recorded for each beach, as well as a physical description of the beaches. Only three of the ten pocket beaches monitored showed an absence of turtle activity during the study period (Table 1). These beaches (Boka Wandomi, Boka Kalki and Boka Patrick) were completely fringed by beach rock and had maximum sand depths <45 cm (Table 1). Beach rock is considered to be a major barrier to nesting turtles (Dr. K. L. Eckert, pers. comm.). Boka Wandomi and Boka Patrick additionally had sand with a high rubble content. Boka Patrick had suffered heavy losses of sand due to recent mining, evidently with heavy machinery, and potentially usable sandy beach width was reduced to only 10 m. Turtle crawls and diggings had been seen at Boka Patrick in 1992 (R. Finies, pers. comm.).

TABLE 1. The total number of sea turtle crawls observed and physical parameters for the northeast coast beaches monitored on Curaçao, April-November 1993.

Beach	Total number of crawls	Beach length (m)	Beach width (m)	Beach setback (m)	Beach rock (%)	Potentially usable sand area (m^2)	N[1]	Boulder contents index (% ± 1 SD)	Depth (cm) to: a—water table b—beach rock
Un Boka	2	20	30	80	0	300	5	15.0 ± 13.4	a: min = 70
Dos Boka	3	20	27	70	100	220	5	40.0 ± 16.3	b: max =40
Boka Djego	1	16	26	80	100	300	5	53.3 ± 24.9	b: max = 40
Boka Mansaliña	12	14	44	115	10	330	10	5.5 ± 7.9	a min = 85
Boka Kortalein	2	22	20	120	60	300	5	80.0 ± 8.5	b: max = 35
Boka Wandomi	0	32	25	80	100	290	5	47.5 ± 28.0	b: max =35
Boka Kalki	0	33	75	100	100	170	10	8.0 ± 9.3	b: max = 45
Boka Braun	19	29	31	100	0	490	10	25.5 ± 28.4	a: min = 60
Boka Bergantin	3	32	29	100	0	600	5	40.0 ± 4.1	b: max = 40
Boka Patrick	0	275[2]	21	180	100	40	2	90.0 ± 0.0	b: max = 45

[1] Sample size used for boulder contents and depth measurements.
[2] Beat-h length with potentially usable sand " 10 m.

Forty-two turtle crawls were recorded on seven beaches during the study period. Nesting-related activity appeared concentrated on two beaches which together accounted for 31 (74%) of the 42 crawls recorded (Table 1). These beaches had little rubble in the sand, minimum sand depths ≥60 cm and negligible amounts of fringing beach rock. For the 10 beaches monitored, the combined level of beach use recorded in the monitoring period of eight months came down to 42 crawls for a total of 228 m of beach front.

The number of crawls found per month were: April—three; May—five; June—three; July—five; August—ten; September—seven; October—six; November—three. Thus, while activity was recorded in all months, the months of peak activity were July-October. Seasonal differences in beach use were evident between the two most heavily used beaches. At Boka Mansaliña activity was recorded April–August while at Boka Braun activity was only recorded August-November. Although the study period encompassed the peak nesting months for all species potentially nesting in Curaçao (Dr. K. L. Eckert, pers. comm.), nesting-related activity during months not included in the study remains a possibility.

Nine nests (9/42 = 21% of crawls) were located, some detaiIs of which are given in Table 2. Nests were found at Un Boka (1 nest), Boka Mansaliña (5 nests) and Boka Braun (3 nests). Only three nests were actually found during trial digging the morning after egg-laying took place. The other six nest finds were more or less fortuitous, occurring during hatching on the basis of juveniles found on the beach, or while digging to locate a known nest. The actual proportion of crawls which resulted in successful nesting (i.e., egg-laying) cannot be known. The presence of eggs is difficult to confirm post-nesting, and subsequent hatchling tracks are easily and quickly obscured.

Hatchlings of three sea turtle species emerged from the nests. These were the Loggerhead Turtle *(Caretta caretta* L.), the Hawksbill Turtle *(Eretmochelys imbricata* L.) and the Green Turtle *(Chelonia mydas* L.). All were readily identified on the basis of prefrontal scale and carapace scute counts of hatchlings recovered from the beach or nest (Pritchard et al., 1983). From data collected elsewhere in the Caribbean, these species are known to deposit an average of 3-5 nests per season at 12-15 day intervals (Dr. K. L. Eckert, pers. comm.). Thus, even if all 42 crawls resulted in egg-laying

TABLE 2. Hatching results for nine sea turtle nests laid on northeast coast beaches of Curaçao, April–November 1993. Hyphens (-) = data not available, N.A. = not applicable.

Species	Beach	Date laid	Date hatched	Number of eggs laid	Embryonal stage[1] undev.	early	mid-term	late	Dead piplings	Dead hatchlings	Number of hatchlings leaving nest	Hatching success
Loggerhead	Boka Manzaliña	?	21-Jun	101	4	1	1	2	1	0	92	91%
Loggerhead	Boka Manzaliña	20-Jun	9-Aug	125	-	-	-	-	-	-	119	95%
?	Boka Braun	1-Aug	N.A.	155	0	155	0	0	0	0	0	0%
Hawksbill	Boka Manzaliña	?	29-Sep	163	4	0	3	0	1	5	156	96%
Hawksbill	Boka Manzaliña	?	7–8–9-Oct	338[2]	115	32	5	51	51	1	84	25%
Hawksbill	Boka Braun	?	8–9-Nov	179	20	27	1	1	8	0	122	68%
Hawksbill	Boka Braun	?	25–26-Nov	193	36	17	1	40	14	0	85	44%
Green Turtle	Un Boka	13-Jul	N.A.	105	90	14	1	0	0	0	0	0%
Green Turtle	Boka Manzaliña	?	9-Oct	125	4	0	0	29	3	35	89	71%

[1] Undev. = no eye development; early = eye developed but no carapace scutes; mid-term = carapace scutes but ≤40 mm; late = >40 mm.
[2] Probably a double nest.

(which is highly unlikely), the study area probably supported fewer than 10 gravid females, all species combined. The small sizes of the populations concerned, have become especially evident from the fact that additional daily monitoring of the eight westernmost beaches from April through October 1994 failed to produce any signs of sea turtle nesting activity.

The fate of the nests was quite varied (Table 2). The two Loggerhead Turtle nests hatched early in the season and showed excellent hatching success. In one instance nest emergence was observed and videotaped at 1645 h on 21 June. With the exception of a few stragglers, all animals left this nest simultaneously. The other loggerhead nest was stepped into by beach visitors just prior to nest emergence. Despite efforts by the Christoffel National Park rangers to prevent further disturbance, all hatchlings were removed by the beach visitors and given to the Curaçao Seaquarium, which used the animals for display in aquaria (and where the animals remain). One turtle nest laid at Boka Braun on 1 August showed no significant embryonic development of any of the eggs and could not be identified as to species.

The four Hawksbill nests (one of which likely was a double nest based on an egg count of 338) showed hatching success of between 25% and 96% (Table 2). The double nest (resulting from two females unintentionally nesting in virtually the same spot), showed the lowest hatching success. Eggs had been laid adjacent to the beach in soily sand under a rock ledge and were covered by a secondary mud layer, probably as a result of flooding due to torrential showers on 13 and 14 September. Three of the four Hawksbill nests showed non-simultaneous nest emergence, with animals leaving the nest over several days.

One of the two Green Turtle nests had been deposited in a run-off channel at a low elevation on the beach at Un Boka and showed little to no development and no hatching (Table 2), probably due to the generally moist conditions. The other Green Turtle nest was laid at Boka Mansaliña and showed a hatching success of 71%. At least 8 of the 35 dead hatchlings

in the nest had become lodged under a large buried piece of coral rubble. Of the 1484 eggs laid, all nine nests combined, 747 hatchlings left the nests (50.3%).

In an independent effort, Reef Care Curaçao volunteers (a local environmental organization) monitored nine beaches of the western sector of the southwest coast of the island during the period May-November but reported no sea turtle activity (J. Sybesma and P. Hoetjes, pers. comm.). While such results indicate the generally low level of nesting activity for the southwest coast of the island, nesting along the southwest coast cannot be discounted altogether. For the period spanning this study, we can report nocturnal sea turtle visits to Blauwbaai on the central southwest coast on 20 July, 5 August and 23 August, 1993. In the first instance (20 July) Allan van de Ree found a turtle on the beach at about 2230 h. The animal had dug four holes but no nest could be located. The animal of 5 August showed no indication of digging activity and eggs were not looked for. For the case of 23 August, an animal with alternating tracks (indicating either a Loggerhead or Hawksbill Turtle) had dug five holes and a fresh nest was found. Dry egg shells were also found, indicating prior egg deposition on this southwest coast beach. A few weeks later the nest site was destroyed by construction activity and the nest is presumed to have been lost.

We provide a heretofore unpublished record of sea turtle nesting for another southwest coast beach. About the end of July/beginning of August 1990, Roelant van Olst witnessed the emergence of many turtle hatchlings from a nest at the beach of Santu Pretu. The nest was located about 20 m from the edge of the water; emergence took place around 0200 h and lasted for about 1.5 h. One photograph was made of a hatchling and we suspect it was a Loggerhead, but a definitive determination cannot be made.

DISCUSSION

Aside from historical accounts of nesting by Loggerhead, Hawksbill and Green Turtles (Sybesma, 1992) and a single recent record of Loggerhead nesting (Sybesma and Hoetjes, 1992), no other records of sea turtle nesting existed for Curaçao prior to this study. This report, however, documents contemporary records of successful nesting by Hawksbill and Green Turtles in Curaçao, and provides additional documentation of successful nesting by the Loggerhead Turtle. The study also indicates the western-most wave-exposed pocket beaches as some of the most important remaining sea turtle nesting habitat on the island. The best nesting beaches were clear of large boulders, heavy beach rock development and terrestrial sources of rubble, and had sand depths exceeding 60 cm.

Based on measurements of rubble content and sand depth for five southwest coast beaches it was determined that physical conditions for nesting compare favorably with the northeast coast beaches in terms of both sand depth (generally >60 cm) and rubble content (5–15% with one outlier at 50%). Although this study reports on a very limited number of sea turtles, we speculate that the evidently lower level of nesting activity observed along the southwest coast may be related with the long-time intensive recreational and artesanal use of these wave-sheltered beaches. The possibility cannot be excluded that the turtles may simply be preferentially drawn to windward beaches, as suggested for the Leatherback Turtle by Carr (1956) and Chu Cheong (1990).

The fates of the nests reported herein provide some insight into the threats facing sea turtle nests on Curaçao beaches. Disturbance and nest robbing associated with recreational beach use led to the complete loss of one nest, while another nest on the southwest coast was destroyed by coastal development. One nest was probably lost because of excessive moisture due to poor placement, while temporary flooding was indicated as a likely problem for at least one other nest. Obstruction by coral rubble contributed significantly to hatchling mortality in one case. There was no evidence that predation by dogs (only rarely seen during patrols) or other predators (e.g., crabs) was a problem.

It is especially evident that turtles often

had deposited their eggs at less than ideal sites due to the paucity of sand and the abundance of rubble on these generally marginal beaches. In this respect a significant threat to the turtles is beach sand mining (illegal at all times) for construction purposes. Sand mining on beaches is common and was noticed several times during the course of this study. Sand theft could be minimized by, for instance, hindering vehicular access to the beaches or by improved and more aggressive law enforcement (Sybesma, 1992). Aside from protecting these beaches against development, sand mining and excessive recreational use, there is room for habitat improvement as well. For instance, regular beach clean-ups could be useful at some sites.

In conclusion, the small northeast coast pocket beaches of western Curaçao appear to be some of the most important remaining sea turtle nesting habitat of the island, and of the Netherlands Antilles (Sybesma, 1992). However, turtle populations appear to be at critically low levels and active measures are urgently needed for their protection.

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