

1990 MARINE TURTLE NEST
SCREENING PROGRAM AT
CANAVERAL NATIONAL SEASHORE,
FLORIDA

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ABSTRACT

In 1990 Canaveral National Seashore completed the seventh year of its sea turtle nest screening program. A total of 4108 nests were deposited along its 23.25 miles of beach, the highest total since record-keeping began in 1984. This included 3922 loggerhead (Caretta caretta), 185 green (Chelonia mydas) and one leatherback (Dermochelys coriacea) sea turtle nests.

The previous year, nests were screened in the northern 11.25 miles of the park to protect the eggs from predators. Predator removal, primarily the raccoon (Procyon lotor), was conducted by U.S. Fish and Wildlife Service in the southern 12 miles. In 1990, due to management concerns, predator removal was discontinued. Eighty-eight percent (1047) of the nests in the northern half of the park and 18 percent (500) in the southern half were screened. A very low amount of nest depredation in the southern half, due to prior predator removal, allowed the discontinuation of screening four weeks into the nesting period.

In the north end, 90 percent of the screened nests hatched. Only two percent of the screened nests were depredated after screening. Predators destroyed 17% of the nests prior to their discovery. An additional nine percent were partially depredated (20% 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.

Overall, a representative sample of sea turtle nests at Canaveral National Seashore exhibited 92% nesting success. The average clutch size of the loggerhead nests was 105 with an average hatching rate of 82 percent or 84 eggs. Average green turtle clutch size was 116 with an average hatching rate of 81 percent or 94 eggs.

The need for a study of raccoon population dynamics and the raccoon's role in the Canaveral National Seashore ecosystem is critical. Only then can the best long range strategy be devised to protect both the sea turtle and the fragile seashore ecosystem.

INTRODUCTION

Canaveral National Seashore (CANA) is an important nesting beach for several species of endangered and threatened sea turtles. 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) is a major consumer of sea turtle eggs at CANA. In past years, it has depredated as many as 99 percent of the nests (McMurtray 1986). The National Park Service began a nest screening program in 1984 to prevent raccoons from digging up the eggs. Over the next five years the number of successful nests fluctuated between 30 and 46 percent as the program's hours of coverage and number of personnel varied.

In 1989 two significant events occurred. The U.S. Fish and Wildlife Service (FWS) had successfully reduced nest depredation on the adjoining beach through a program of predator removal. They were allowed to trap predators on the southern half (12 miles) of CANA. CANA continued to screen nests on the northern 11 1/4 miles of beach as before, with one exception; the hours of coverage were changed from 4:00 a.m. - 12:00 noon to 10:00 p.m. - 6:00 a.m.. The results of the two methods were compared for nesting success and cost effectiveness.

Both methods were very successful in protecting nests. The FWS removed 219 raccoons and reduced depredation to about five percent. CANA's screening efforts achieved a success rate of 81 percent. The cost was slightly higher to screen (\$29,000 versus \$25,000).

Even though predator removal proved highly successful, CANA's management was uncomfortable with the strategy for several reasons. National Park Service policy discourages single species management (the removal of one native species to aid another). An environmental assessment should be done to determine what impact the removal of such a large number of animals might have upon the overall ecosystem. Less severe actions such as selective removal, aversive conditioning, and habitat management have not been thoroughly explored. Also, screening has been shown to be an effective strategy when properly employed.

As a result, CANA opted to screen nests along the entire 24 miles of beach in 1990 rather than engage in predator removal. Due to financial restraints, heavy reliance was placed upon volunteer labor. Through a recruitment drive called "Night Stalker", over 100 volunteers were enlisted and actively participated in the nest screening program.

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 13 to August 31, 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 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, screening of loggerhead nests was discontinued after the first four weeks due to a total lack of nest depredation. A determination was made that screening would resume if the depredation rate exceeded 10 percent after the date of the first recorded depredation. 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. All of the nests deposited on the northern half of the beach were marked with a stake to facilitate screen retrieval. Ten percent of the nests were monitored throughout the incubation period to determine hatching success. On the southern half of CANA, nests deposited on a randomly selected night each week were marked and monitored to determine their outcome.

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 normal incubation period for the loggerhead turtle is about 60 days and the green turtle from 48 to 70 days. After 65 days or evidence of hatching the screen was pulled from each nest. For 10 percent of the nests a total excavation was performed. Each unhatched egg and empty shell (hatched egg) was counted to calculate an average hatching success for the entire beach.

RESULTS

Nesting and False Crawls

A total of 4108 sea turtle nests were deposited at CANA in 1990, the highest total since CANA began keeping records in 1984. Of those, 3922 were loggerhead and 185 were green (Table 1). Overall nest density was 176.7 per mile (110.4 per kilometer). The highest previous total was 145.1 per mile (90.7/km) in 1986 (Bryant 1986b). Nesting density for the loggerhead sea turtle was 168.7 per mile (105.4/km) and 8.0 per mile (5.0/km) for the green sea turtle. A single leatherback turtle nest was deposited just inside the northern boundary of the park on May 29. It hatched on August 4. The last leatherback nest recorded at CANA was in 1987 (Bryant 1987). In addition, one leatherback false crawl was recorded in the southern portion of the park.

The total number of false crawls was 3159 yielding a false crawl to nest ratio of 1:1.3 (Table 1). This was slightly less than the 1:1.5 ratio in 1989 and slightly more than the 1:1.06 ratio in 1988 (Bryant 1988, Stiner 1990). The false crawl to nest ratio of the green sea turtle was 1:1.2.

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

<u>Species</u>	<u>Nests</u>	<u>False Crawls</u>
Loggerhead	3922	3000
Green	185	158
Leatherback	<u>1</u>	<u>1</u>
Total	4108	3159

Predators

Raccoons once again were the primary predator on marine sea turtles at CANA. However, the impact of predator removal by the FWS in 1989 was still evident in the south end of the park. The first instance of nest depredation in that area was not noted until June 13, four weeks after nesting began. Depredation in the south never did reach one percent of the total.

In 1989 one armadillo (Dasypus novemcinctus) depredated several nests in CANA before FWS was able to remove it. In 1990, no damage by armadillos was observed. Feral hogs, a major threat to sea turtle nests south of CANA, occur within the park but were not seen on the beach.

Nest Screening

A total of 1547 nests were screened at CANA in 1990, 1047 in the northern half and 500 in the south. This represented 38 percent of the 4108 nests deposited in the park. Of those, 1432 were undepredated and 114 were partly depredated (Table 2). It can be seen that the major screening effort occurred in the north end where raccoons were still in abundance. While 81 percent of the nests were screened in the north, only 18 percent of the nests were screened in the south. This reflected the discontinuation of loggerhead nest screening in the south after the first four weeks of the program.

Table 2. Turtle Nest Action Upon Initial Encounter. 1990
North and South Districts
Canaveral National Seashore

<u>Action</u>	<u>Loggerhead</u>		<u>Green</u>		<u>Total</u>
	North	South	North	South	Combined
Undep/Scrn	896	357	37	142	1432 (35)
Part Dep/Scrn	111 (09)	0	2	1	114 (03)
Tot Dep/Not Scrn	219 (8)	9	2	0	230 (06)
Undep/Not Scrn	<u>19</u>	<u>2311</u>	<u>1</u>	<u>0</u>	<u>2311</u> (56)
TOTAL	1245	2677	42	143	4107

One additional leatherback nest would fall into Undep/Scrn

Undep/Scrn = Undepredated/Screened
Part Dep/Scrn = Partly Depredated/Screened
Tot Dep/Not Scrn = Totally Depredated/Not Screened
Undep/Not Scrn = Undepredated/Not Screened

Nest Depredation

A total of 262 or six percent of the nests deposited at CANA were totally depredated (Table 3). An additional 114 or three percent were partially depredated (20% or fewer of the eggs destroyed). These nests were cleaned up and screened. Prior data indicate that such nests have the same chances of hatching as non-depredated nests (Stiner 1990). All of the totally or partially depredated nests were loggerhead with the exception of five greens. Only 22 of the depredated nests were in the southern half of the park where predators had been removed the previous year.

Table 3. Nest Depredation at Canaveral National Seashore. 1990.
North and South Districts
Canaveral National Seashore

	<u>Loggerhead</u>		<u>Green</u>		<u>Total</u>
	North	South	North	South	Combined
Total Dep	239 (19)	21 (01)	2 (05)	0	262 (06)
Partial Dep	111 (09)	0	2 (05)	1	114 (03)
Not Dep	<u>895</u> (72)	<u>2656</u> (99)	<u>38</u> (90)	<u>142</u>	<u>3731</u> (90)
TOTAL	1245	2677	42	143	4107

One additional leatherback nest would fall into Not Dep category
() = percent of total at bottom of column
Total Dep = Total Depredation
Partial Dep = Partial Depredation (<20% of eggs destroyed)
Not Dep = Not Depredated

The clearest picture of the screening program's effectiveness can be gained by observing the northern portion of CANA, where raccoons had not been removed. Depredation primarily occurs when the raccoons reach a nest before park personnel. A total of 221 or 17 percent of the 1288 nests deposited in that area were destroyed in this manner. Another 113 or nine percent were partially predated, that is 20 percent or fewer of the eggs were destroyed. These nests were cleaned up and screened. Once screened, nests were rarely depredated. As in 1989, screening proved to be an effective deterrent in preventing raccoons from digging up the eggs (Stiner 1990). Only 20 or two percent of the 1047 screened in the northern section of CANA were depredated after screening. Park personnel were able to reach 934 or 72% of the nests before they were disturbed by raccoons.

Hatching Success

The overall hatching success of 978 monitored loggerhead nests was 90 percent in the north and at least 93 percent in the south (Table 4). Ten percent of the nests in the north did not hatch. The fate of six percent of the nests in the south remained unknown.

Table 4. Outcome of Monitored Sea Turtle Nests. 1990.
North and South Districts
Canaveral National Seashore

<u>Outcome</u>	<u>Loggerhead</u>		<u>Green</u>		<u>Total</u>
	North	South	North	South	Combined
Hatched	99 (90)	808 (93)	6	128 (90)	1041 (92)
Unhatched	11 (10)	4 (01)	0	0	15 (01)
Unknown	<u>0</u>	<u>56</u> (06)	<u>0</u>	<u>14</u> (10)	<u>70</u> (06)
Total	110	868	6	142	1126

Nest Excavations

Ten percent of the nests were completely excavated to determine mean clutch size and mean nest success. A total of 434 loggerhead and 32 green sea turtle nests were sampled (Table 5). Excavations were distributed throughout the season and done randomly. All the hatched (empty eggshells) and unhatched eggs in each clutch were counted.

Table 5. Sea Turtle Clutch Size and Nest Production. 1990.
Canaveral National Seashore

<u>Species</u>	<u>Nests</u>	<u>Eggs Hatched</u>	<u>Eggs Unhatched</u>	<u>Average Clutch</u>	<u>Average Hatch</u>
Loggerhead	434	37530	8069	105	86 (82%)
Green	32	3027	699	116	94 (81%)

The mean clutch size for loggerhead nests was 105 eggs, the same number recorded in 1989 (Stiner 1989). In 1988 the mean clutch size for loggerheads was 108 and in 1986 111 (Bryant, 1988 and 1986b). The mean number of hatched eggs was 86 or 82 percent. Multiplying the mean number of hatched eggs (86) by the projected number of successful nests (3608) equals an estimated 310,288 loggerhead hatchlings produced at CANA in 1990.

The mean clutch size for green sea turtle nests was 116 eggs compared to 134 in 1990. The mean number of hatched eggs was 94 or 81 percent. Multiplying mean number of hatched eggs (94) by projected number of successful nests (166) equals an estimated 15,604 green sea turtle hatchlings produced at CANA in 1990.

Relocated Nests

Approximately 20 loggerhead nests were relocated. The nests were moved 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.

More nests would have been relocated, however the amount of time involved in careful transfer of the eggs (up to 45 minutes) and the need to reach other nests quickly limited such activity.

Disorientation

A concern of the park was disorientation of hatchlings due to artificial lighting. Just to the north of the park are residences with outdoor pole lights. To the south lies Kennedy Space Center. A launch pad, very heavily lit up for security reasons, can be seen at least 15 miles up the beach. Several night time emergences were observed in 1990. No cases of disorientation were noted.

DISCUSSION

The year 1990 was a peak year for nesting loggerhead and green sea turtles in the southeastern United States. Many beaches in Florida reported an increase in nesting. CANA's 4108 nests exceeded all other years since nesting recording began in 1984 (Table 6). Loggerhead totals rose 27 percent over last year while green turtles showed an even more dramatic increase, jumping from 41 to 185, an increase of 450 percent. The increases were somewhat unexpected since 1989 was thought to be a peak year. Loggerhead nesting tends to peak roughly every third year.

Table 6. Total Sea Turtle Nests and Depredation Rate. 1984-1990.
Canaveral National Seashore 1984-1990

<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

* Combined NPS and FWS figures

The number of nests destroyed by predators in the initial 12 hours after deposition increased from seven percent in 1989 to 17 percent in 1990 in the north half of the park (Table 6). Some increase in depredation was expected since CANA was in the first year of implementing its "Night Stalker" volunteer program. A large number of volunteers were trained and needed time to develop skills in turtle crawl identification and nest screening technique. The first several nights a volunteer went out they remained with a park ranger. Only after the ranger felt comfortable with their technique were they allowed to function independently enough to "leapfrog" down the beach as each nest was encountered. It was at this period that rapid coverage of the beach became possible and the greatest number of nests could be saved.

In 1991 CANA will have an experienced corps of volunteers to draw from. While new volunteers will also be added, the overall amount of time spent in training will be greatly reduced, allowing quicker coverage of the beach. Most nest depredation occurs within the first few hours after deposition so reaching the nests as quickly as possible is critical.

The volunteer program did more than contribute valuable labor. It also enhanced park - community relations, educated the public about endangered and threatened sea turtles, and allowed volunteers the satisfying experience of participating in sea turtle protection. If the nest screening option for sea turtle management is pursued at CANA, the "Night Stalker" program will be an essential component.

For the second straight year the percent of screened nests depredated by raccoons remained low (1.9 percent) after an 18.7 percent depredation rate in 1988 (Table 6) (Bryant 1988). As in 1989, extra rebar was used to fasten down the sides of a screen whenever a nest was partially depredated or raccoons were sighted in the area. This made it difficult for raccoons to get underneath the edge of the screen and tunnel to the nest.

Other factors may be involved in the reduction of tunneling. The ability to depredate a screened nest is a learned behavior. Even digging up unscreened nests must be learned. Evidence of this is the continued low rate of depredation in the southern portion of CANA, even after raccoons began to return in late summer. Individuals that have learned to tunnel under the screens may have decreased in the north. Some may have emigrated into the area of low raccoon density to the south; however this is not reflected by an increase in nest depredation in that area. Some may have succumbed to disease or other cause of mortality. The actual number of culprits may be quite small and the death of just a few individuals may noticeably reduce depredation of screened or unscreened nests.

The amount of nest depredation was analyzed by grid (94 quarter-mile segments) to determine if certain areas had higher depredation rates. If so, depredation might be attributable to particular resident individuals. Field workers felt there were certain hot-spots where depredation was more likely to occur. However, examination of the beach over the entire season did not readily show such areas. Individual raccoons, predominantly adult males, may roam over a fairly large area during the sea turtle nesting season. Of the 219 raccoons removed from the south portion of CANA by FWS in 1989, 64.5% were adult males.

Also the importance of turtle eggs in the raccoon's diet may fluctuate from year to year as alternate food sources such as fruits or other prey species vary in abundance. The role of the raccoon in the CANA ecosystem must be more carefully examined before any definite statements can be made.

There was one small area where the depredation rate was quite low. The northernmost 11 grids had only five instances of nest disturbance. Two parking areas and several beachfront houses occur along this stretch of beach. Raccoons may be less abundant in this area or feeding on other food sources.

CONCLUSION

In 1990, CANA initiated the "Night Stalker" volunteer sea turtle nest protection program and screened nests along the entire length of its beach. Over 100 volunteers participated in the program. A total of 4108 sea turtle nests were deposited in the park. Aided by the volunteers and the residual effect of the previous year's predator removal on the south end of the beach, the depredation rate was held to nine percent (six percent total and three percent partial). Ninety-two percent of the monitored nests hatched. This far exceeded the 50 percent nesting success recommended by the FWS Marine Turtle Recovery Plan (Hopkins and Richardson 1984).

While predator removal is quite effective, screening alone held the total depredation rate to under 20 percent. In 1991, with an experienced corps of volunteers, the results should be even better. CANA is seeking to have a study on the raccoon's population dynamics and role in the CANA ecosystem conducted within the near future. Only then will the necessary knowledge be available to determine how to handle the raccoon in a comprehensive program of sea turtle management. In the interim the park will continue the nest screening program.

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CANA would like to thank the many volunteers who contributed their time and energy to make the Night Stalker nest protection program a success. Many gave up sleep on a regular basis to screen nests at night. Others cut screen, sanded stakes, serviced ATV's, and coordinated the volunteer schedule.

A number of local businesses in Volusia County donated much-needed screens, stakes, rebar, hammers, and flashlights. Rodney Thompson of Dixie Crossroads restaurant in Titusville collected enough money to donate two six-wheel ATV's.

Special mention must be made of the original volunteers who have been quietly supporting the screening program for years. It was their faithful support that brought the program through the lean years and revealed the valuable role that volunteers can play in nest protection. They were the ones who first planted the seeds that would later develop into the Night Stalker program.