

2008 MARINE TURTLE NESTING SUMMARY

CANAVERAL NATIONAL SEASHORE



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ABSTRACT

The number of sea turtle nests at Canaveral National Seashore increased by over 900 nests from 2007. A total of 4543 sea turtle nests were deposited in 2008: 3637 Loggerhead, 899 Green, 5 Leatherback and 2 Kemp's ridley. This year was the second most successful nesting season at the seashore since recording began. Nest densities were 95.21 per kilometer for the Loggerhead and 23.5 per kilometer for the Green – an overall nest density of 118.62. Both the Loggerhead and Green nests exceeded the number of false crawls (ratios of 1:1.41 and 1:1.06 respectively). Over 96 percent (96.1%) of the nests were screened to exclude predators. Prior to screening, less than eight percent (7.5%) of the nests were partially or totally depredated and 7.5% of the nests were depredated after screens were in place. Overall, the depredation rate (partial and total) for all nests was 15%. Every twentieth Loggerhead, tenth Green, and all Leatherback and Kemp's ridley nests were marked for excavation. Hatching success rates of 69.5%, 47.3%, 36.9%, and 88.6% were recorded for the indexed Loggerhead, Green, Leatherback and Kemp's ridley nests, respectively.

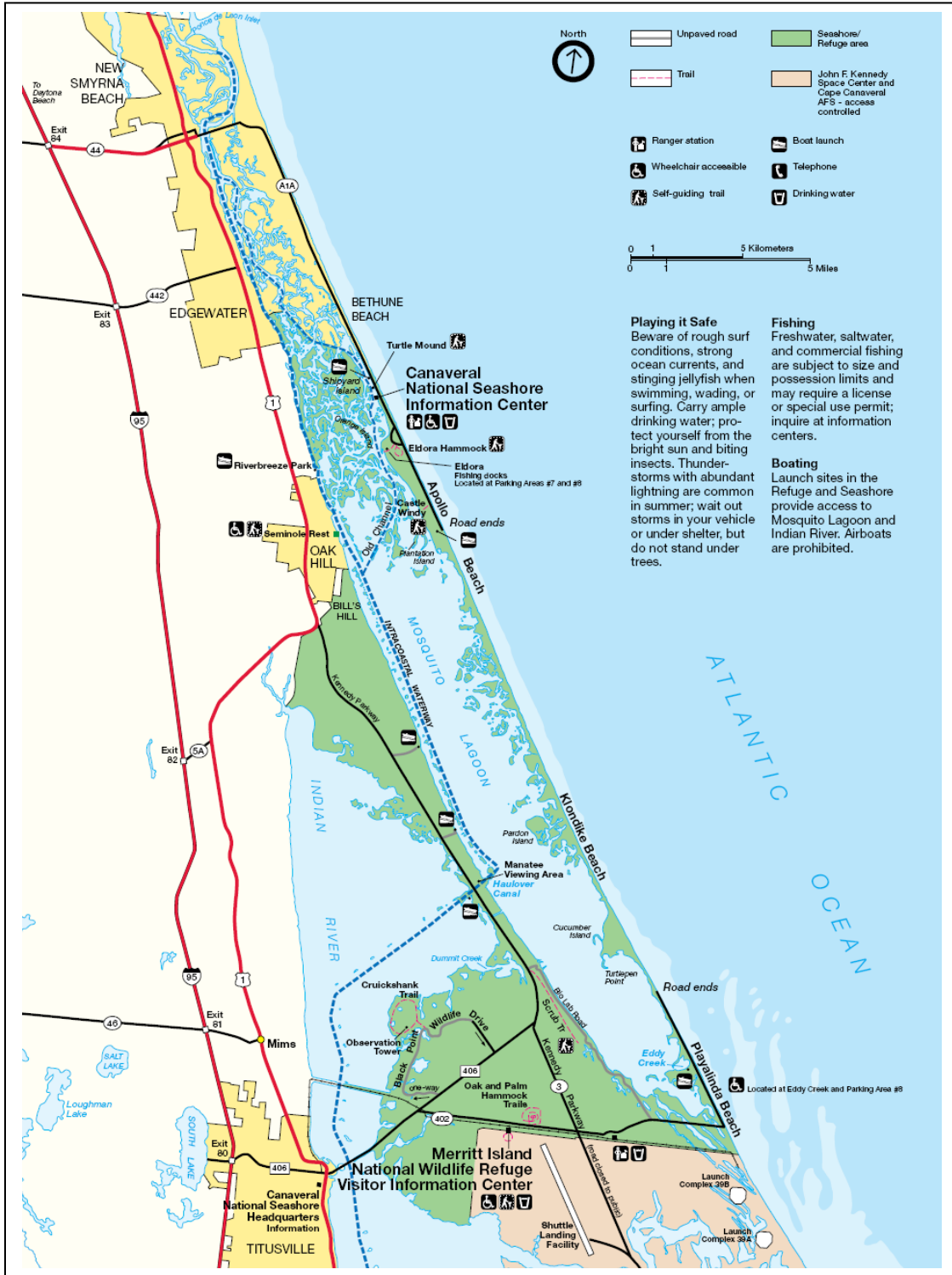
INTRODUCTION

Canaveral National Seashore (CANA) is comprised of approximately 24 miles of beach along the Atlantic Ocean in the state of Florida. 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 to the park in Brevard County. The South District is adjacent to National Aeronautics and Space Administration (NASA) property (Figure 1.). Public closures occur during space shuttle launches in this portion of the seashore.

The middle 19.31 kilometers (12 miles) of the seashore, Klondike Beach, is accessible to the public only by foot with permit. 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 fourteen species of federally-listed, threatened, or endangered species, the second greatest number in the National Park system. Included in these are five species of marine turtles. The Loggerhead, *Caretta caretta*, and the Green, *Chelonia mydas*, are the most prevalent. The less common Leatherback sea turtle, *Dermochelys coriacea*, had its highest number of nests in 2007. An occasional Kemp's ridley, *Lepidochelys kempii*, nest is recorded. A Hawksbill, *Eretmochelys imbricata*, nested in the park in 1982.

Figure 1. Canaveral National Seashore



CANA has been studying nesting sea turtles on park beaches since 1976. 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 three to four years. The Green, in contrast, is relatively predictable, usually 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 and ghost crabs, 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 an integral part of the seashore ecosystem.

Since 1995, teams consisting of park staff and volunteers have consistently screened over 95% of the several thousand nests deposited each year, reducing nest depredation to as low as 4.7% in 2005. The park strives 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 habitat.

METHODS AND MATERIALS

On April 17, 2008, the park initiated patrols on all-terrain vehicles (ATVs) to record sea turtle nest emergences (nest and false crawls) and to screen nests along the twenty four miles of beach. Patrols were expanded to seven days a week on May 10 and continued until August 31, 2008 according to protocol for the state-directed 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 and Student Conservation Association (SCA) interns listed on the Florida Fish and Wildlife Conservation Commission (FWC) permit with the assistance of numerous volunteers.

The beach was patrolled from 23:00 to 07:30, with one team beginning at the North District (Apollo Beach) proceeding south, and another team starting at the South District (Playalinda Beach) proceeding north. The beach is divided into quarter mile grids, starting at 0 in the North District and continuing to grid 94 in the South District. 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 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 to 70° at one end. Information written on the nest marker included nest number, species, grid number, 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 eggs were laid. The eggs were covered by sand and screened in the usual manner.

Every 20th Loggerhead nest, every 10th Green and all Leatherback and Kemp's ridley nests were marked as index nests to determine hatching success. Nests were excavated three days after first hatchling emergence or, if no sign of emergence, 60-70 days after the nest was laid. The following excavation information was recorded: number of hatchlings emerged (empty egg shells), 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 change to recorded nests. The observations included nest tampers, partial and total depredations, hatches, inundations, nest erosions, or any other notable conditions.

On September 1, 2008 in the North District patrols were adjusted to 04:00 – 12:30. In the South District patrols were switched on September 1, 2008 to 06:00 to 14:30. This was due to a decrease in nesting and to expedite nest excavations and removal of screens from nests that had hatched.

A Microsoft Access database was utilized to track marine turtle nesting information. All new nests, false crawls, species, nest locations and conditions, observers, dates, tampers, subsequent depredations, 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 periods of May 15 to August 31, 2008.

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, Seashore 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.

As always, certain raccoons learned to tunnel under the screens, resulting in partial or total depredation of a nest. CANA has observed this to be a learned behavior for the raccoons and combated these predators with live trapping. Traps were placed in the backcountry of both districts, baited with canned sardines. CANA managed to trap and relocate 14 raccoons within the park.

RESULTS

Nest and False Crawl Totals

A total of 4543 sea turtle nests were deposited in 2008: 3637 Loggerheads, 899 Greens and 5 Leatherbacks, and 2 Kemp's ridley (Table 1). Nest densities were 94.96 per kilometer for the Loggerhead and 23.47 per kilometer for the Green, with the total density at 118.62 per kilometer, including the Leatherback and Kemp's ridley nests. As in former years, the greatest concentration of nesting was noted in the South District with 58.7% of the nests laid in the south (Brevard County) and 41.3% in the north (Volusia County) (Table 1). Figures 2a and 2b show the number of nests and false crawls by individual grids.

Table 1. 2008 Marine Turtle Crawl Survey (Canaveral National Seashore)

Overall

	Loggerhead	Green	Leatherback	Kemp's	Total
Nests	3637	899	5	2	4543
False Crawls (FC)	2581	845	1	0	3427
Nest Density (nests/km)	94.96	23.47	.13	.05	118.62
FC Density (FC/km)	67.39	22.06	.026	0	89.48
FC to Nest Ratio	1:1.41	1:1.06	1:5	0:2	1:1.33

North District (Volusia County)

	Loggerhead	Green	Leatherback	Kemp's	Total
Nests	1530	344	3	0	1877
False Crawls (FC)	1024	333	1	0	1358
Nest Density (nests/km)	84.53	19.01	.17	0	103.70
FC Density (FC/km)	56.57	18.40	0.055	0	75.03
FC to Nest Ratio	1:1.49	1:1.03	1:3	0:0	1:1.38

South District (Brevard County)

	Loggerhead	Green	Leatherback	Kemp's	Total
Nests	2107	555	2	2	2666
False Crawls (FC)	1557	512	0	0	2069
Nest Density (nests/km)	104.83	27.48	.10	.10	131.78
FC Density (FC/km)	77.08	25.35	0	0	102.43
FC to Nest Ratio	1:1.35	1:1.08	0:2	0:2	1:1.29

False crawl (non-nesting emergences) totals for Loggerheads were lower than nest numbers while Greens had a similar false crawl total to nest ratio. False crawl densities were 67.39 per kilometer for the Loggerhead and 22.06 for the Green. The false crawl to nest ratios were 1:1.41 for Loggerheads and 1:1.06 for Greens, respectively (Table 1). There was one false crawl recorded for Leatherbacks. Figures 2a and 2b show the number of false crawls by individual grids for the entire beach.

**Figure 2a. Nests, false crawls and depredations in the North District (Grids 0-44)
Canaveral National Seashore - 2008**

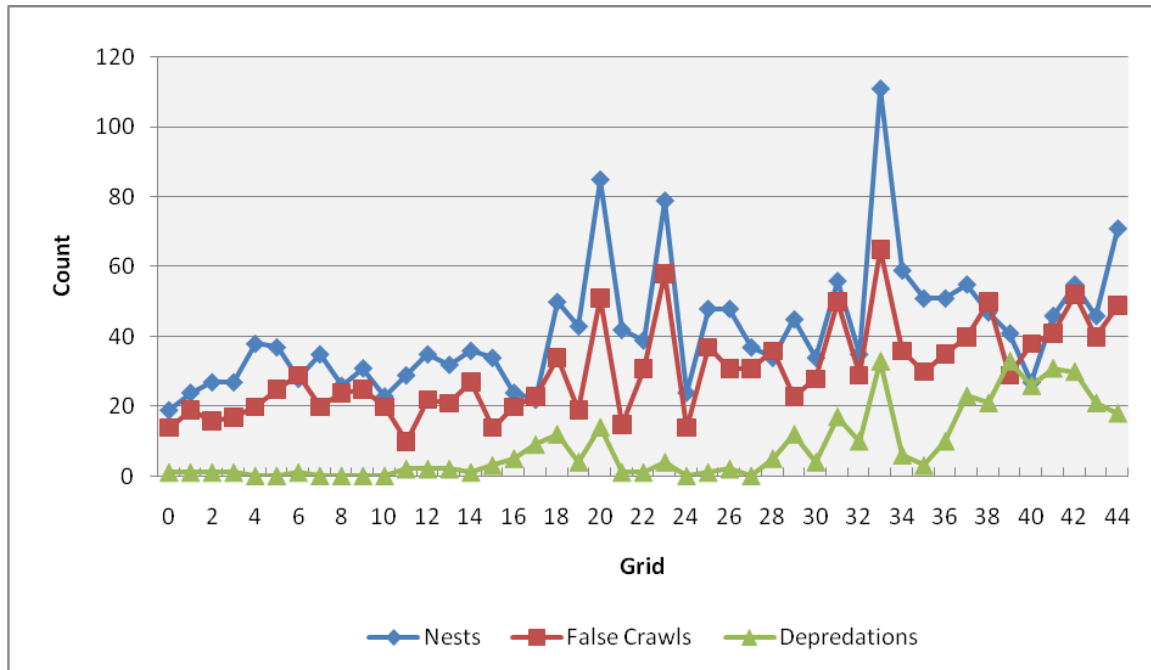
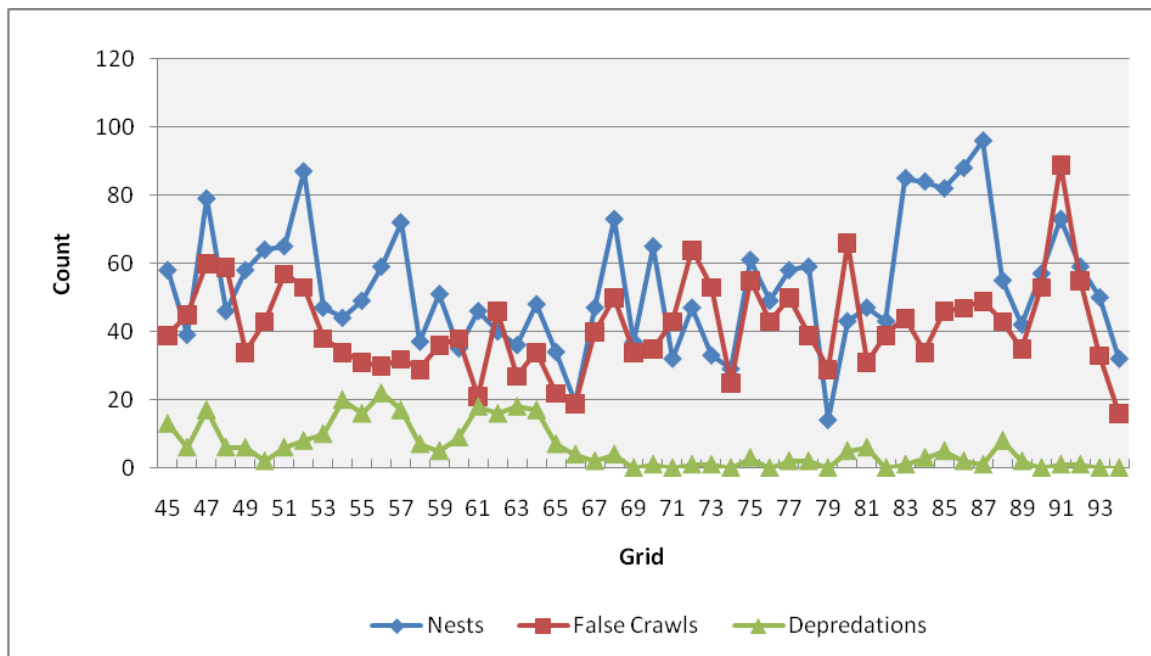


**Figure 2b. Nests, false crawls and depredations in the South District (grids 45-94)
Canaveral National Seashore – 2008**



Nest Depredation

In 2008, 96.1% of the sea turtle nests were screened by park staff. Less than four percent (3.9%) of the nests were totally depredated prior to discovery (Table 2). A total of 342 (7.5%) nests were impacted by predators that managed to get around the screening. Overall nest predation was 14.3%. Figures 2a and 2b show the number of nest depredations in green by individual grids for the entire beach. Table 2 summarizes the impact on nests by predators for the 2008 nesting season.

Table 2. Nest Treatment and Depredation

a. Initial Treatment and Depredation

Initial Encounter	Loggerhead	Green	Leatherback	Kemp's	Total
Not Dep/Screened:	3285	878	5	2	4170 (91.79%)
Partial Dep/Screened:	179	17	0	0	196 (4.31%)
Total Depredation:	173	4	0	0	177 (3.90%)

b. Subsequent Depredation of nests after screening

	Total Depredation	Partially Depredated	Total
North District	46	87	133
South District	121	88	209
Total	167	175	342 (7.5%)

c. Overall Depredation (initial encounter and subsequent depredations)

	Total Depredation	Partially Depredated	Total
North District	195	193	388
South District	115	147	262
Total	310	340	650 (14.3%)

* Nests depredated more than one time (31) were only counted once for the above exercise to reflect number of nests actually impacted by depredation rather than total incidents. Including all incidents resulted in a nest depredation rate of 14.99%.

Hatching Success

Index nests were used to estimate hatching success for each species at CANA in 2008. The estimated number of hatchlings that emerged from the nests is calculated as follows: (% hatching success) x (eggs per clutch) x (number of nests) x (% not eroded away or totally depredated) = number of hatchlings. For the Loggerhead, the figures are (69.50%) x (96.18) x (3637) x (69.06%) = 167,895 hatchlings emerged. For the Green, the calculation is (47.32%) x (105.23) x (877) x (59.55%) = 26,005 hatchlings. The Leatherback calculation is (36.87%) x (79.20) x (5) x (100%) = 146 hatchlings. For Kemp's ridley, (88.57%) x (70) x (2) x (50%) = 62. (Table 3).

Table 3. Hatching Success of Marked Nests

	<i>Loggerhead</i>	<i>Green</i>	<i>Leatherback</i>	<i>Kemp's ridley</i>
Nests Marked	181	89	5	2
Nests Excavated	125	53	5	1
Total Eggs	12022	5577	396	70
Average Clutch Size	96.18	105.23	79.20	70
Hatchling Emerged	8355	2639	146	62
Hatching Success	69.5%	47.32%	36.87%	88.57%
Eroded/Washed Out	45	36	0	1
Washed Over	98	73	3	0
Depredated	11	1	0	0
Unknown Fate	0	0	0	0

DISCUSSION

Nesting and False Crawl Totals

The number of sea turtle nests recorded at CANA in 2008 was over 900 more than in 2007. Loggerhead numbers actually increased by over 1200 nests, while the Green total decreased from its previous year by approximately 300 nests. The loggerhead nesting totals were the highest in eight years. (Table 4, Figure 3a and 3b). This was a welcome sign in lieu of the lower Loggerhead nesting totals in recent years. The decrease in Green nests fit the general up and down pattern associated with two and/or four year nesting cycles, as 2007 was the highest nesting numbers recorded. The leatherback nesting total was relatively low compared to last year's high. Two Kemp's ridley nests were recorded this season.

Table 4. Sea Turtle Nest Totals 1984-2008

Year	Loggerhead	Green	Leatherback	Kemp's Ridley	Unknown	Total
2008	3637	899	5	2	0	4543
2007	2357	1249	21	0	0	3627
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	856	8	0	0	4025
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, 1984-2008 Canaveral National Seashore.

**Figure 3a. Loggerhead Sea Turtle Nesting Totals, Canaveral National Seashore
1984 – 2008**

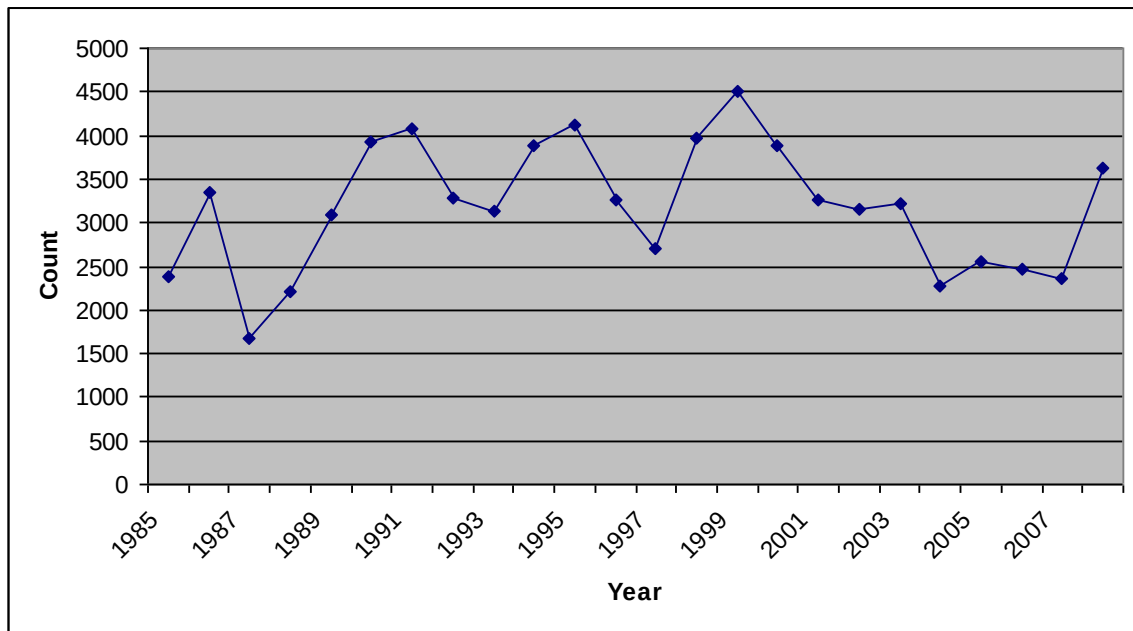
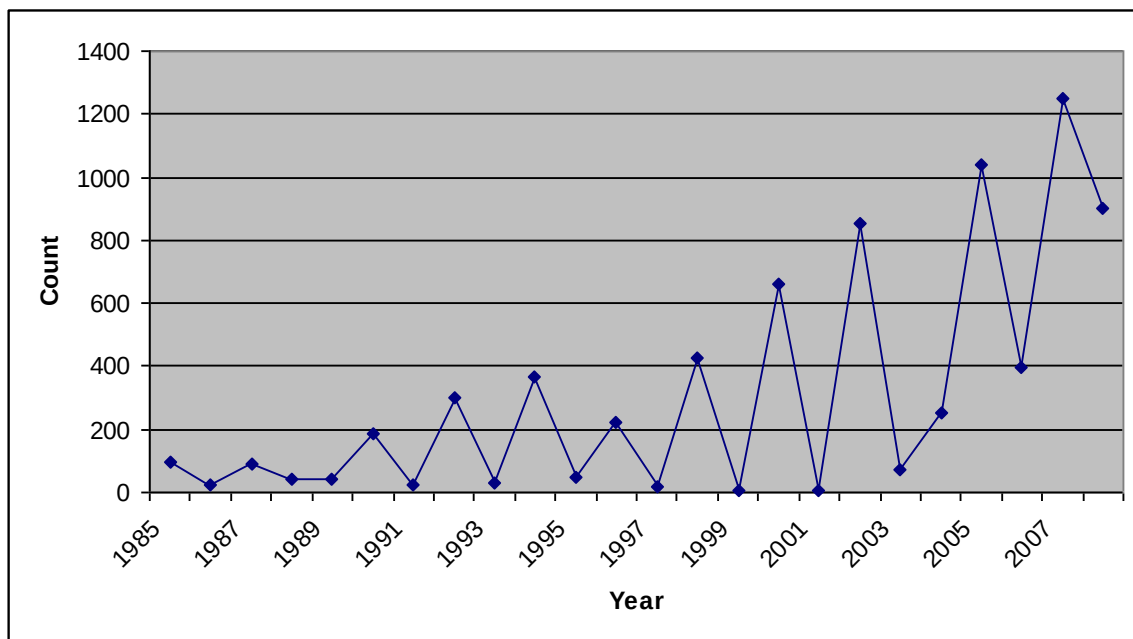


**Figure 3b. Green Sea Turtle Nesting totals, Canaveral National Seashore
1984 – 2008**



The false crawl to nest ratio can be an indicator of suitable habitat or disturbance during nesting. The number of nests per false crawl for the Loggerhead has continued to be in the range of 1:1+ while the Green ratio increased slightly from the past 4 years.

Table 5. False Crawl to Nest Ratio: 1984 – 2008. Canaveral National Seashore.

Year	Loggerhead	Green	Leatherback	Kemp's ridley
2008	1:1.41	1:1.06	1:5.00	0:2.00
2007	1:1.03	1:0.76	1:2.33	-
2006	1:0.99	1:0.81	0:1.00	-
2005	1:0.94	1:0.61	1:3.25	-
2004	1:1.32	1:1.00	1:2.40	-
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	-	-	-	-

Screening Activity and Nest Depredation

Over 96% of the nests deposited at CANA were screened in 2008 (Table 6). This continues to be attributed to the experience of the returning seasonal biological technicians and dedication of numerous volunteers. While the overall depredation rate increased by almost 5% from the previous year, it was still below the average of 20% recorded between 1991 and 2001.

Table 6. Amount of Screening and Depredation of Screened Nests: 1984 – 2008

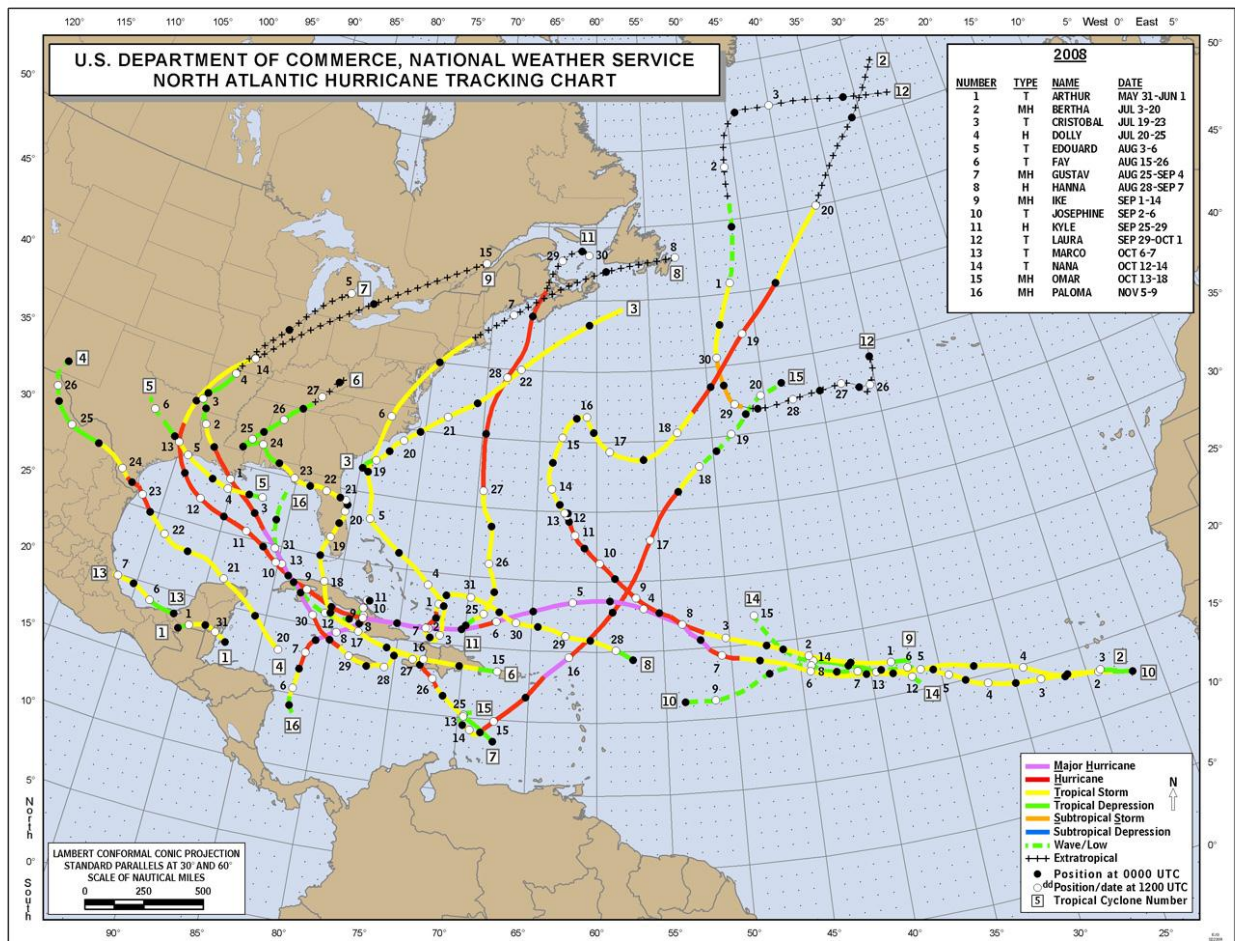
Year	Nests	Nests Screened*	Screened Nests Depredated (%)	Overall Depredation (%)
2008	4543	4366 (96%)	7.5	15
2007	3627	3581 (99%)	7.5	10.2
2006	2868	2860 (99%)	6	7.1
2005	3600	3586 (99%)	3.6	4.7
2004	2542	2536 (99%)	6.8	6.6
2003	3320	3307 (99%)	4.4	5.6
2002	4026	3957 (98%)	8.3	14.4
2001	3274	3207 (98%)	9.9	19.9
2000	4563	4304 (98%)	7.2	23
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	41.7
1984	2125	213 (19%)	-	65

* Percent rounded to nearest whole number

Weather and Tidal Influences

There were several tropical storms and hurricanes in the Caribbean and Gulf of Mexico during the 2008 season. Tropical Storm Fay directly impacted CANA and Hurricane Hanna and Tropical Storm Kyle impacted CANA's beach in the form of high tides. During the 2008 season, about 11% of the CANA's index sea turtle nests were lost to erosion due to storms. Nests still fared better than those lost in the severe hurricane season of 2004 when 44% of the index loggerhead and 96% of the index green nests were lost to high tides and rough seas.

Figure 4. The 2008 Atlantic Hurricane Season Track Map.



Relative Hatching Success

Hatching success increased from the previous year for the Loggerhead but decreased for Greens (Table 7). The hatching success for loggerheads was 69.5%, exceeding the target of 60% hatching success established in the USFWS sea turtle recovery plan. Leatherback hatching success was over 36%, continuing a general trend of being lower than the percentages for loggerhead and green sea turtles. Greens tend to have lower hatching success rates in relation to the Loggerhead due to the majority of Green nests deposited later in the season when they are more susceptible to inundation and erosion from fall storms and tidal surges.

Table 7. Comparison of Hatching Success with Previous Years, 1996 – 2008.

Year	Loggerhead	Green	Leatherback
2008	69.50%	47.32%	36.87%
2007	58.16%	51.08%	32.13%
2006	67.40%	52.10%	39.00%
2005	63.90%	57.60%	43.30%
2004	72%	30% (N/A)	41% (N/A)
2003	71% (N/A)	59% (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.

Associated Studies

Mark Dodd and Brian Shamblin of the Georgia Department of Natural Resources (DNR) again requested assistance from CANA in collecting eggshells or flippers of dead hatchlings from Leatherback, Loggerhead and Green nests scheduled for excavation. The purpose was to determine the genetic populations of sea turtles nesting in Florida and to serve as a pilot study to determine feasibility of obtaining microsatellite genotypes from tissue and hatched egg samples from other Florida and Georgia beaches. CANA expects to participate again in 2009.

ACKNOWLEDGEMENTS

Canaveral National Seashore's sea turtle nest screening program would not be possible without the effort of many dedicated people. The seasonal employees Michael Daley, Sean McKenna, Kate Hargrove, and Kristen Kneifl, patrolled the beach each night, dealing with high humidity, bothersome insects, and unexpected obstacles. Candace Carter, as always, provided invaluable logistical support and advice. In addition the four Student Conservation Association (SCA) resource interns, Rebecca Keller, Jessie Ackerman, Molly Cox, and Lauren Riegler, provided regular beach patrols, assisted with end-of-season screen removal, maintained numerous databases, and analyzed and composed the final report along with John Stiner and Candace Carter. There were also the many volunteers who sacrificed sleep and comfort to support the cause of sea turtle preservation. Thanks to you all!

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