

1992 MARINE TURTLE NEST
SCREENING PROGRAM AT
CANAVERAL NATIONAL SEASHORE
FLORIDA

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DECEMBER 1992

ABSTRACT

In 1992 Canaveral National Seashore completed the ninth year of its sea turtle nest screening program. A total of 3578 nests were deposited along its 23.25 miles of beach. This included 3281 loggerhead (Caretta caretta) and 298 green (Chelonia mydas) sea turtle nests. This was the most green nests since recordkeeping began in 1984, surpassing the previous high by over 100. 301 3277

A total of 1281 nests were deposited in the northern half of the Seashore. Of these, 1099 or 86 percent of the nests were screened. Of the 2296 nests deposited in the southern half of the park, 1116 or forty-nine percent were screened.

A combination of nest screening and limited predator removal achieved an 88 percent depredation-free rate; predators destroyed six percent of the nests prior to their discovery while an additional three percent were partially depredated (20 percent or fewer of the eggs destroyed). The partially depredated nests were cleaned up and screened. A total of 4.3 percent of the screened nests were depredated after screening.

A six percent sample (205) of the sea turtle nests at Canaveral National Seashore exhibited 90 percent nesting success. The average clutch size of the loggerhead nests was 96.6 with an average hatching rate of 77 percent or 74 eggs. Average green turtle clutch size was 109 with an average hatching rate of 84 percent or 91 eggs.

An estimated 243,899 loggerhead and 27,335 green hatchlings were produced at Canaveral National Seashore in 1992.

INTRODUCTION

Canaveral National Seashore (CANA) is one of the critical federally-owned areas containing sea turtle nesting habitat. Between 3,000 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) is a major consumer of sea turtle eggs at CANA. In the early 1980's, 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 has increased to over 80 percent. The program however is time-consuming and expensive.

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 expended by the FWS versus \$29,000 expended by CANA).

A combination of screening and limited predator removal was implemented for the entire beach in 1990, due to National Park Service policy and the need for an environmental assessment on predator control. It has continued as such until the present.

A two-year study has been funded, which will begin in January 1993, to study raccoon dynamics at CANA, explore alternative methods of nest protection and to assess the impact of predator removal on the seashore ecosystem. Results of the study will provide critical information to guide park management in establishing the best long range strategy for protecting sea turtle nests and the fragile seashore ecosystem.

STUDY SITES AND METHODS

Canaveral National Seashore is located 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.

On May 5, the park began daytime patrols of the beach to count sea turtle nests and false crawls. The 24 mile stretch of beach was covered by using four-wheeled all-terrain vehicles (ATV's). Beginning on May 15, the park switched to a nighttime operation, with two to four rangers and volunteers working from 10:00 p.m. to 6:00 a.m. screening turtle nests and collecting data. Nighttime patrols ceased on August 31, with daytime patrols continuing in the North District until September 9.

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.

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.

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. Ten percent of the nests were monitored throughout the incubation period to determine hatching success. All of the nests were marked with a stake to facilitate screen retrieval and to identify unscreened nests that had been counted.

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.

The stake for every tenth nest was marked with spray paint for easy identification. After 65 days or evidence of hatching the screens were pulled from these nests and each unhatched egg and empty shell (hatched egg) was counted to calculate an average hatching success for the entire beach.

Data on nest depredation were analyzed collectively and individually for the North and South Districts, to detect any residual differences from the 1989 trapping effort. That year over 200 raccoons were removed from the South District.

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 3577 sea turtle nests were deposited at CANA in 1992-3279 loggerhead and 298 green (Table 1). While the number of loggerhead nests dropped 20 percent from the previous year's total of 4074, the number of green nests jumped from 25 in 1991 to 298 in 1992. The highest previous total recorded for green nests, since the nest protection program began in 1984, was 185 in 1990. Overall nest density was 141.1 per mile (87.5 per kilometer) for the loggerhead and 12.8 per mile (7.9 per kilometer) for the green. No leatherback nests were recorded for the first time in three years.

Table 1. Turtle Nest and False Crawls. 1992.
Canaveral National Seashore

<u>Species</u>	<u>False Crawls</u>	<u>Nests</u>	<u>False Crawl Nest Ratio</u>
Loggerhead	2295	3279	1:1.4
Green	<u>271</u>	<u>298</u>	<u>1:1.1</u>
Total	2566	3577	1:1.4

As in previous years, the greatest concentration of nesting occurred in the South District. Sixty-four percent (2296) of the nests or a density of 191.4 nests per mile was noted on the southern 12 miles of beach compared to 36 percent (1281) or a density of 114.0 nests per mile for the northern 11.25 miles of beach.

The total number of loggerhead false crawls was 2295 yielding a false crawl to nest ratio of 1:1.4 (Table 1). There were 271 green turtle false crawls, equalling a false crawl to nest ratio of 1:1.1. Grid 93 exhibited the highest false crawl total with 73. The next three highest were grids 86, 51 and 47 with 58, 57 and 54 false crawls respectively.

Ninety-one percent (3259) of the nests were undepredated at the time of initial discovery (Table 2). Of the remaining nine percent, five percent were totally depredated (10 percent (125) in the North District and three percent (71) in the South District) and four percent were partially depredated (eight percent (102) in the North District and one percent (14) in the South).

Very few green turtle nests were depredated, possibly because they are deeper and more difficult for the raccoons to uncover. Only three of the 298 nests were totally depredated and five others partially depredated (Table 2). This was 2.6 percent of the total number.

Table 2. Turtle Nest Action Upon Initial Encounter. 1992.
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	966 (81)	941 (45)	26 (31)	159 (74)	2092 (58)
U/NS	5 (01)	1055 (51)	53 (64)	52 (24)	1165 (33)
PD/S	102 (08)	14 (01)	4 (05)	1	121 (04)
TD/NS	125 (10)	71 (03)	0	3 (01)	199 (05)
Total	1198	2081	83	215	3577

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

A total of 2,213 or 61 percent of the nests were screened, 1,098 (86 percent) in the northern one-half of CANA and 1,115 (49 percent) in the southern half (Table 3).

Of the screened loggerhead nests, 96 or 4.3 percent were depredated by tunnelling; 2.1 percent in the North District and 7.7 percent in the South (Table 3). No screened green nests were depredated (Table 3).

Table 3. Tamperers and Depredations of Screened Nests
Canaveral National Seashore. 1992

	<u>Loggerhead</u>		<u>Green</u>		<u>Total</u>
	North	South	North	South	Combined
Screened Nests	1068	955	30	160	2213
Depredations	22	74	0	0	96
Percent of Dep	2.1	7.7	0	0	4.3
Tamperers	107	9	2	0	116

Depredation = Successful attempt to reach eggs of screened nest
Tamper = Unsuccessful attempt to reach eggs of screened nest

Raccoon removal was employed in areas where heavy nest depredation was observed, particularly where raccoons had learned to tunnel under the screens. A total of 60 raccoons were live-trapped in the two districts of CANA and relocated to other areas. Over one-half of the animals removed from the North District were taken in a one mile stretch from grid 20 to 23.

A total of 186 loggerhead and 19 green in situ nests were excavated to determine hatching success. This was a 5.6 percent and 6.4 percent nest sample respectively. A larger sample would have been taken, however, on September 28, Hurricane Earl passed to the south of CANA. It caused extremely high tides, which covered the entire beach for several days and washed away many of the stakes marking the remaining nests.

Of the excavated loggerhead nests, 167 or 90 percent hatched (Table 4). Seventeen of the nineteen excavated green turtle nests hatched (Table 4).

Table 4. Outcome of Monitored In Situ Sea Turtle Nests. 1992.
North and South Districts
Canaveral National Seashore

<u>Outcome</u>	<u>Loggerhead</u>	<u>Green</u>
Hatched	167 (90%)	17 (90%)
Unhatched	<u>19</u> (10%)	<u>2</u> (10%)
Total	186	19

The mean clutch size for in situ loggerhead nests was 96.6 eggs and the mean number of hatched eggs was 74 or 77 percent (Table 5). Mean clutch size for the green turtle was 109 eggs and mean number of hatched eggs, 91 or 84 percent (Table 5).

Table 5. Sea Turtle Clutch Size and Nest Production. 1992.
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	186	13,754	4,209 *	96.6	74 (77%)
Green	19	1,744	312 *	109.2	91 (84%)

* Includes dead hatchlings found in nest

A total of 111 nests were relocated, 104 loggerhead and 7 green. Of the nine relocated nests that were monitored, eight hatched. Of the 635 eggs contained in the relocated nests, 437 or 69 percent hatched.

One case of hatchling disorientation was observed in 1992. Only two instances of predation upon emerging hatchlings were noted, involving a total of 21 hatchlings.

A total of 329 or 11 percent of the loggerhead nests were still unhatched (based upon a 55 day incubation period) when the high water from Hurricane Earl hit CANA. Eighty-five (85) or 29 percent of the green turtle nests were still under the 55 day mark.

The estimated number of hatchlings produced at CANA in 1992 was calculated for both a best case and a worst case scenario. If the nests, still unhatched when Hurricane Earl hit, hatched at the same rate as the nests prior to Earl, an estimated 243,899 loggerhead hatchlings were produced (3279 nests x 96.6 eggs/nest x 77% hatching rate). If all the nests still on the beach when Earl hit failed, and estimated 219,576 hatched (2952 nests x 96.6 eggs/nest x 77% hatching rate).

For the green turtle, the estimated number of hatchlings was 27,335 (298 nests x 109.2 eggs/nest x 84% hatching rate) and 19,538 (213 nests x 109.2 eggs/nest x 84% hatching rate) respectively.

DISCUSSION

The total nest figure of 3577 in 1992 was lower than the previous two years at CANA but remained above totals recorded in the 1980's (Table 6). The green sea turtle nest figure of 298 was the highest recorded since the program began in 1984 (Table 6).

Table 6. Sea Turtle Nesting at Canaveral National Seashore
1984-1992

<u>Year</u>	<u>Loggerhead</u>	<u>Green</u>	<u>Leatherback</u>	<u>Unknown</u>	<u>Total</u>
1992	3279	298	0		3577
1991	4074	25	1		4100
1990	3922	185	1		4108
1989	3091	41	1		3133
1988	2203	43	0	4	2250
1987	1670	90	1	15	1776
1986	3349	22	3		3374
1985	2389	94	0	25	2508
1984	(Individual breakdown not available)				2125

(From Bryant 1986a, 1986b, 1987 and 1988 and Stiner 1990, 1991a and 1991b)

The false crawl to nest ratio of 1:1.39 was slightly below the previous two years (Table 7). Since 1984, seven of the nine years have exhibited more nests than false crawls, with a high of 1:1.55 in 1989. Between 1990 and 1992, grids 86 and 92 in the South District and 33 in the North District have exhibited the greatest number of false crawls. The reasons for this are not readily apparent.

Table 7. False Crawl to Nest Ratio at Canaveral National Seashore
1984-1992

<u>Year</u>	<u>Loggerhead</u>	<u>Green</u>	<u>Average</u>
1992	1:1.43	1:1.10	1:1.39
1991	1:1.10	1:0.66	1:1.10
1990	1:1.31	1:1.17	1:1.30
1989	1:1.53	1:3.00	1:1.55
1988	1:0.94	1:1.16	1:0.94
1987	1:1.02	1:0.72	1:1.015
1986	1:0.98	1:0.76	1:0.97
1985	1:1.22	1:1.02	1:1.20
1984	--	--	1:1.24

(From Bryant 1986a, 1986b, 1987 and 1988 and Stiner 1990, 1991a and 1991b)

As in previous years, the ratio of nests in the South District compared to the North District is about 2 to 1. However, a specific pattern for the entire beach is hard to determine. The relative number of nests in any given grid can vary widely from year to year. However there are a small number of grids that consistently rank among the highest in nesting and false crawl densities. These are Grids 86 and 92 in the South District and 20, 33 and 42 in the North. Reasons for this are not readily apparent.

In 1992 nine percent of the nests were totally or partially depredated prior to initial discovery (Table 8). This compares to a figure of 11 percent in 1991 and nine percent in 1990, a remarkably stable figure over the last three years. As in 1990 and 1991, initial predation was heavier in the northern half of the park - 18 percent of the nests versus four in the South District (Table 2).

Table 8. Total Sea Turtle Nests and Depredation Rate. 1984-1992.
Canaveral National Seashore

<u>Year</u>	<u>Number of Nests</u>	<u>12 Hour Depredation Rate</u>			<u>Screened Nest Depredated</u>
			<u>Partial</u>	<u>Total</u>	
1992	3579	05%	04	09	4.3 percent
1991	4100	06%	05	11	3.3 percent
1990	4108	06%	03	09	1.9 percent
1989	3132*	07%	07	07	3.4 percent
1988	2250	58%	07	0	18.7 percent
1987	1776	56%	--	--	7.2 percent
1986	3374	46%	--	--	3.7 percent
1985	2508	42%	--	--	5.0 percent
1984	2125	65%	--	--	--

This could be expected for 1990, since over 200 raccoons were removed from the southern half of the beach the previous year (Stiner 1990). However, the continuation of such a low depredation rate three years after removal has been unexpected. Recent trapping efforts for telemetry work indicate that raccoon density in the South District has returned to levels equalling the North (M. Ratnaswamy, Univ GA, pers comm). Possibly the population in the South District has a larger percentage of young animals, which are inexperienced in depredating sea turtle nests.

However, further compounding the picture is the fact that tunnelling into screened nests was much more prevalent in the South District (Table 3). It would seem that the North District, with a higher overall depredation rate and less subject to trapping pressure over the last four years, would have a greater number of mature animals who had learned the tunnelling behavior, and therefore exhibit a higher rate of tunnelling activity than the South District. This is not the case.

Tunnelling occurred in about 1/3 of the 94 grids with "hot spots" in Grids 20-23, 47-50, 51-54 and 84-87. Areas where tunnelling was noticeably absent were Grids 0-5, 8-19 and 60-78. In 1991 areas of heavy depredation were Grids 20, 28 and 31-33 in the North District (Stiner 1991b).

Obviously the manner in which raccoons learn to depredate sea turtle nests - screened or unscreened - is not well understood. In 1990, the year after intensive raccoon removal in the South District, there was virtually no predation on screened or unscreened nests on that half of the beach (Stiner 1991a). This pattern continued throughout the season, even though tracks indicated that raccoons were common on the beach by mid-summer. The 1991 season started with little predation, lulling the CANA staff into thinking that depredation may again be light or at least gradually increase in intensity, when depredation rates suddenly soared sharply in mid-June.

Whatever the method of learning, the increase in depredation of screened nests from 1.9 percent in 1990 to 4.3 percent in 1992 (Table 8) indicates that the ability to tunnel under screens is spreading among the raccoon population.

Another unexpected behavior was noted in 1991 and 1992. Prior to 1991, most depredation was noted on the same night as deposition. While this still held true in 1991 and 1992, depredation of unscreened nests on succeeding nights was higher than previously observed.

Since the intense removal in the South District in 1989, a more limited policy of raccoon removal has been practiced. Individuals that consistently depredated unscreened nests or tunneled into screened nests were trapped and relocated. A total of 67 raccoons were relocated in 1991 and 60 in 1992.

In both years, the necessity to move this number of animals was due largely to a shortage of screening supplies. The nest protection program has always functioned under an extremely tight budget. In 1991, raccoon depredation increased more sharply than anticipated, after being virtually absent in the South District the previous year (Stiner 1991b). Adequate screening supplies were not on hand and it took several weeks to obtain more. In 1992, an unusually cool summer prolonged the incubation period and delayed the recycling of screening materials. This caused nests deposited in mid-season to be left unprotected and necessitated raccoon removal in "hot spots" of high depredation.

While relocation enhanced nesting success, continued relocation of such a large number of animals cannot be continued on a prolonged basis. It is costly, has unknown impacts on the area of relocation and animals which have been moved tend to have a low survival rate (Wright, 1977).

CONCLUSION

In 1992 a combination of screening and limited predator removal achieved a 88 percent depredation free rate at CANA. Excavation of six percent of the nests revealed a 90 percent nesting success. This far exceeded the 60 percent hatch success targeted by the Recovery Plan for loggerhead and green sea turtles (NMFS and USFWS 1991).

However as in previous years, budget restraints and staff shortages have made implementation of this program a strain on park resources. Without donations and a large group of dedicated volunteers, the program would not be possible. If the program is to continue, specific funding must be dedicated to it, rather than continuing to draw from the already overburdened general park budget.

A raccoon study scheduled to begin in January of 1993 will seek to obtain critical answers on raccoon behavior, population dynamics, role in the CANA ecosystem and impact of intensive predator control. In addition, several other possible measures for protection of sea turtle nests will be tested. This information will guide CANA in designing the best long range plan to protect both sea turtles and the seashore ecosystem.

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