

1995 MARINE TURTLE NESTING SUMMARY
CANAVERAL NATIONAL SEASHORE

INTRODUCTION

Canaveral National Seashore (CANA) receives between 3,000 and 4,000 sea turtle nests each year. These are primarily loggerhead (Caretta caretta), with a few green (Chelonia mydas) and an occasional leatherback (Dermochelys coriacea). The Seashore is committed to achieving greater than 60 percent hatching rate as recommended in the recovery plans for the loggerhead and green sea turtles (NMFS and USFWS 1991).

Nest depredation by the raccoon (Procyon lotor) is a serious threat to sea turtle nests at CANA. Nest surveys in the early 1980's revealed that over 95 percent of the nests were being depredated by raccoons each year (McMurtray 1986). To protect the nests, the park implemented a nest screening program in 1984. 1995 was the twelfth year of this program.

Between January 1993 and November 1994, field work was conducted by the University of Georgia (UGA) to obtain critical information about the raccoon population at CANA and to explore alternative methods of nest protection (Ratnaswamy et al. 1994; Ratnaswamy, in draft). The methods included screening, predator removal and conditioned-taste-aversion. The results, when completely analyzed, will help to design a long range strategy that will protect sea turtle nests while allowing predators such as the raccoon to remain as a natural part of the seashore ecosystem. During the interim year of 1995, the park placed protective screens over every nest that could be reached before it was destroyed by predators.

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 (Figure 1). The northern 11.25 miles of beach is situated in Volusia County and 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 2, the park initiated patrols to record sea turtle nests and false crawls. The 24 mile stretch of beach was covered utilizing four-wheeled all-terrain vehicles (ATV's). Two teams, each consisting of a ranger and a volunteer, worked from 11:00 p.m. to 7:00 a.m., seven nights a week, screening turtle nests and recording data. In addition, daytime patrols were conducted at least three times a week to record any additional depredations to recorded nests. On July 31 (North District) and August 03 (South District), night patrols were switched to daytime and combined with the depredation patrols, due to a decrease in nesting activity.

Initial data collection for each nest included: date, nest number, species, grid (the beach was divided into 94 quarter mile sections), number of eggs depredated, if any, and sighting/treatment. Sighting/treatment referred to the condition of the nest (undepredated, partially depredated or totally depredated) and the subsequent treatment (screened or unscreened). Each nest was marked with a numbered stake for later identification. Date and grid location of each false crawl was also recorded.

The screening procedure 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. Partially depredated nests that retained a significant number of intact eggs had the broken eggs removed and were covered with clean sand.

During daytime depredation patrols, all new nest depredations were recorded, the number of damaged eggs counted and all damaged eggs removed from the beach. The latter was done to deter raccoons from easily relocating any remaining eggs and to prevent counting depredations more than once. As with the initial discovery of partially depredated nests, if a significant number of viable eggs remained, the nest was cleaned and covered with clean sand.

The stake for every tenth nest was marked with spray paint for easy identification. After a minimum of 65 days or evidence of hatching the nests were excavated and the following information recorded: number of eggs, number of hatchlings emerged, number of live hatchlings in nest, number of dead hatchlings in nest, number of pipped eggs (hatchling still partially in eggshell) and number of unhatched eggs. Depredated eggs recorded during daytime runs were added to the total of unhatched eggs. This data was then used to calculate average hatching success for the entire beach.

Nests were relocated if time permitted for one of two reasons: 1) the nest was located at the base of a heavily travelled boardwalk; 2) 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 screened in the usual manner.

An attempt was made to remove individual raccoons that had learned to tunnel under the screens or that repeatedly depredated unscreened nests. All raccoons were captured using Tomahawk live-traps.

RESULTS

Nesting and False Crawl Totals

A total of 4169 sea turtle nests were deposited at CANA in 1995 - 4121 loggerhead, 47 green and one leatherback (Table 1). Overall nest density was 109.9 per kilometer (177.25 per mile) for the loggerhead and 1.25 per kilometer (2.02 per mile) for the green.

The total number of loggerhead false crawls was 3025 or 80.7 per kilometer (130.1 per mile), a false crawl to nest ratio of 1:1.36 (Table 1). There were 39 green false crawls or 1.04 per kilometer (1.68 per mile), a false crawl to nest ratio of 1:1.21.

As in former years, the greatest concentration of nesting was noted in the southern half of CANA with 63% (2606) of the nests occurring in the South District (Brevard County) and 37% (1563) in the North District (Volusia County) (Table 1). Nesting densities were 134.7/km (217.2/mi) and 86.1/km (138.9/mi) respectively.

Grids 84-92 in the southernmost three miles of the park exhibited the highest nesting totals, with all but one grid having more than 70 nests (CANA files). For the second year in a row, grid 33 had the most nests in the North District, with 77.

The false crawl total was highest in grid 33 with 73 (CANA files). The next highest false crawl numbers were noted in grids 73 (70), 48 (69), 90 (58) and 85 (58).

Initial Sighting and Nests Screened

In 1995, 95 percent (3975) of the 4169 nests deposited at CANA were screened (Table 2, Initial Encounter). This included one leatherback, 47 green and 3927 loggerhead nests. Of the loggerhead nests screened, 248 (06 %) had been partially depredated prior to discovery. An additional 182 nests were destroyed before discovery, while 12 others (less than one percent) were found fully or partially intact a day or more after deposition. None of the green sea turtle nests were depredated prior to discovery.

Depredation Rate

Five percent (189) of the screened nests were depredated by raccoons that had learned to tunnel underneath the screens (Table 2, Subsequent Depredation). Tunnelling was significantly higher in the North District, with 10% (141) of the screened nests being depredated versus two percent (48) in the South District. Of the 12 unscreened nests discovered a day or more after deposition, seven (58%) were depredated.

Table 1. 1995 MARINE TURTLE CRAWL SURVEY

OVERALL

	LOGGERHEAD	GREEN	LEATHERBACK	TOTAL
Nests	4121	47	1	4169
False Crawls	3025	39	0	3064
Nest Density	109.9/km	1.25/km	-	111.2/km
FC Density	80.7/km	1.04/km	-	81.7/km
FC to Nest Ratio	1:1.36	1:1.21	-	1:1.36

DISTRIBUTION BY DISTRICT

North District (Volusia County)

	LOGGERHEAD	GREEN	LEATHERBACK	TOTAL
Nests	1544	19	0	1563
False Crawls	1142	4	0	1146
Nest Density	85.1/km	1.0/km	-	86.1/km
FC Density	62.9/km	0.2/km	-	63.1/km
FC to Nest Ratio	1:1.35	1:4.75	-	1:1.36

South District (Brevard County)

	LOGGERHEAD	GREEN	LEATHERBACK	TOTAL
Nests	2577	28	1	2606
False Crawls	1883	35	0	1918
Nest Density	133.2/km	1.4/km	-	134.7/km
FC Density	97.3/km	1.81/km	-	99.1/km
FC to Nest Ratio	1:1.37	1:0.8	-	1:1.36

Table 2. 1995 NEST TREATMENT AND DEPREDACTION

INITIAL ENCOUNTER

	LOGGERHEAD	GREEN	LEATHERBACK	TOTAL
Not Dep/screened	3679	47	1	3727 (89%)
Part Dep/screened	248	0	0	248 (06%)
Total Depredation	182	0	0	182 (04%)
Not Dep/not screened	9	0	0	9 (<01%)
Part Dep/Not screened	3	0	0	3 (<01%)
TOTAL	4121	47	1	4169

Part = Partial Dep = Depredation

SUBSEQUENT DEPREDACTION

Screened Nests (Tunneling)

North District	140	1	-	141 (10%)
South District	48	0	0	48 (02%)
TOTAL	188	1	0	189 (05%)

Unscreened Nests

North & South District	7	0	0	7 (58%)
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OVERALL DEPREDACTION (ALL NESTS)

North District	408	1	-	409 (26%)
South District	208	0	0	208 (08%)
TOTAL	616	1	-	617 (15%)

Only 16 nests were recorded as being depredated more than once, 15 screened nests and one unscreened nest (CANA files). This indicates that the effort to clean up and screen partially depredated nests may allow at least some of the eggs to hatch.

Overall, 616 loggerhead and one green nest were depredated (either partially or totally) during the 1995 season (Table 2, Overall Depredation). This represented 15% of the loggerhead and 2% of the green nests. Forty percent (248) of the loggerhead depredations were nests that had been partially impacted prior to discovery and were cleaned up and screened. As in past years, the majority of depredations occurred in the North District, where 26% (408) nests were depredated compared to 08% (208) in the South District.

A total of five problem raccoons were removed from the beach during the nesting season.

Monitored Nests

Ten percent (420) of the total nests were marked for excavation after the incubation period to determine hatching success. Because of Hurricane Erin, which struck CANA on August 02, and several other storm events during August and September, many stakes were washed away, making it impossible to relocate 54% (228) of the nests. A total of 43% (180) of the marked nests were excavated to determine hatching rate (Table 3). Another five percent (21) were destroyed by depredation. Combining the 21 destroyed nests with 40 partially depredated nests gave an overall depredation rate of 15 percent (61).

Average clutch size for the 171 excavated loggerhead nests was 97.3 eggs (Table 3). Seventy percent of the eggs successfully hatched. When the estimated number of eggs from the 21 totally depredated loggerhead nests is added to the total number of unhatched eggs, the estimated hatching success drops to 62 percent.

Average clutch size for eight green nests was 119.4 eggs with a success rate of 72 percent. The single leatherback nest yielded eight hatchlings out of 103 eggs.

A minimum estimated number of loggerhead hatchlings was calculated based on the 46 percent of marked nests that were excavated. This was done as follows:

$(62\% \text{ hatching success}) \times (97.3 \text{ eggs/clutch}) \times (4121 \text{ nests}) \times (46\% \text{ of the sample nests}) = 114,358 \text{ hatchlings}$

The actual number would have been somewhat higher since some of the sample nests undoubtedly hatched prior to Erin but had not yet been excavated, while still others would have survived the storm events.

For the green sea turtle, eight of nine excavated nests hatched. However, all but two of these were deposited before July 15th. Multiplying hatching success of the excavated nests times the number of nests known to have hatched yields a minimum number of hatchlings as follows:

$(72\% \text{ hatchling success}) \times (119.4 \text{ eggs/clutch}) \times (17 \text{ nests}) = 1,461$
hatchlings

Again, as with the loggerhead, the actual total would have been higher.

Table 3. HATCHING SUCCESS OF MARKED NESTS

	LOGGERHEAD	GREEN	LEATHERBACK
Nests Marked	410	9	1
Nests Excavated	171	8	1
Total Eggs	16,631	955	103
Ave. Clutch Size	97.3	119.4	103
Hatchlings Emerged	11,646	689	8
Hatchlings Not Emerged	4,985	266	0
Hatching Success	70%	72%	08%
Nests Depredated	61 (15%)	1	0
Nests Destroyed	21 (05%)	0	0
Unknown Fate	228 (54%)	0	0
Estimated Overall Success	62% *	---	---

* Estimated number of depredated eggs in 21 nests destroyed by predators added to total of unhatched eggs: i.e. (21 nests)x(97.3 eggs/nest)= 2043 eggs + 4985 unhatched eggs = 7028 eggs.

DISCUSSION

Comparison to Former Years

In 1995, the largest number of loggerhead nests (4121) and second highest number of sea turtle nests (4169) was recorded since the park implemented nesting surveys in 1984 (Table 4). The greatest number of nests was noted in 1994. Green nesting dropped significantly, after setting a record high in 1994, a pattern of alternating low and high years which has been exhibited since 1990. The single leatherback nest makes at least one nest for that species at CANA in seven of the last 11 years.

The depredation rate (partial and total) of 14.8 percent was a decline from the 1994 total of 18.7 percent (Table 5). This may be due to the increase in number of nests screened. In 1995, 95 percent of the nests were screened compared to 41 percent in 1994. Prior to 1995, the most nests screened in a season was 62 percent in 1992. Less nests were screened in 1993 and 1994 to allow the University of Georgia to test three different nest protection strategies. However, less predator control was employed in 1995, with only five raccoons being removed compared to 215 during the 1993-94 seasons.

Tunnelling is of particular concern to park staff since it negates efforts to protect the nests. The incidences of tunnelling increased from 69 in 1994 to 189 in 1995; however, with the greater number of screened nests, it only represented an increase from 4.3 to 4.8 percent (Table 5). The more disturbing aspect is that it occurred in 64 of the 94 grids in 1995 versus 32 in 1994 (CANA files). This would imply that the behavior is spreading among the raccoon population. The highest concentration of tunnelling occurred in grids 41-44 where no instances were recorded in 1994.

Impact of Severe Storm Season

Beginning with Hurricane Erin on August 02, a number of severe storms battered CANA's beach throughout August and September. Some storm events severely eroded sections of the beach, while others deposited as much as three feet of sand on remaining nests. Throughout the period tides were prolonged and unusually high. Because so many stakes were lost, many of the nests deposited in the latter half of the season could not be relocated. As a result, an undetermined amount of nests were inundated or washed away. Loose screening material was found scattered about the beach and on a few occasions eggs were even seen rolling along the tide line. However, at the same time, signs of hatching continued to be noted from unmarked nests, showing that some nests had survived. A minimum number of hatchlings was calculated based on the 46% of the nests that were relocated.

It is ironic that in the year the park screened the greatest amount of nests (95 percent compared to the next highest total of 62 percent in 1992), the worst weather conditions should occur since the screening program began. Because of the heavy amount of sand deposited on many nests, efforts to remove screens at the end of the season were greatly hampered. Some areas of the beach were not cleared until January. A larger amount of screening material was lost than in previous years.

Table 4. TURTLE NESTING AT CANAVERAL NATIONAL SEASHORE. 1984-1995.

YEAR	LOGGERHEAD	GREEN	LEATHERBACK	UNKNOWN	TOTAL
1995	4121	47	1		4169
1994	3886	364	2		4252
1993	3140	28	0		3168
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	*				2125

* = Individual breakdown not available.

Table 5. AMOUNT OF SCREENING AND DEPREDAATION OF SCREENED NESTS.
1984 - 1995

YEAR	NESTS	NESTS SCREENED	SCREENED NESTS DEPREDATED (%)	ESTIMATED OVERALL DEPREDAATION (%)
1995	4169	3975 (95%)	4.8	14.8
1994	4252	1724 (41%)	4.3	18.7
1993	3168	1221 (39%)	7.6	28.6
1992	3579	2213 (62%)	4.3	11.6 *
1991	4100	1507 (37%)	3.3	13.9 *
1990	4108	1547 (38%)	1.9	9.2 *
1989	3132	1030 (33%)	3.4	17.5
1988	2250	887 (39%)	18.7	64.1
1987	1776	766 (43%)	7.2	58.7
1986	3374	1517 (45%)	3.7	47.3
1985	2508	1023 (41%)	5.0	41.7
1984	2125	213 (19%)	----	65.0

* Daytime runs to check secondary nest depredation were not conducted on a regular basis

Future Plans

An interagency meeting between CANA, USFWS, Florida DEP and other interested parties was set for December, 1995 to discuss the results of the UGA study on raccoon biology and sea turtle nest protection strategies. One of the goals of that meeting was to determine a feasible long-range program of sea turtle nest protection at CANA. Representatives from the NPS field office were invited to identify funding sources for the selected program. Unfortunately due to the Congressional budget impasse, the meeting had to be cancelled. The park is attempting to reschedule the meeting for the Spring of 1996.

If cuts are not made in the scheduled funding, CANA is prepared to screen every possible nest as it did in 1995, albeit with a smaller seasonal staff. If funding is reduced, the park will rely on volunteers to cover as many of the nights as possible. The park is also planning to host a NPS chemical immobilization class to train its personnel in humane ways to euthanize predators, should screening and other options prove unfeasible.

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