

2006 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 2005. A total of 2868 sea turtle nests were deposited in 2006 - 2470 loggerhead, 396 green, one leatherback and one Kemp's ridley. Nest densities were 64.5 per kilometer for the loggerhead and 10.3 per kilometer for the green - an overall nest density of 74.9. Number of false crawls slightly exceeded nests for the loggerhead and green (ratios of 1:0.99 and 1:0.81 respectively). Over 99% (99.7%) 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 6.0% depredated after screening. Overall depredation rate for all nests was 7.1%. Every twentieth loggerhead, fourth green, and both the Leatherback and Kemp's ridley nests were marked for excavation. Hatching success rates of 67.5% and 51.7% were recorded for the marked loggerhead and green nests, respectively. The single leatherback and Kemp's ridley nests yielded hatching success rates of 39 and 34%, respectively.

INTRODUCTION

Canaveral National Seashore (CANA) spans the Atlantic Ocean in the state of Florida for approximately 24 miles. The North District (Apollo Beach) begins just south of Bethune Beach in Volusia County and continues for 18.1 kilometers (11.25 miles) to the Brevard County line. At this point the South District (Playalinda Beach) begins and continues to add another 20.2 kilometers (12.5 miles) of beach front to the park in Brevard County. The South District is adjacent to National Aeronautics and Space Administration (NASA) property where public entry is prohibited (Figure 1).

The middle 12 miles of the seashore, Klondike Beach, is accessible only by horseback or foot. CANA has a sloping beach that can be from 30-50 yards wide or completely covered by water, depending on the tide. The sand is primarily composed of quartz and calcium carbonate (shell fragments).

CANA provides habitat for 14 species of federally-listed threatened or endangered animals, the second greatest number in the entire National Park Service. Included in these are five species of marine turtles. The loggerhead, *Caretta caretta*, and the green, *Chelonia mydas*, are the most prevalent. A few (up to 16) leatherback, *Dermochelys coriacea*, nests have been recorded annually since 1994 and single Kemp's ridley, *Lepidochelys kempii*, nests were recorded in 2003 and 2006. A hawksbill, *Eretmochelys imbricata*, nested in the park in 1982.



At CANA, the sea turtle nesting season for loggerhead and green sea turtles generally extends from late April into September, with peak numbers occurring in late June and early July. During that time, up to 100 nests may be deposited each night. The leatherback nesting period is earlier and shorter, with nests recorded between April and June. Loggerhead totals fluctuate up and down, with a peak about every 3-4 years. The green, in contrast, with rare exception, is extremely predictable, being high one year and low the next. Many of the greens appear to be on the same cycle, nesting every second or fourth year.

Nest depredation, primarily by raccoons, is a serious threat. Depredation rates exceeded 90% in the early 1980s (McMurtray 1986). 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. 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.

2006 was the 23rd year for CANA's sea turtle nest protection program. Since 1995, park staff and volunteers have screened over 90% of the several thousand nests deposited each year, reducing nest depredation to as low as 4.7% in 2005. 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.

METHODS AND MATERIALS

On May 11, 2007, the park initiated patrols on four-wheeled all-terrain vehicles (ATV's) to record sea turtle nest emergences (nests and false crawls) and to screen nests along the 24 miles of beach. Patrols were expanded to seven days a week on May 15 and continued until August 31, 2006 according to the protocol for the Florida Index Nesting Beach Survey. During September, patrols were conducted on weekdays and sporadically into October. Surveys were performed by permanent and seasonal Biological Science Technicians, Student Conservation Association (SCA) interns, and volunteers listed on the Florida Fish and Wildlife Conservation Commission (FWS) permit.

The beach was patrolled from 23:00 to 07:30, with personnel beginning at the North District heading south, and another team starting at the South District heading north. The beach is divided into $\frac{1}{4}$ mile grids, starting at 0 in the North District and continuing south to grid 94. One team was responsible for the first 44 grids and the other for the southern 50 grids, with the Volusia/Brevard County line as the dividing point. A one-axle box trailer was attached to one of the ATV's to carry necessary equipment. When a sea turtle crawl was located, the personnel inspected it to determine if a nest was present. All nests (unless totally depredated by predators) were marked and a 4' x 4' square 2" x 4" wire mesh screen placed over it to exclude predators. The corners of

the screen were secured using #3 rebar with a bend of 70° at one end. Information written on the nest marker included nest number, grid number, species, date, and observer.

A small number of 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 through predator activity; 3) the nest was in imminent danger of erosion. Pits, approximating the natural nest cavity were dug on the beach near the base of the dune and eggs were carefully transferred during the first few hours after the eggs were laid. The eggs were covered by sand and screened in the usual manner.

Every 20th loggerhead nest and every 4th green nest were marked as index nests to determine hatching success. These nests were excavated three days after first hatchling emergence or 70 days after the nest was laid, whichever was shorter. The following excavation information was recorded: number of hatchlings emerged (empty eggshells), number of unhatched eggs, the number of live or dead hatchlings in nest, and the number of live or dead pipped eggs (hatchling still partially in eggshell). Depredated eggs were added to the total of unhatched eggs prior to analysis.

In addition, daytime patrols were conducted two to three times a week to document any status changes to recorded nests. The observations included nest tamperers, partial and total depredations, hatches, inundations, nest erosion, or any other notable conditions.

On September 05, 2006, patrols were switched to 06:00 -14:00 due to a decrease in nesting and to expedite nest excavation and removal of screens from nests that had hatched.

A Microsoft Access database was utilized to track marine nesting information. All new nests, false crawls, species, nest locations and conditions, observers, dates, and relocations were entered into the database.

An additional database was maintained as part of the Florida Index Nesting Beach Survey and submitted periodically throughout the nesting season. Data collected were number of nests and false crawls for each species nightly per half mile segment of beach between the period of May 15 to August 31, 2007.

The Visitor's Center was frequently updated on the number of marine turtle nests at the seashore so the numbers could be posted for public view. During June and July, Park interpreters conducted "Turtle Watch" programs, allowing visitors to see a loggerhead sea turtle nest, learn about sea turtle conservation issues and recognize the importance of CANA for sea turtle nesting.

RESULTS

Nest and False Crawl Totals

A total of 2868 sea turtle nests were deposited in 2006 - 2470 loggerhead, 396 green, one leatherback and one Kemp's ridley (Table 1). The Kemp's nest was only the second recorded at CANA, with the emerging female witnessed by Park staff. Nest densities were 64.5 per kilometer for the loggerhead and 10.3 per kilometer for the green, totaling an overall nest density of 74.9 per kilometer. As in former years, the greatest concentration of nesting was noted in the South District with 62% of the nests laid in the South (Brevard County) and 38% in the North (Volusia County) (Table 1). Figures 2a and 2b show the number of nests false crawls by individual grids.

Table 1. 2006 Marine Turtle Crawl Survey (Volusia and Brevard County)

Overall

	Loggerhead	Green	Kemp's Ridley	Leatherback	Total
Nests	2470	396	1	1	2868
False Crawls (FC)	2479	490	0	0	2969
Nest Density (nests/km)	64.5	10.3	<1	<1	74.9
FC Density (FC/km)	64.7	12.8	0	0	77.5
FC to Nest Ratio	1:0.99	1:0.81	0	0	1:0.97

North District (Volusia County)

	Loggerhead	Green	Kemp's Ridley	Leatherback	Total
Nests	935	164	0	1	1100
False Crawls (FC)	813	202	0	0	1015
Nest Density (nest/km)	51.7	9.1	0	<1	60.8
FC Density (FC/km)	44.9	11.2	0	0	56.1
FC to Nest Ratio	1:1.15	1:0.81	0	0	1:1.08

South District (Brevard County)

	Loggerhead	Green	Kemp's Ridley	Leatherback	Total
Nests	1535	232	1	0	1768
False Crawls (FC)	1681	288	0	0	1969
Nest Density (nest/km)	76.0	11.5	<1	<1	87.5
FC Density (FC/km)	83.2	14.3	0	0	97.5
FC to Nest Ratio	1:0.91	1:0.81	0	0	1:0.90

False crawl (non-nesting emergence) totals slightly exceeded nest numbers for both loggerhead and green. False crawl densities were 64.7 per kilometer for the loggerhead and 12.8 for the green, a false crawl to nest ratio of 1:0.99 and 1:0.81, respectively (Table 1). No false crawls were recorded for the leatherback or Kemp's ridley. Figures 2a and 2b show the number of nests false crawls by individual grids for the entire beach.

**Figure 3a. Number of nests, false crawls, depredations, and tunneling activity for grids 0-44
Canaveral National Seashore 2006**

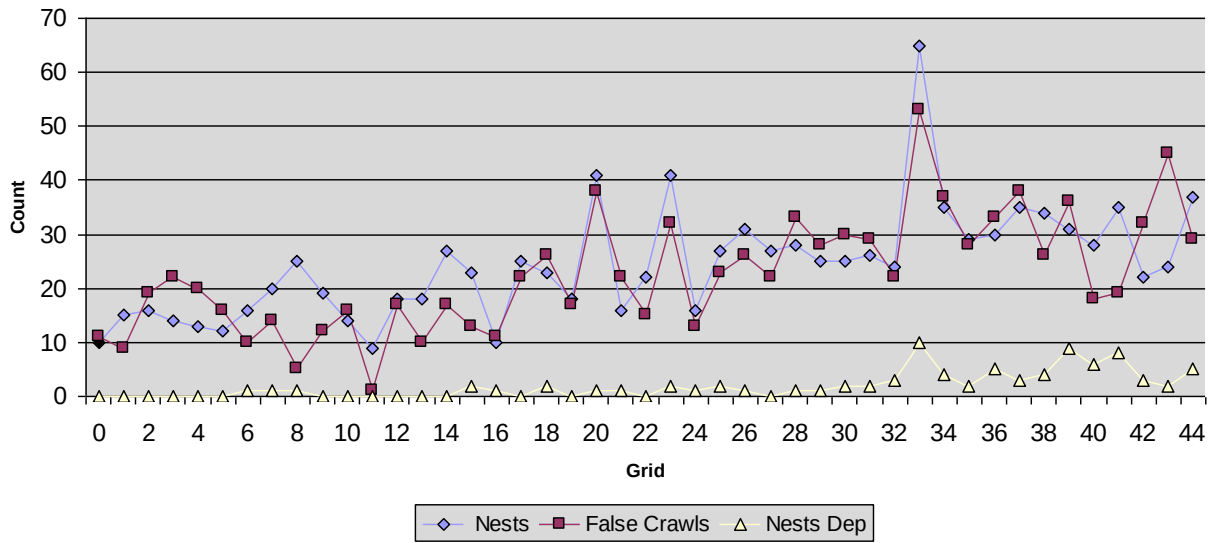
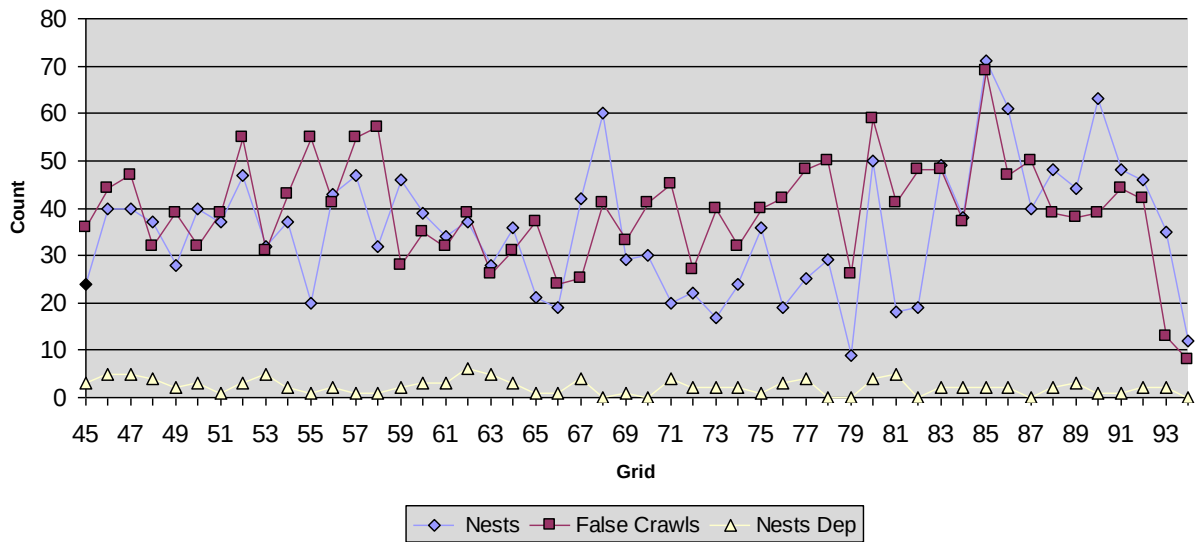


**Figure 3b. Number of nests, false crawls, depredations, and tunneling activity for grids 45-94
Canaveral National Seashore 2006**



Nest Depredation

In 2006, 99.7% of the sea turtle nests were screened by park staff and interns. Less than one percent (8) of the nests were totally depredated and 1.1% (32) partially depredated prior to discovery (Table 2). Six percent (173) of the nests were impacted by predators who learned to tunnel under the screens and reach the egg chamber. Overall nest predation was 7.4%. Figures 2a and 2b show the number of nest depredations by individual grids for the entire beach.

Table 2. Nest Treatment and Depredation

a. Initial Treatment and Depredation

Initial Encounter	Loggerhead	Green	Leatherback	Kemp's	Total
Not Dep/Screened	2430	396	1	1	2828
Partial Dep/Screened	32	0	0	0	32
Total Depredation	8	0	0	0	8

b. Subsequent Depredation of nests after screening

Screened Nests	Loggerhead	Green	Leatherback	Kemp's	Total
North District	56	4	0	0	60
South District	109	4	0	0	113
Total	165	8	0	0	173 (6.0%)

c. Overall Depredation (Initial Encounter and Subsequent Depredation)

All Nests	Loggerhead	Green	Leatherback	Kemp's	Total
Partial Depredation	189	8	0	0	197
Total Depredation	7	0	0	0	7
Total	196	8	0	0	204 (7.1%)

Nests depredated at both initial and subsequent encounter (8) were only counted once to reflect number of nests depredated rather than incidents

d. Overall Depredation (by district)

By District	Loggerhead	Green	Leatherback	Kemp's	Total
North District	86	4	0	0	90 (8.2%)
South District	110	4	0	0	114 (6.4%)
Total	196	8	0	0	204 (7.1%)

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

Hatching Success

Index nests were used to estimate hatching success for each species at CANA in 2006. The estimated number of hatchlings that emerged from the nests present is calculated as follows: (% hatching success) x (eggs/clutch) x (# of nests) x (% not eroded) = number of hatchlings. For the loggerhead the figures are (67.4%) x (98.0) x (2470) x (0%) = 163,148 hatchlings emerged. The green calculation is (52.1%) x (122.5) x (396) x (80%) = 20,219 hatchlings emerged. The leatherback nest produced 30 hatchlings out of 76 eggs, a hatch success of 39%, while the Kemp's ridley nest yielded 25 hatchlings out of 74 eggs, a hatch success of 34% (Table 3).

Table 3. Hatching Success of Marked Nests

	Loggerhead	Green	Leatherback	Kemp's
Nests marked	141	99	1	1
Nests Excavated	137	79	1	1
Total Eggs	4902	9675	76	74
Ave. Clutch Size	98.0	122.5	76	74
Hatchlings Emerged	3302	5040	30	25
Hatching Success	67.4%	52.1%	39%	34%
Eroded/Washed out	0	3	0	0
Washed Over	61	78	0	0
Depredated	7	4	0	0
Unknown Fate	1	17	0	0

DISCUSSION

Nesting and False Crawl Totals

The number of sea turtle nests recorded at CANA in 2006 was approximately 700 less than 2005 (Table 1). Since loggerhead numbers were essentially the same for both years, the difference was a decline in green nesting. The loggerhead total continued to remain considerably below the high of 4500 recorded in 1999 and was the second lowest number in the last 18 years (Table 1 and Figure 2a). The drop in green nests fit the general overall up and down pattern exhibited over the last 18 years (Table 1 and Figure 2a). The single leatherback nest was the lowest recorded since 1995, with a high of 16 nests noted in 2003. The Kemp's ridley nest recorded this year makes two within the last 4 years at CANA, after none in the previous 19. Kemp's were also observed nesting at Cape Lookout National Seashore, North Carolina in 2003 and New Smyrna Beach, Florida in 1996 indicating that Kemp's nesting activity may become more regular along the Atlantic coast.

Table 4. Sea Turtle Nest Totals 1984-2006

YEAR	LOGGERHEAD	GREEN	LEATHERBACK	KEMPS	UNKNOWN	TOTAL
2006	2470	396	1	1	0	2868
2005	2547	1040	13	0	0	3600
2004	2281	255	6	0	0	2542
2003	3229	74	16	1	0	3320
2002	3161	857	8	0	0	4026
2001	3257	7	10	0	0	3274
2000	3892	662	9	0	0	4563
1999	4501	5	9	0	0	4515
1998	3976	427	5	0	0	4408
1997	2702	21	4	0	0	2727
1996	3260	222	3	0	0	3485
1995	4121	47	1	0	0	4169
1994	3886	364	2	0	0	4252
1993	3140	28	0	0	0	3168
1992	3279	298	0	0	0	3577
1991	4074	25	1	0	0	4100
1990	3922	185	1	0	0	4108
1989	3091	41	1	0	0	3133
1988	2203	43	0	0	4	2250
1987	1670	90	1	0	15	1776
1986	3349	22	3	0	0	3374
1985	2389	94	0	0	25	2508
1984	*	*	*	*	*	2125

* Individual breakdown not available.

Taken from yearly Sea Turtle Nesting Summaries, 1984-2006 Canaveral National Seashore Titusville, Florida

The false crawl to nest ratio for the loggerhead was almost 1:1 (1:0.99) (Table 1). Over the past 22 years, number of nests has exceeded false crawls 16 times (Table 5). Number of nests per false crawl for the green increased from 1:0.61 in 2005 to 1:0.81 in 2006 (Table 5). Since 1985 nests have exceeded false crawls about half the time for the green sea turtle.

Figure 2a. Loggerhead Sea Turtle Nesting Totals, Canaveral National Seashore 1985 - 2006

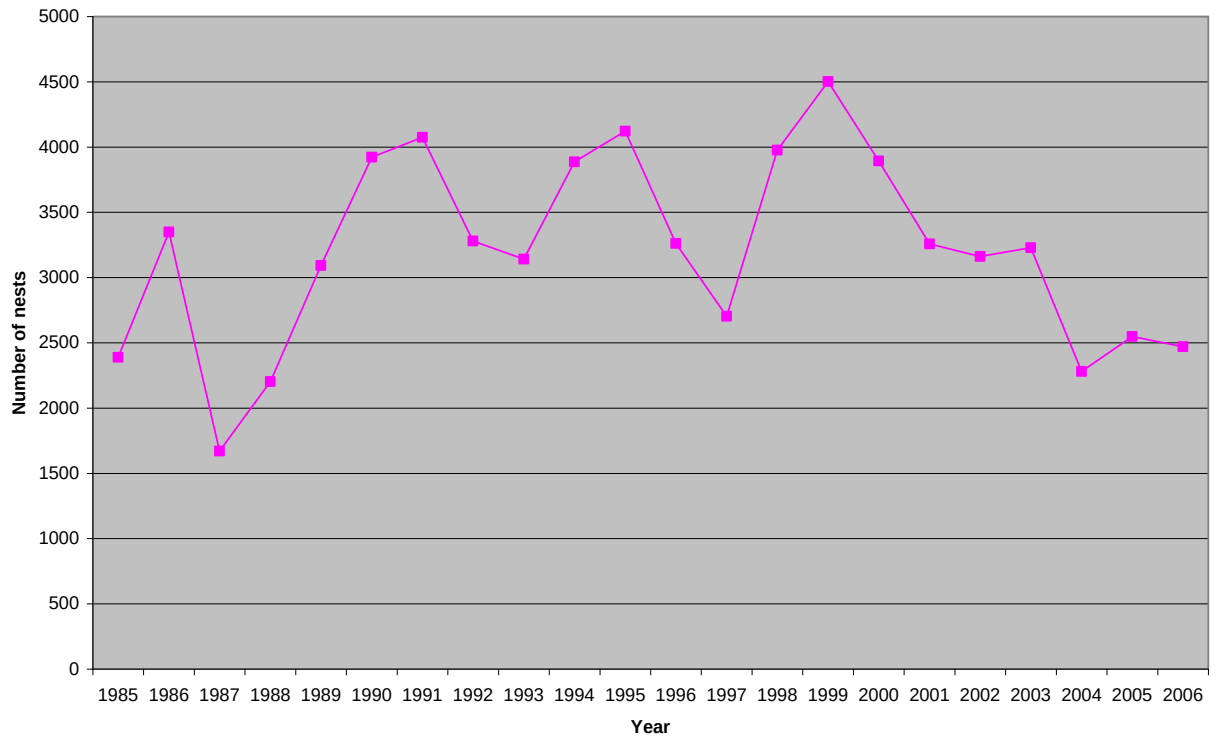


Figure 2b. Green Sea Turtle Nesting Activity, Canaveral National Seashore 1985 - 2006

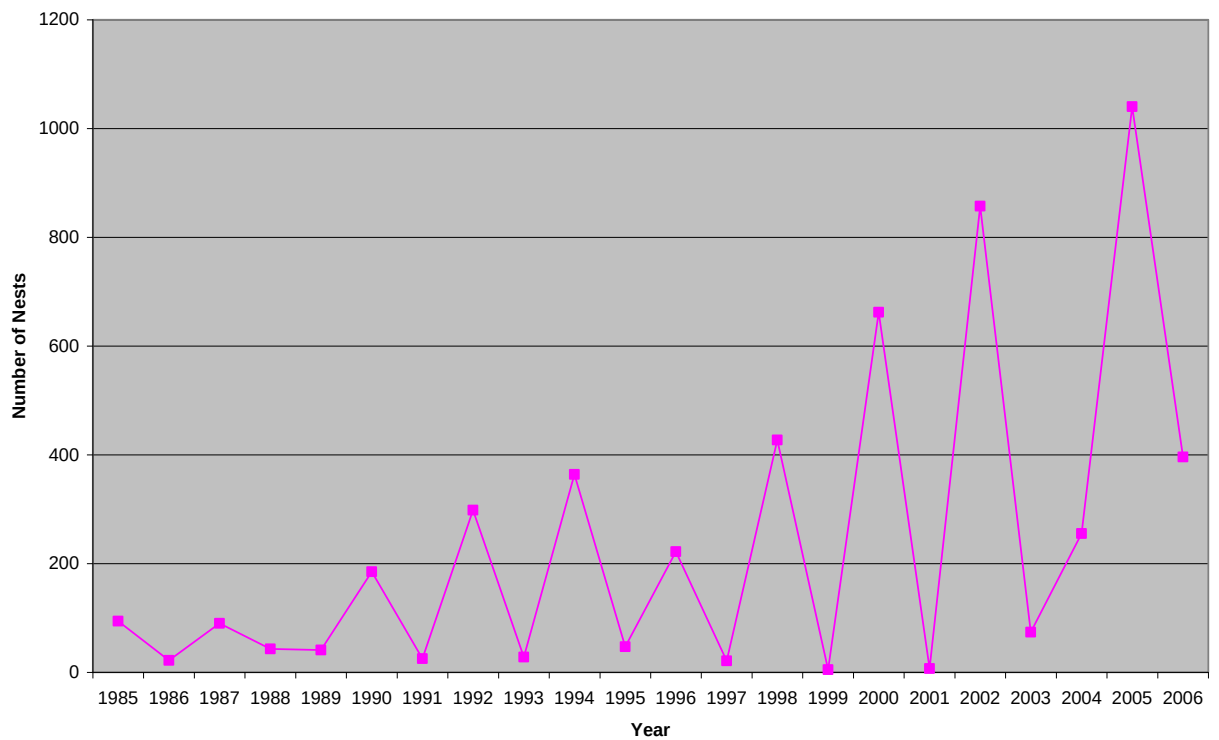


Table 5. False Crawl to Nest Ratio- 1984-2006. Canaveral National Seashore.

<u>Year</u>	<u>Loggerhead</u>	<u>Green</u>	<u>Leatherback</u>
2006	1:0.99	1:0.81	0:1.00
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, 1984-2006, Canaveral National Seashore Titusville, Florida.

Screening Activity and Nest Depredation

Over 99% of the nests were screened in 2006, the fourth year in a row that this level has been achieved (Table 6). The reason for this is clear - the experience of the biological technicians. All three had at least 5 years of experience, while one had over 10. While the overall depredation rate increased to 7.1% in 2006 from 4.7% in 2005, the overall rate was still significantly below depredation rates recorded between 1989

(when night-time screening was initiated) and 2002, where rates ranged from 9.2% to 29.9%. Tunneling activity increased from 3.6% in 2005 to 6.0% in 2006.

Table 6. Amount of Screening and Depredation of Screened Nests- 1984-2006

YEAR	NESTS	NESTS SCREENED	SCREENED NESTS DEPREDATED (%)	ESTIMATED OVERALL DEPREDATION (%)
2006	2868	2860 (99%)	6.0	7.1
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

Relative Hatching Success

Hatching success for the loggerhead increased to 67.4% In 2006 from 63.9% in 2005 (Table 7). This exceeded the target of 60% hatching success established in the USFWS sea turtle recovery plan. Green success was 52.1%, slightly down from last

year's total of 57.6%. The loggerhead hatching success rate has exceeded the target in 8 of the last 11 years while the green rate has met or exceeded the target in 4.

Table 7. Comparison of Hatching Success with Previous Years- 1996-2006

	Loggerhead	Green	Kemps	Leatherback
2006	67.4%	52.1%	34%	39%
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.

Part of the reason for the lower green success rate is that the majority of green nests are deposited later in the season and are more susceptible to inundation and erosion from fall storms and tidal surges. Though not as devastating as the 2005 storm season, considerable over-wash and nest inundation occurred when Hurricane Florence (category 1) skirted the east coast of Florida in mid- September producing tides that approached the dune and vegetation line. Tropical Storm Ernesto also came through CANA from the west in late August causing nest over-wash. In 2006, 78 Of the 99 green index nests (78%) were over-washed at some point, while this occurred to only 61 of 141 of the loggerhead index nests (43%).

.ACKNOWLEDGEMENTS

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