

1991 MARINE TURTLE NEST
SCREENING PROGRAM AT
CANAVERAL NATIONAL SEASHORE
FLORDIA

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ABSTRACT

In 1991 Canaveral National Seashore completed the eighth year of its sea turtle nest screening program. A total of 4100 nests were deposited along its 23.25 miles of beach, almost identical to last years record high of 4108 nests. This included 4074 loggerhead (Caretta caretta), 25 green (Chelonia mydas) and one leatherback (Dermochelys coriacea) sea turtle nests. Green turtle nests dropped sharply from 185 in 1991.

A total of 1,073 or 84 percent of the nests were screened in the northern one-half of the seashore. Fifteen percent or 434 of the 2,822 nests were screened in the southern half of the park.

A combination of nest screening and limited predator removal achieved a 70 percent depredation-free rate; predators destroyed 14 percent of the nests prior to their discovery in the northern one-half of the park while an additional 14 percent were partially depredated (20 percent or fewer of the eggs destroyed). The partially depredated nests were cleaned up and screened; data from 1989 indicate no difference in hatching success from non-depredated nests. Only four percent of the screened nests were depredated after screening.

A seven percent sample (293) of the sea turtle nests at Canaveral National Seashore exhibited 90 percent nesting success. The average clutch size of the loggerhead nests was 94 with an average hatching rate of 78 percent or 73 eggs. Average green turtle clutch size was 116 with an average hatching rate of 70 percent or 81 eggs.

The need for a study of raccoon population dynamics and the raccoon's role in the Canaveral National Seashore ecosystem continues to be critical. Money has recently been appropriated to initiate such a study in 1992. Hopefully the necessary answers can be gained to devise the best long range strategy to protect both the sea turtle and the fragile seashore ecosystem.

INTRODUCTION

Canaveral National Seashore (CANA) is one of the critical federally-owned areas containing sea turtle nesting habitat. Between 2,000 and 4,000 loggerhead sea turtle (Caretta caretta) nests are deposited on its 23.25 miles of beach each year. A lesser number of green sea turtles (Chelonia mydas) and an occasional leatherback turtle (Dermochelys coriacea) nest at CANA as well.

The raccoon (Procyon lotor) continues to be a major consumer of sea turtle eggs at CANA. Prior to the screening program, as many as 99 percent of the nests were depredated by this species (McMurtray 1986). Since screening began in 1984, the number of predation-free nests increased to a high of 74 percent in 1990 with an additional nine percent partially depredated. The latter nests were cleaned-up, screened and hatched at the same rate as non-depredated nests (Stiner 1990).

In 1989 predators were trapped in the southern half of the park by the U.S. Fish and Wildlife Service (FWS). Removal of 219 raccoons resulted in a 95 percent predation-free rate compared to an 81 percent success rate in the northern half, where nest screening was employed in lieu of predator removal (Stiner 1990). The cost was also slightly cheaper (\$25,000 versus \$29,000).

The predation level remained extremely low on the southern end in 1990 (Stiner 1990). However, screening was reestablished on the entire beach in 1990 due to National Park Service policy and the need for an environmental assessment on predator control.

The 1991 season posed an important question for the CANA staff; how soon would nest depredation return to former levels on the southern half of the beach? In 1990, raccoons moving into the vacant area created by trapping in 1989, lacked the knowledge needed to dig up sea turtle nests. Eventually these new animals would gain that knowledge.

Screening was still considered preferable to intensive predator control until a study could be done to assess the impact of predator removal. Heavy involvement by volunteers in the screening program was again crucial, to supplement CANA's limited budget and staff.

STUDY SITES AND METHODS

Canaveral National Seashore lies along the east-central coast of Florida with Bethune Beach to the north and Kennedy Space Center to the south. The northern 11.25 miles of beach is situated in Volusia County, the southern 12 miles in Brevard County.

The beach is essentially undeveloped with only a few artificial lights and a number of boardwalks to protect the dune vegetation. The dune is well developed along most of the beach and is stabilized by a thick growth of sea oats (Uniola paniculata), sea grape (Coccoloba uvifera), saw palmetto (Serenoa repens) and other dune species. The beach is closed to the public between sunset and sunrise except for occasional guided turtle walks. These walks are limited in size to minimize disturbance to the nesting turtles.

From May 07 to August 10, two to three rangers and volunteers patrolled the beach each night on four-wheeled all-terrain vehicles (ATV's). They worked from 10:00 p.m. to 6:00 a.m. screening turtle nests and collecting data. Screening consisted of placing a 4 feet X 4 feet wire mesh screen over the nest and staking down the corners with three foot sections of #3 rebar. The rebar was bent over near one end to form a 70 degree angle. The 2 inches X 4 inches mesh size was large enough to allow hatchlings to emerge while discouraging raccoon attempts to reach the eggs.

In the northern half (North District) of CANA all nests undepredated at the time of discovery were screened. Any depredated nests that had less than 20 percent of the eggs destroyed were cleaned up and screened as well.

In the southern half (South District) of CANA, due to the lack of predation the previous year, screening of loggerhead nests was delayed until the depredation rate reached 10 percent. Loggerhead nest screening was initiated on June 15. Green sea turtle nests were screened throughout the entire season.

Data collection for each nest included: date, observer, nest number, species, location (the beach was divided into 94 quarter mile sections) and extent of depredation or tampering, if any. The date and grid location of each false crawl were also recorded. Seven percent of the nests were monitored throughout the incubation period to determine hatching success. All of the nests deposited on the northern half of the beach were marked with a stake to facilitate screen retrieval.

Categories included hatched, destroyed by predators, inundated, eroded away and fate unknown. Hatching and emergence was determined by the presence of hatchling tracks and nest excavation. Emergences were observed for any evidence of disorientation caused by artificial lighting.

After 65 days or evidence of hatching the screen was pulled from each nest. Seven percent of the nests were excavated and each unhatched egg and empty shell (hatched egg) was counted to calculate an average hatching success for the entire beach. Excavations were distributed throughout the season and done randomly.

Nests were relocated if time permitted for one of three reasons: 1) they had been deposited near the surf line and were in danger of being inundated or washed away; 2) the nest was located at the base of a heavily travelled boardwalk; 3) the nest had been partially depredated and required major clean up of broken egg shells and yolk.

Pits approximating the natural nest cavity were dug near the base of the dune. The eggs were then carefully transferred, buried and the nest screened in the usual manner.

Raccoons were removed from areas of the park where heavy nest depredation was observed or certain individuals had learned to tunnel under the screens. Raccoons were captured using Tomahawk live traps and relocated to areas away from the barrier island.

RESULTS

A total of 4100 sea turtle nests were deposited at CANA in 1991-4074 loggerhead, 25 green and one leatherback (Table 1). While the total was almost identical to the 1990 figure of 4108, the number of green sea turtles dropped sharply from the previous year's figure of 185. Overall nest density was 172.6 per mile (107.0 per kilometer). This was the second year in a row that a leatherback nest was recorded. The last prior leatherback sighting was in 1987 (Bryant, 1987).

Table 1. Turtle Nest and False Crawls. ~~1990~~ 1991
Canaveral National Seashore

<u>Species</u>	<u>False Crawls</u>	<u>Nests</u>	<u>False Crawl Nest Ratio</u>
Loggerhead	3688	4074	1:1.10
Green	38	25	1:0.66
Leatherback	<u>0</u>	<u>1</u>	0:1.00
Total	3726	4100	1:1.10

As in previous years, the greatest concentration of nesting occurred in the South District. Sixty-nine percent (2822) of the nests or a density of 225.8 nests per mile was noted on the southern 12.5 miles of beach compared to 31 percent (1278) or a density of 113.6 nests per mile for the northern 11.25 miles of beach.

The total number of loggerhead false crawls was 3726 yielding a false crawl to nest ratio of 1:1.1 (Table 1). The green turtle false crawl to nest ratio was 1:0.66. Grids exhibiting the highest false crawl totals occurred in Grids 40-46, 63 and 68-75.

A total of 1,507 or 37 percent of the nests were screened, 1,073 (84 percent) in the northern one-half of CANA and 434 (15 percent) in the southern half. Eighty-six percent (1300) were undepredated at the time of screening. Fourteen percent of the nests in the North District were partially depredated (20 percent or less of the eggs destroyed) (Table 2).

Table 2. Turtle Nest Action Upon Initial Encounter. 1991.
North and South Districts
Canaveral National Seashore

<u>Action</u>	<u>Loggerhead</u>		<u>Green</u>		<u>Total</u>
	North	South	North	South	Combined
U/S	888 (70)	391 (14)	7	14	1300 (32)
PD/S	178 (14)	29 (01)	0	0	207 (05)
TD/NS	181 (14)	74 (03)	1	1	257 (06)
U/NS	<u>23</u> (02)	<u>2311</u> (82)	<u>0</u>	<u>2</u>	<u>2336</u> (57)
Total	1270	2805	8	17	4100

One additional leatherback nest would fall into Undep/Scrn

() = Percent of column total
 U/S = Undepredated/Screened
 PD/S = Partly Depredated/Screened
 TD/NS = Totally Depredated/Not Screened
 U/NS = Undepredated/Not Screened

A total of 182 or 14 percent of the nests in the North District were totally depredated (Table 3). An additional 35 or 3.3 percent of the screened nests were destroyed after screening. Thus 217 or 17.1 percent of the nests in the northern section were lost to raccoons. An additional 178 or 14 percent were partially depredated. These were cleaned-up and screened. Data from 1989 and 1990 indicate no significant difference in hatching success from undepredated nests (Stiner 1989 and 1990).

Table 3. Nest Depredation at North District
Canaveral National Seashore. 1991

	<u>Loggerhead</u>	<u>Green</u>	<u>Total</u>
TD/NS	181 (14)	1	182 (14)
TD/S	35 (03)	0	35 (03)
PD	178 (14)	0	178 (14)
UD	<u>876</u> (69)	<u>2</u>	<u>883</u> (69)
Total	1270	8	1278

() = percent of total column
 TD/NS = Total Depredation of unscreened nests
 TD/S = Total Depredation of screened nests
 PD = Partial Depredation (<20% of eggs destroyed)
 UD = Undepredated

It was more difficult to determine the amount of depredation in the South District of the park. The number of nests depredated prior to discovery by night patrols was only 75 or three percent (Table 2). However a much heavier rate of depredation occurred on unscreened nests later the same night or in succeeding nights. Over 100 unscreened, depredated nests were counted during a daytime run in mid-June. This was almost exactly ten percent of the 1071 nests laid to that point, the threshold established for screening on the southern half of the beach. Therefore screening of loggerhead nests was initiated on June 15.

On June 7 raccoon removal was initiated in areas of the South District where heavy nest depredation was observed. Trapping in the North District began as early as May 21 in Grids 23-26 where where raccoons had learned to tunnel under the screens. A total of 67 raccoons were live-trapped in the two districts of CANA and relocated to other areas.

A total of 284 loggerhead, 8 green and the single leatherback nest were excavated to determine hatching success. Of the loggerhead nests, 253 or 89 percent hatched (Table 4). Six of the eight monitored green turtle nests hatched as well as the single leatherback nest.

Table 4. Outcome of Monitored Sea Turtle Nests. 1991.
North and South Districts
Canaveral National Seashore

<u>Outcome</u>	<u>Loggerhead</u>	<u>Green</u>	<u>Total</u>
Hatched	253 (89%)	6 (75%)	259 (89%)
Unhatched	<u>31</u> (11%)	<u>2</u> (25%)	<u>33</u> (11%)
Total	284	8	292

The mean clutch size for loggerhead nests was 94 eggs and the mean number of hatched eggs was 73 or 78 percent (Table 5). Mean clutch size for the green turtle was 116 eggs and mean number of hatched eggs 81 or 70 percent. The leatherback nests contained 73 eggs, of which 46 or 63 percent hatched.

Table 5. Sea Turtle Clutch Size and Nest Production. 1991.
Canaveral National Seashore

<u>Species</u>	<u>Nests</u>	<u>Eggs Hatched</u>	<u>Eggs Unhatched</u>	<u>Average Clutch</u>	<u>Average Hatched</u>
Loggerhead	284	20,520	5,793	94	73 (78%)
Green	8	652	275	116	81 (70%)
Leatherback	1	46	27	73	46 (63%)

Ninety-four nests were relocated. Of the 19 that were monitored, 18 or 94 percent hatched. Of the 1,606 eggs contained in the relocated nests 1,069 or 67 percent hatched.

Grids showing the highest false crawl to nest ratios occurred near the mid-portion of the beach and about one-quarter of the way from the south boundary, apparently unrelated to the lighted NASA launch towers south of the park. No cases of hatchling disorientation were observed in 1991. Twenty-two instances of predation upon emerging hatchlings were noted involving 155 hatchlings or an average of seven hatchlings per emergence.

DISCUSSION

The 1991 total of 4100 sea turtle nests was almost identical to the total of 4108 in 1990 (Table 6). The 1990 figure was the highest recorded since CANA began monitoring nests in 1984. Disguised within this figure is the fact that green sea turtle nests dropped sharply from 185 in 1990 to 25 in 1991, a decrease of 87 percent. This was the lowest total since 1986 when 22 green turtle nests were recorded (Bryant, 1986).

Conversely the number of loggerhead nests increased from 3922 in 1990 to 4074, an increase of four percent. Thus loggerhead nesting at CANA has increased for the fourth consecutive year after a low of less than 1800 in 1987. A decline in the number of loggerhead nests next year should not be unexpected, since nesting tends to peak roughly every third or fourth year.

The false crawl to nest ratio for the loggerhead increased slightly over last year's value from 1:1.3 to 1:1.1. Previous values were 1:1.3 in 1989 and 1:1.06 in 1988 (Stiner 1991, Bryant 1988). The green sea turtle false crawl to nest ratio declined from 1:1.2 in 1990 to 1:0.66 in 1991.

In 1991 14 percent of the nests in the northern half of CANA were depredated by raccoons before park staff could reach them (Table 6). This is slightly less than the value of 17 percent for 1990. Raccoons were able to reach and destroy 3.3 percent of the screened nests, a slight increase from 1.9 percent in 1990.

Table 6. Total Sea Turtle Nests and Depredation Rate. 1984-1991.
Canaveral National Seashore

<u>Year</u>	<u>Number of Nests</u>	<u>12 Hour Depredation Rate</u>	<u>Screened Nests Depredated</u>
1984	2125	65 percent	---
1985	2508	42	5.0 percent
1986	3374	46	3.7
1987	1776	56	7.2
1988	2250	58	18.7
1989	3132*	07	3.4
1990	4108	17	1.9
1991	4100	14#	3.3

* Combined NPS and FWS figures

North District

Certain areas sustained heavier depredation and tampering than others, particularly in the northern half of CANA. Grids 20, 28, 31, 32 and 33 all had more than 20 recorded depredations and partial depredations. These grids correspondingly had more nests than the surrounding grids.

It was difficult to determine the exact depredation rate in the southern half of CANA. Initially the park did not screen this area due to the extremely low depredation rate in 1990, a residual of FWS trapping efforts in 1989. Expensive screening materials were conserved for use in the northern half of the park where the raccoon population remained unchecked. Also personnel surveying the southern half had more time to assist with screening in the southernmost grids of the North District.

It was expected that raccoon depredation would increase slowly as the new raccoons learned how to exploit sea turtle nests. If and when the depredation rate reached 10 percent, nest screening would be initiated on the southern half of CANA.

However a gradual increase in depredation was not observed. Depredation did not appear to be a major problem the first month of the nesting season. Then suddenly in mid-June the depredation level jumped to almost 10 percent of the nests laid to that point.

Two possibilities for this phenomena are: 1) the knowledge of how to locate and uncover sea turtle eggs had been recently introduced into the raccoon population and was spreading rapidly 2) the majority of depredations were not being observed.

Nests were found each night by following fresh crawls. Once a nest was recorded, the crawl was marked to inform the same crew or subsequent crews on succeeding nights that the nests had been checked. After that point, except for random nests marked to determine hatching success, the nests were not rechecked.

Staff shortages did not allow both night and day patrols until nest excavations were scheduled in mid-July. Thus an accurate gauge of the predation rate was not made until a daytime sweep in mid-June when approximately 100 depredated nests were observed.

At this point, screening on the south end was initiated. However, severe illness in the family of the coordinator and a shortage of supplies delayed full implementation.

An estimate can be made of raccoon depredation in the South District. Mid-June is approximately one-third of the way through the nesting period. If the 100 depredated nests are multiplied by three, a total of approximately 300 nests or 11 percent of the total in the south half of CANA would have been lost to raccoons. The figure may be lower. Any increase in raccoon efficiency at locating and uncovering nests would have been more than balanced by the initiation of screening and predator removal.

In 1989, raccoons tended to depredate only fresh nests (within the first two nights after deposition) (Stiner, 1990). However with the 1991 depredation rate being higher than expected, it was determined that action must be taken to protect the 1070 unscreened nests deposited in the southern half of CANA prior to June 16. Therefore the park felt it had no choice but to reduce the number of predators. An effort was made to live-trap raccoons in the areas of greatest depredation. Seventeen animals were captured in the South District and relocated away from the beach.

Fifty-one additional raccoons were removed from the North District of CANA where screening was employed from the very beginning of the nesting season. While the total of 67 raccoons removed from both districts does not approach the 219 removed by the FWS from the South District alone in 1989, it does show that CANA has found it necessary to supplement the screening program with trapping.

In 1991 CANA was simply not able to maintain a sufficient ATV fleet and employ enough personnel to cover the whole 24 miles of beach quickly enough to reach more than 72 percent of the nests before raccoons had at least partially depredated them (14 percent totally depredated, 14 percent partially depredated). At the height of the nesting season (late June to mid-July) it was particularly difficult to "win the race" to each nest.

A certain amount of nest depredation by raccoons is natural. This phenomena has been occurring for thousands of years. However no one would dispute that the sea turtle is threatened and in critical need of protection; or that man's activities have increased raccoon numbers to unprecedented numbers. The difficult question is at what level is depredation considered acceptable. The Sea Turtle Recovery Plan calls for 50 percent nesting success (Hopkins and Richardson, 1984) yet CANA management would be greatly disappointed if the success rate fell that low.

Intense effort over the last eight years has raised the non-depredation rate to between 70 and 80 percent. Is this sufficient? Would the efforts of intensive predator removal enhance or damage the natural system? Should one be given priority over the other? These difficult questions emphasize the challenge that sea turtle management at CANA poses to those who would preserve and protect her unique and irreplaceable natural resources.

CONCLUSION

In 1991 a combination of screening and limited predator removal achieved a 70 percent depredation free rate at CANA. The effort was costly and cannot be maintained indefinitely given present funding and staff constraints.

Park management remains committed to provide the maximum possible protection for sea turtle nests while maintaining the most natural possible environment. The nest protection program will continue in whatever form is deemed appropriate by the researchers and park management until the scheduled raccoon study is complete. At that point, in consultation with FWS and the regional office, CANA will determine a long range plan of protection.

A raccoon study funded for 1992 will seek to obtain critical answers on raccoon behavior, population dynamics and overall role in the CANA ecosystem. The objective of the study will be to determine the impact of intensive predator control and to evaluate other possible protection measures for the sea turtle.

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