

2005 MARINE TURTLE NESTING SUMMARY

CANAVERAL NATIONAL SEASHORE



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ABSTRACT

The number of sea turtle nests at Canaveral National Seashore rebounded from an extremely low year in 2004. A total of 3600 sea turtle nests were deposited in 2005 - 2547 loggerhead, 1040 green, and 13 leatherback. Nest densities were 66.5 per kilometer for the loggerhead, 27.2 per kilometer for the green and 0.34 per kilometer for the leatherback. Number of false crawls exceeded nests for the loggerhead and green (ratios of 1:0.94 and 1:0.61 respectively). Over 98% (98.9%) of the nests were screened to exclude predators. During the season, less than one percent of the nests were partially or totally depredated prior to discovery and 3.6% of the nests were depredated after screening. Overall depredation rate for all nests was 4.7%. Every twentieth loggerhead, all green, and all leatherback nests were marked for excavation. Hatching success rates of 63.9%, 57.6% and 43.3% were recorded for the loggerhead, green and leatherback sea turtles, respectively. Actual loggerhead and green success rates were lower; 24% of the loggerhead and 50% of the green index nests were lost to high tides caused by storms.

INTRODUCTION

Canaveral National Seashore (CANA) is an important nesting area for several species of threatened and endangered sea turtles. These are primarily the loggerhead (*Carretta caretta*), with a lesser number of green (*Chelonia mydas*) and an occasional leatherback (*Dermochelys coriacea*). In 1982 a hawksbill nest was documented (CANA Files) and in 2003 a Kemp's ridley nest was recorded (CANA 2003 nesting summary).

Nest depredation, primarily by raccoons, is a serious threat. Depredation rates exceeded 90 % in the early 1980's (McMurtray 1986). In 1984, the park implemented a nest screening program to protect nests, while allowing the raccoon to remain as an integral part of the seashore ecosystem. In 1993 and 1994, the University of Georgia compared three methods of nest protection, screening, predator removal and conditioned-taste-aversion (Ratnaswamy 1995; Warren 1996). They found screening to be most effective and compatible with National Park Service guidelines and objectives.

2005 was the 21st year for CANA'S sea turtle nest protection program. Since 1995, park staff has screened over 90% of the several thousand nests deposited each year, reducing nest depredation to as low as 5.6 % in 2003. The park's goal each season is to achieve the 60% hatching rate targeted in the loggerhead and green sea turtle recovery plans (NMFS and USFWS 1991) without removing predators from their important role in the barrier island 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 (Figure 1). The northern 18.1 kilometers (11.25 miles) of beach is situated in Volusia County and the southern 20.2 kilometers (12.5 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 its length 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 was divided into 94 quarter-mile long grids by placing numbered four by four posts along the dune line. These grids provide a reference point for documenting nest locations.

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 April 25, 2005, the park initiated periodic patrols on four-wheeled all-terrain vehicles (ATV's) to record sea turtle emergences (nests and false crawls) and to screen nests. Regular patrols of both districts were implemented on May 12, 2005. The 24 miles of beach was divided into two 12 mile segments, each covered by a team consisting of a ranger and a volunteer. Teams worked from 11:00 p.m. to 7:00 a.m., seven nights a week. In addition, daytime patrols were conducted at least three times a week to document any subsequent depredations to recorded nests. On September 06, 2005, patrols were switched to daytime, due to a decrease in nesting and to enhance nest excavation activities.

Initial data collected for each nest included: date, nest number, species, grid, number of eggs depredated and sighting/treatment. Sighting/treatment referred to the condition of the nest upon discovery (un-depredated, partially depredated or totally depredated) and the subsequent treatment (nest screened or left 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 attempts by predators 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 patrols, all new nest depredations were recorded, number of depredated eggs counted and broken eggs removed from the nest site. The latter was done to deter predators from



easily locating any remaining eggs and to prevent recording depredations more than once. If a significant number of viable eggs remained, broken eggs were removed and the nest was re-covered with clean sand.

Other data recorded during the incubation period included evidence of hatching, tampering with screens or stakes by humans, if the nest was covered by water at some point and if the nest was washed away.

The stake for every twentieth loggerhead, tenth green and every leatherback nest was painted white for ready identification. After a minimum of 70 days, or 3 days after evidence of hatching, these nests were excavated and the following information recorded: number of hatchlings emerged (empty eggshells), number of unhatched eggs, number of live or dead hatchlings in nest and number of live or dead pipped eggs (hatchling still partially in eggshell). Depredated eggs recorded during daytime runs were added to the total of unhatched eggs prior to analysis. This data was then used to calculate average hatching success for the entire beach.

Eighty nine (89) nests were relocated for one of three reasons: 1) the nest was located at the base of a heavily traveled boardwalk; 2) the nest cavity and eggs had been fouled by the contents of broken eggs; 3) the nest was in imminent danger of erosion. 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 learned how to repeatedly tunnel under the screens. Three raccoons were captured using Tomahawk live-traps and relocated to a mainland portion of the park.

RESULTS

Nesting and False Crawl Totals

A total of 3600 sea turtle nests were deposited at CANA in 2005 - 2547 loggerheads, 1040 greens, and 13 leatherbacks (Table 1). Overall nest density was 66.5 per kilometer for the loggerhead, 27.2 per kilometer for the green and 0.34 per kilometer for the leatherback.

The total number of loggerhead false crawls was 2720 or 71.0 per kilometer, a false crawl to nest ratio of 1:0.94 (Table 1). There were 1707 green false crawls or 44.6 per kilometer, a false crawl to nest ratio of 1:0.61. Four leatherback false crawls were recorded, or 0.10 per kilometer, for a false crawl to nest ratio of 1:3.25.

As in former years, the greatest concentration of nesting was noted in the southern half of CANA, with 64% (2316) of the nests occurring in the South District (Brevard County) and 36% (1284) in the North District (Volusia County) (Table 1). Nesting densities were 114.7 and 70.9 per kilometer respectively. Figures 2a and 2b show the number of nests and false crawls by individual grids for the entire beach.

Initial Sighting and Nests Screened

In 2005, 99.8% (3586) of the 3600 nests deposited at CANA were screened, comprising 3559 un-depredated and 27 partially depredated nests (Table 2, Initial Encounter). This included 2534 loggerhead, 1039 green and 13 leatherback nests. Thirteen loggerhead and one green nest were depredated prior to discovery (Table 2, Initial Encounter).

Table 1. 2005 Marine Turtle Crawl Survey, Canaveral National Seashore.

Overall

	Loggerhead	Green	Leatherback	Total
Nests	2547	1040	13	3600
False Crawls (FC)	2720	1707	4	4349
Nest Density (nest/km)	66.5	27.2	0.34	94.0
FC Density (FC/km)	71.0	44.6	0.10	113.6
FC to Nest Ratio	1:0.94	1:0.61	1:3.25	1:0.83

Distribution by District

North District (Volusia County)

	Loggerhead	Green	Leatherback	Total
Nests	920	361	3	1284
False Crawls	828	632	2	1380
Nest Density (nest/km)	50.8	19.9	0.17	70.9
FC Density (FC/km)	45.7	34.9	0.11	32.1
FC to Nest Ratio	1:1.11	1:0.57	1:1.50	1:0.93

South District (Brevard County)

	Loggerhead	Green	Leatherback	Total
Nests	1627	679	10	2316
False Crawls	1892	1075	2	2969
Nest Density (nest/km)	80.5	33.6	0.50	114.7
FC Density (FC/km)	93.7	53.2	0.10	147.0
FC to Nest Ratio	1:0.86	1:0.63	1:5.00	1:0.78

**Figure 2a. Number of nests, false crawls, depredations, and tunneling activity for grids 0-44
Canaveral National Seashore 2005**

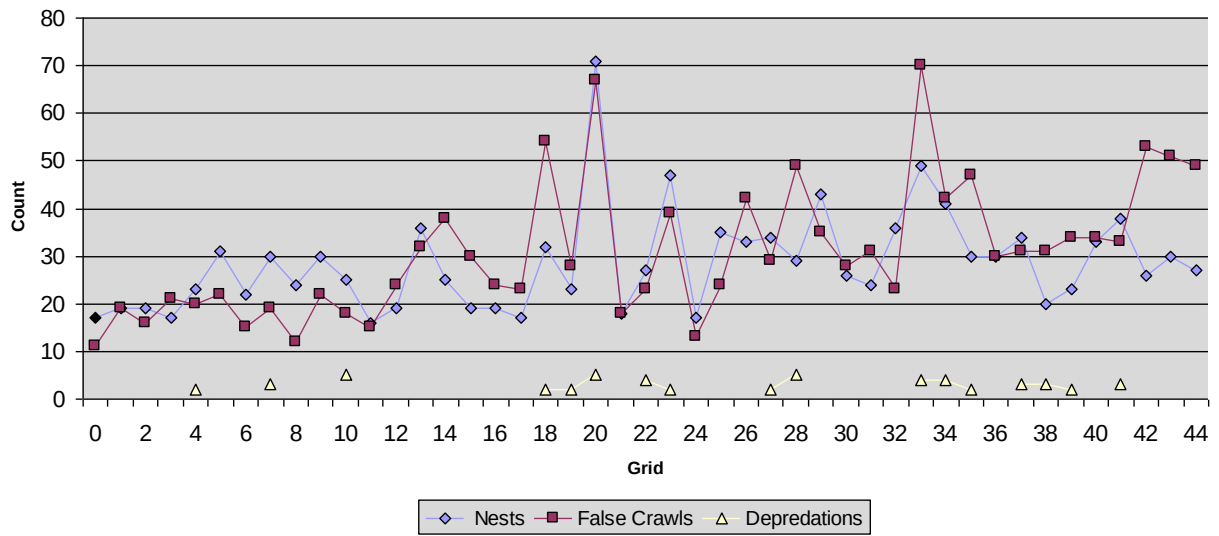


**Figure 2b. Number of nests, false crawls, depredations, and tunneling activity for grids 45-94
Canaveral National Seashore 2005**

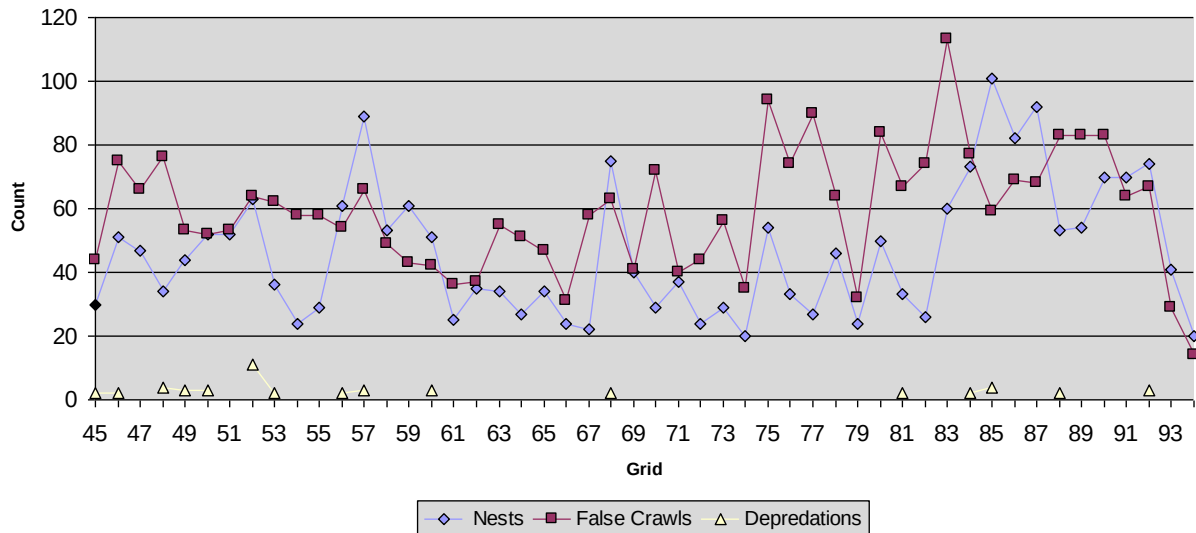


Table 2. Nest Treatment and Depredation- 2005 Canaveral National Seashore.

Initial Encounter

	Loggerhead	Green	Leatherback	Total
Not Dep/Screened	2508	1039	13	3559
Partial Dep/Screened	26	1	0	27
Total Depredation	13	1	0	14
TOTAL	2547	1040	13	3600

Dep=Depredation

Subsequent Depredation (G,I)

Screened Nests

	Loggerhead	Green	Leatherback	Total
North District	62	6	0	68 (5.3%)
South District	46	15	0	61 (2.6%)
Total	108	21	0	129 (3.6%)

Overall Depredation (Initial Encounter and Subsequent Depredation)

All Nests

	Loggerhead	Green	Leatherback	Total
Partial Depredation	131(5.1%)*	18 (1.7%)	0	149(4.1%)
Total Depredation	16 (>01%)	5(>01%)	0	21 (>01%)
Total	147 (5.8%)	23 (2.2%)	0	170 (4.7%)

* Percentages in species columns are derived from total number of nests for that species

^ Percentages in Total column are derived from total number of nests for all species (3600)

By District

	Loggerhead	Green	Leatherback	Total
North District	95	6	0	101 (7.9%)*
South District	52	17	0	69 (3.0%)*
Total	147	23	0	170 (4.7%)

* Percentages are derived from total number of nests in each district

Subsequent Depredations

Less than four percent (129) of the screened nests were partially or totally depredated by predators that reached through the top of the screens to get the upper layers of eggs or tunneled underneath the screens (Table 2, Subsequent Depredation). The depredation rate was higher in the North District with 5.3% (68) of the screened nests depredated, versus 2.6% (61) in the South. Five (>1.0%) of the nests were depredated more than once after initial screening (CANA files).

Overall Depredations

The overall depredation rate for both screened and unscreened nests and initial and subsequent depredations was 4.7%; 4.1% (149) of the loggerhead and less than 01% (21) of the green nests (Table 2, Overall Depredation, All Nests). Specifically, 16 (>01%) of the loggerhead nests were totally depredated and 131 (5.1%) were partially depredated. Five (>01%) green nests were totally depredated and 18 (1.7%) were partially depredated. None of the leatherback nests were depredated.

As in past years, the highest percentage of depredations (partial and total) occurred in the North District, where 7.9% (101) of the nests were depredated, compared to 3.0% (69) in the South District (Table 2, Overall Depredation, By District).

Hatching Success

Every twentieth loggerhead nest was marked for excavation after the incubation period to determine hatching success. Of the 159 marked loggerhead nests, 120 (75.5%) were excavated (Table 3). One hundred ten (110) of these were un-depredated and ten (10) were partially or totally depredated. Thirty-eight (38) nests, 24% of the total, were eroded by storms (Table 3). Thirty of these were in the South District and eight in the North District. One loggerhead nest was destroyed by a green sea turtle digging a nest chamber.

Hatching success for the excavated loggerhead nests was 63.9% (Table 3). Average clutch size was 99.9 eggs. Four partially-depredated loggerhead nests were excavated, with a hatching success of 42.6%. The estimated number of loggerhead hatchlings produced on CANA'S beach in 2005 was calculated as follows:

$$(63.9\% \text{ hatchling success}) \times (99.9 \text{ eggs/clutch}) \times (2547 \text{ nests}) \times (75.5\% \text{ not eroded}) = 122,756 \text{ hatchlings.}$$

Every tenth green turtle nest was marked for excavation. Only 52 of the 104 marked nests were actually excavated; the remaining 52 were eroded away (Table 3). No depredations were recorded for any of the green nests. Average clutch size was 119.6 eggs and hatching success was 57.6%. An estimated number of green hatchlings was calculated as:

$$(57.6\% \text{ hatchling success}) \times (119.6 \text{ eggs/clutch}) \times (1040 \text{ nests}) \times (50\% \text{ not eroded}) = 35,823 \text{ hatchlings.}$$

All 13 of the leatherback nests were excavated. Average clutch size was 69.4 eggs and hatching success was 43.3% (Table 3). Total estimated number of hatchlings was:

$$(43.3\% \text{ hatching success}) \times (69.4 \text{ eggs/clutch}) \times (13 \text{ nests}) = 391 \text{ hatchlings}$$

Table 3: Hatching Success of Marked Nests- 2005 Canaveral National Seashore.

	Loggerhead	Green	Leatherback
Nests marked	159	104	13
Nests Excavated	120	52	13
Total Eggs	11986	6219	902
Ave. Clutch Size	99.9	119.6	69.4
Hatchlings Emerged	7665	3583	391
Hatching Success	63.9%	57.6%	43.3%
Eroded/Washed out	38 (24%)	52 (50%)	0

DISCUSSION

Nesting and False Crawl Totals

The 3600 sea turtle nests recorded in 2005 was over 1000 more the 2004 total of 2542, the lowest number recorded in 17 years (Table 4). Loggerhead numbers increased slightly but were still the lowest since 1988. Green numbers were the most ever recorded at CANA breaking the 1000 mark. If green totals drop significantly in 2006, it will restore the pattern of a peak every other year, interrupted in 2004 with an unexpectedly low number (Figure 3). There were 13 leatherback nests, the second highest total since 1985. The downward trend in loggerhead nests continued since a high of 4501 nests in 1999 (Figure 3).

Loggerhead nests failed to exceed false crawls for only the fifth time in the past 21 years, with a ratio of 0.94 nests per every false crawl (Table 5). The leatherback nest total exceeded false crawls for the fifteenth time in 16 years with a ratio of 3.25 nests per false crawl (Table 5). The green pattern continued to be less predictable than the other two species. In 2005 the ratio was 0.61 (Table 5).

Screening Activity and Nest Depredation

Over 98 percent (3586) of the sea turtle nests deposited at CANA in 2005 were screened. Overall nest depredation dropped from 14.4% in 2002 to 5.6% in 2003 (Table 6). This was the lowest amount since 1994. The depredation rate has fluctuated between 29.9 and 5.6% since 1993, when daytime runs were implemented to detect subsequent nest depredations.

Tunneling activity, digging under the screens to reach the eggs, also decreased from 8.3% in 2002 to 4.4% in 2002 (Table 6). This too was the lowest value since 1994. The efficiency of the seasonal employees may be a key factor for the low depredation rate; all had extensive experience with the nest screening program from prior years. Since 1985, tunneling has ranged from 18.7% in 1988 to 1.9% in 1990. The unusually high value in 1988 was almost twice that of any prior year.

Table 4: Sea Turtle Nest Totals- 1984-2005. Canaveral National Seashore.

YEAR	LOGGERHEAD	GREEN	LEATHERBACK	KEMPS	UNKNOWN	TOTAL
2005	2547	1040	13			3600
2004	2281	255	6			2542
2003	3229	74	16	1		3320
2002	3161	857	8			4026
2001	3257	7	10			3274
2000	3892	662	9			4563
1999	4501	5	9			4515
1998	3976	427	5			4408
1997	2702	21	4			2727
1996	3260	222	3			3485
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.

Taken from yearly Sea Turtle Nesting Summaries, 1984-2005 Canaveral National Seashore
Titusville, Florida

Figure 3. Green Sea Turtle nesting totals, Canaveral National Seashore 1985-2005

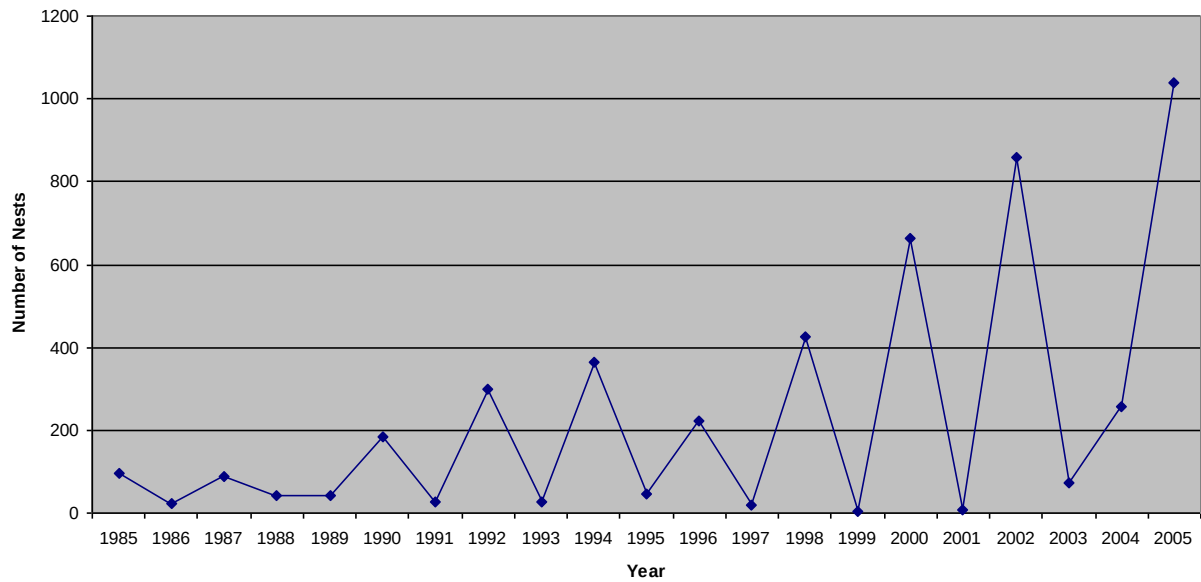


Figure 4. Loggerhead Sea Turtle nesting totals, Canaveral National Seashore 1985-2005

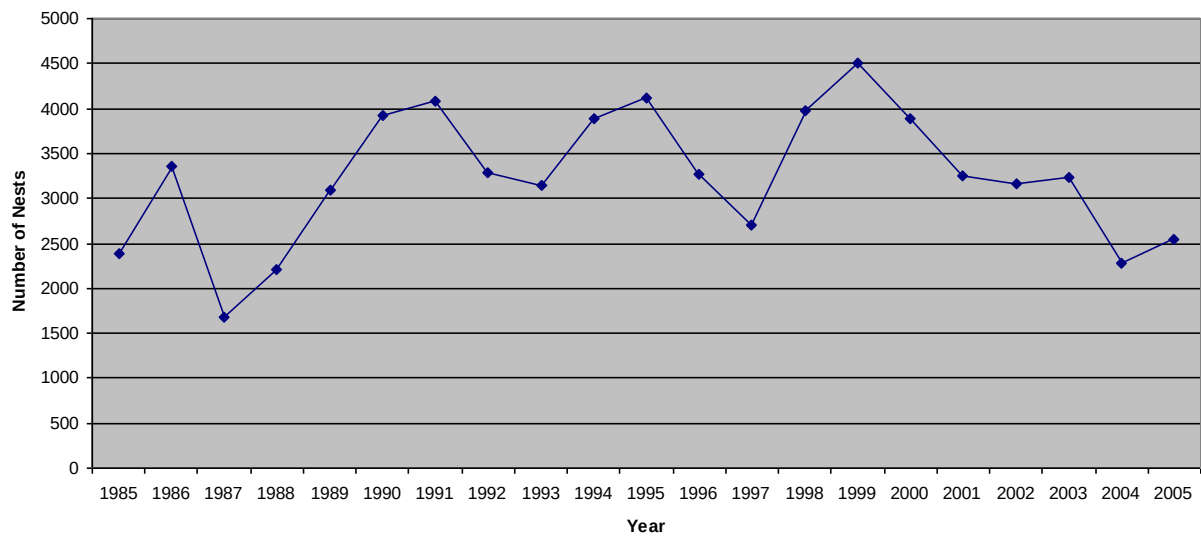


Table 5. False Crawl to Nest Ratio- 1984-2004.Canaveral National Seashore.

<u>Year</u>	<u>Loggerhead</u>	<u>Green</u>	<u>Leatherback</u>
2005	1:0.94	1:0.61	1:3.25
2004	1:1.32	1:1	1:2.4
2003	1:2.21	1:1.16	1:2.66
2002	1:0.95	1:1.27	1:2.66
2001	1:1.54	1:0.70	1:5.00
2000	1:1.02	1:0.71	1:3.00
1999	1:1.20	1:0.63	1:3.00
1998	1:0.99	1:0.52	1:0.63
1997	1:1.19	1:0.72	0:4.00
1996	1:1.32	1:0.77	1:1.00
1995	1:1.36	1:1.21	0:1.00
1994	1:1.60	1:1.38	0:2.00
1993	1:1.46	1:1.87	--
1992	1:1.43	1:1.10	--
1991	1:1.10	1:1.66	0:1.00
1990	1:1.31	1:1.17	1:1.00
1989	1:1.53	1:3.00	--
1988	1:0.94	1:1.16	--
1987	1:1.02	1:0.72	0:1.00
1986	1:0.98	1:0.76	0:3.00
1985	1:1.22	1:1.02	--
1984	--	--	--

Taken from yearly Sea Turtle Nesting Summaries, 1984-2005, Canaveral National Seashore
Titusville, Florida.

Table 6. Amount of Screening and Depredation of Screened Nests- 1984-2005.
Canaveral National Seashore

YEAR	NESTS	NESTS SCREENED	SCREENED NESTS DEPREDATED (%)	ESTIMATED OVERALL DEPREDATION (%)
2005	3600	3586 (99%)	3.6	4.7
2004	2542	2536 (99%)	6.8	6.6
2003	3320	3307 (99%)	4.4	5.6
2002	4026	3957(98%)	8.3	14.4
2001	3274	3207 (98%)	9.9	19.9
2000	4563	4304 (94%)	7.2	23.0
1999	4515	4311 (95%)	8.2	22.2
1998	4408	4233 (96%)	7.2	19.3
1997	2727	2510 (92%)	9.6	29.9
1996	3485	3198 (92%)	5.7	19.7
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.

Weather and Tidal Influences

The 2005 storm season, while not as severe as 2004, still caused considerable nest erosion. Although east central Florida did not sustain any direct hits, four hurricanes and two tropical storms skirted or passed through the general area, often causing high tides to batter CANA's beach. Tropical storm Arlene was the first, occurring the second week of June, followed by Hurricane Dennis in early July, Hurricane Katrina in late August, Hurricane Rita in late September, Tropical Storm Tammy in early October and Hurricane Wilma in late October. Wilma was by far the most destructive of the storms. For the entire season, approximately 24% of the loggerhead and 50% of the green index nests were eroded away by high tides (Table 3). Green nests were affected the most because they were deposited later in the nesting season and still incubating when Wilma hit.

Relative Hatching Success

Every twentieth loggerhead, 10th green and all 13 leatherback nests were marked for excavation at the end of the incubation period. As mentioned above, a significant percentage of the loggerhead and green nests were lost to erosion. For those that were excavated, loggerhead hatching success was almost 64%. This was similar to observed results from 1999 – 2001, although lower than the 71% and 72% recorded in 2003 and 2004, respectively (Table 7). The 2005 success rate exceeded the target of 60% set in the USFWS sea turtle recovery plans. Green success for excavated nests was over 57%, which appears to be much better than the 2004 total of 30%, the lowest rate recorded at CANA since 1996 (Table 7). However, the actual overall success rate would be much lower since 50% of the green nests were lost to erosion. Dividing the success rate by half to allot for the loss of these nests would lower the rate to a similar level as that seen in 2004.

Leatherback hatching success for the 13 evaluated nests was over 43%, the third highest total in the last 10 years (Table 7).

Table 7. Comparison of Hatching Success With Previous Years- 1996-2005.
Canaveral National Seashore

	Loggerhead	Green	Kemps	Leatherback
2005	63.9%	57.6%	-	43.3%
2004	72%	30% (N/A)	-	41% (N/A)
2003	71% (N/A)	59% (N/A)	95% (N/A)	61% (N/A)
2002	57% (55%)	60%(N/A)	-	43% (N/A)
2001	64% (62%)	-	-	31.5% (N/A)
2000	61% (56%)	56% (N/A)	-	38% (N/A)
1999	62% (53%)	64% (55%)	-	29% (N/A)
1998	64% (62%)	71% (N/A)	-	56% (42%)
1997	55% (49%)	51% (N/A)	-	23% (N/A)
1996	59% (53%)	65% (N/A)	-	27% (N/A)

() Percentages in parentheses are adjusted hatching rates, adding in average clutch size for totally depredated nests.

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Canaveral National Seashore's sea turtle nest screening program would not be possible without the effort of many dedicated people. The seasonal employees, Kristin Kniefl, Michael Daley and Sean McKenna, patrolled the beach each night, dealing with high humidity, bothersome insects and unexpected obstacles, but always accomplished the task. Candace Carter, as always, provided invaluable logistical support. The four Student Conservation Association (SCA) resource assistants - Mary Beth Bender, Jeremy Schmid, Michaleen Nikolich and Kelly Kirby - provided regular depredation patrols and maintained the large database. John Stiner, Michaleen Nikolich and Kelly Kirby analyzed data and wrote the final report. And then there were the many volunteers who sacrificed sleep and comforts to support the cause of sea turtle preservation. Thanks to you all.

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