

# **2013 MARINE TURTLE NESTING SUMMARY**

## **CANAVERAL NATIONAL SEASHORE**



**By**

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#### **ABSTRACT**

The 2013 marine turtle nesting season surpassed last year's high and is the most successful season recorded at Canaveral National Seashore. A total of 7,933 nests were laid this season, including 3,758 Loggerhead, 4,152 Green, and 23 Leatherback. Nest densities were 98.12 per kilometer for the Loggerhead and 108.46 per kilometer for the Green – an overall nest density of 207.18. Loggerhead and Green nests exceeded the number of false crawls with ratios of 1:1.51 and 1:1.08, respectively. Due to the high number of nests and limited nest protection supplies, not all Green nests were screened to exclude predators. Prior to marking, 6.3% of the nests were partially or totally depredated and 1.8% of the nests were observed depredated after nests were marked. Overall, the depredation rate (partial and total) for all nests was 8.1%. Every twentieth Loggerhead and Green, and all Leatherback nests were marked for excavation. Hatching success rates of 66.1%, 57.7%, and 21.6%, were recorded for the indexed Loggerhead, Green, and Leatherback, respectively.

#### **INTRODUCTION**

Canaveral National Seashore (CANA) has the highest numbers of nesting sea turtles within the National Park Service. CANA is comprised of approximately 24 miles of beach on a barrier island in Volusia and Brevard counties along Florida's Atlantic coast. For monitoring purposes, the beach is divided into two districts based on county: the North District (Apollo Beach) in Volusia County and the South District (Playalinda Beach) in Brevard County. The North District begins just south of Bethune Beach in Volusia County and continues south for 18.1 kilometers (11.25 miles) to the Volusia-Brevard County line. The South District encompasses 20.2 kilometers (12.5 miles) from the Volusia-Brevard County line to the beginning of property managed by the National Aeronautics and Space Administration (NASA) (Figure 1). Due to its proximity to the Kennedy Space Center and Cape Canaveral, this southern portion of the seashore is subject to public closures during launches. The middle 19.3 kilometers (12 miles) of the seashore, Klondike Beach, is designated "backcountry" and is accessible to the public only by foot with permit. The North District and the South District each contain approximately half of Klondike Beach.

CANA has a sloping beach that can be up to 50 yards wide or completely covered by water, depending on the tide. The sand is composed primarily of quartz and calcium carbonate (shell fragments). Dunes provide a buffer between the beach and the inland habitat.



Fourteen federally-listed threatened or endangered species, the second largest number in the National Park system, have been found in CANA. Five of these fourteen species are marine turtles: Loggerhead (*Caretta caretta*), Green (*Chelonia mydas*), Leatherback (*Dermochelys coriacea*), Kemp's Ridley (*Lepidochelys kempii*), and Hawksbill (*Eretmochelys imbricata*). The Loggerhead and Green turtles are most prevalent, while the Leatherback is found consistently, but in much lower numbers. Kemp's Ridley and Hawksbill Turtles have been documented, though rarely, on CANA's beaches.

Mosquito Lagoon, on the landward side of the barrier island, is approximately a mile wide (Figure 1). It provides valuable nursery habitat for juvenile sea turtles (approximately 3 to 10 years of age, depending on species), as evidenced by the severe cold stun event in 2010. Over 2,000 sea turtles of various ages and sizes were stunned by the cold and washed into shallow areas along the lagoon. Many of these sea turtles survived due to large-scale interagency rescue efforts and were later released.

CANA has been recording sea turtle nesting on park beaches since 1985. Sea turtles are observed nesting in the park from April through October. The nesting season for the Leatherback is generally between April and June, the earliest and shortest nesting season. Loggerheads are primarily observed nesting in the park from May through August, while Greens are recorded slightly later, from June through September. As in the past three years, Green sea turtle nesting extended into October in 2013. The peak of the nesting season generally occurs between late June and early July when over 100 nests may be deposited on CANA's beaches each night.

Nest depredation, primarily by raccoons and ghost crabs, poses a serious threat to marine turtle populations at CANA with depredation rates in the park exceeding 90% in the early 1980s (McMurtry 1986). From 1984 to 1992, CANA screened 33% to 62% of marine turtle nests to reduce raccoon depredation (Stiner 1995). In 1993 and 1994, the University of Georgia compared the effectiveness of three methods of nest protection: screening, predator (raccoon) removal, and conditioned-taste-aversion. Screening was found to be most effective and compatible with National Park Service guidelines and objectives.

Since 1995, teams consisting of park staff and volunteers have consistently screened over 95% of the several thousand nests deposited each year to reduce nest depredation. In 2013 nest numbers were so high that the park had to reduce the percentage of nests screened. Typically, the annual depredation rate varies between 5 and 15%. The park strives to achieve a successful hatching rate without removing predators from their important role in the barrier island habitat.

In keeping with the CANA's commitment to educate its visitors, the Visitor Center staff is frequently updated on the number of marine turtle nests in the park and the numbers are posted for public view. "Turtle Watch" programs, conducted by seashore interpreters in June and July, raise public awareness about the importance of CANA for sea turtle nesting and allow visitors to watch a Loggerhead nest and learn about sea turtle conservation issues.

## METHODS AND MATERIALS

On April 22, 2013, the park initiated patrols to record sea turtle emergences (nest and false crawls) and screen nests along CANA's twenty four miles (38.3 km) of beach. These 24 miles are divided into quarter mile grids beginning at 0 in the North and ending at 94 in the South. The Volusia/Brevard County line divides the two beaches into two sections with the North District team responsible for the first 44 grids and the South District team responsible for the latter 50. Patrols were conducted using all-terrain vehicles (ATVs) towing a one-axle box trailer for equipment. Patrols were maintained seven days a week from May 15<sup>th</sup> through August 31<sup>st</sup>, according to protocol for the state-directed Florida Index Nesting Beach Survey. Patrols continued 7 days a week after the INBS period until mid-October and intermittently after that to record late nesting activity. The patrols predominantly commenced from 23:00 to 07:30 hours, with the North District team (Apollo Beach) proceeding south and the South District team (Playalinda Beach) proceeding north. 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.

When a sea turtle crawl was located, personnel inspected it to determine if a nest was present. All nests during the first half of the season (unless totally depredated by predators) were covered with a 4' x 4' square of 2" x 4" wire mesh screen to exclude predators and labeled with an identification marker. Because of the unprecedented number of nests in 2013, it became impossible to screen all nests. On July 28<sup>th</sup>, park staff stopped screening green nests because they were deeper and less vulnerable to depredation and loggerhead nests on areas of the beach where depredation rate was low. All nests received a nest marker.

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. GPS locations were recorded and archived for most of the nests, making it the biggest locational sea turtle database in the National Park Service.

A small number of nests were relocated for one of two reasons; 1) the nest was located at the base of a heavily traveled boardwalk; or 2) the nest was in imminent danger of erosion. Approximating the natural nest cavity shape, a new chamber was dug near the base of a nearby dune and eggs were carefully transferred during the first few hours after being laid. The eggs were covered by sand and screened in the usual manner.

Every 20<sup>th</sup> Loggerhead, every 20<sup>th</sup> Green, and all Leatherback nests were marked as index nests for which hatching success was determined. Hatching success was also established for all relocated nests. Nests were excavated 72 hours after first hatchling emergence or after 60 days of incubation, 70 for Leatherbacks, if no activity was observed. The following excavation data was

recorded from each index nest: number of hatchlings emerged (empty egg shells), number of unhatched eggs including any depredated prior to excavation, the number of live and dead hatchlings in nest, and the number of live and dead pipped eggs partially or fully developed hatchling still in eggshell. All observations of nest tampering, partial and total depredation, hatching, inundation, erosion, or any other notable conditions were recorded on a daily basis and taken into account prior to analysis. Figures 2a and 2b show the number of nests and false crawls per quarter-mile segment or grid along CANA's 24 miles of beach (starting with marker 0 at the north boundary of the Seashore and ending with marker 94 just north of the southern boundary). On September 8, 2013, patrols were adjusted to 04:00 to 12:30 hours due to staff constraints, a decrease in nesting, and in order to expedite nest excavations and removal of screens from nests that had hatched. Patrols were discontinued from October 1, 2013 through October 16, 2013 due to a government shutdown of National Parks. Patrols resumed from October 17 to 31, 2013. A few sporadic patrols continued into December to complete the final index nest excavations.

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. Several additional databases were maintained as part of the Florida FWCC Index Nesting Beach Surveys (INBS), Statewide Nesting Beach Surveys (SNBS) and Productivity reports: 1) The INBS documents number of nests and false crawls for each species nightly per half mile segment of beach between the periods of May 15, 2013 - Aug 31, 2013; 2) The Productivity report records information on Index nests throughout the season, including productivity (hatching success); and 3) the SNBS compiled nesting totals and nest treatments for the entire year.

As regularly observed throughout past seasons, a small number of raccoons exhibited the learned behavior of tunneling under the screens, resulting in partial or total depredation of a nest. CANA has recognized this learned behavior as a threat to hatchling success and combated these predators with live trapping and relocation. Traps were placed in the backcountry of both districts, baited with canned sardines.

## **RESULTS**

A total of 7,933 marine turtle nests were laid on CANA's beaches in 2013: 3,758 Loggerheads, 4,152 Greens, and 23 Leatherbacks (Table 1). Nest densities were 98.12 per kilometer for the Loggerhead species, and 108.46 per kilometer for the Green (Table 2). The total nest density was 207.18 per kilometer including all three species of marine turtle (Loggerhead, Green, and Leatherback). As observed in years past, the South District had a greater portion of nests with 66.1% of the nests laid in the south (Brevard County) and 33.9% in the north (Volusia County) (Table 1). Non-nesting emergences (false crawls) to nest ratios (Tables 2a and 2b) are higher in

South District than in the North District. Figures 2a and 2b show the number of nests and false crawls per quarter-mile segment or grid along CANA's 24 miles of beach (starting with marker 0 at the north boundary of the Seashore and ending with marker 94 just north of the southern boundary).

**Table 1. 2013 Nest Totals**

	Loggerhead	Green	Leatherback	Total
North District	1551	1126	9	2686
South District	2207	3026	14	5247
Total	3758	4152	23	7933

**Table 2. 2013 Marine Turtle Crawl Survey**

	Loggerhead	Green	Leatherback	Total
<b>Nests</b>	3758	4152	23	7933
<b>False Crawls (FC)</b>	2487	3861	7	6355
<b>Nest Density (nests/km)</b>	98.12	108.46	0.60	207.18
<b>FC Density (FC/km)</b>	64.93	100.81	0.18	165.93
<b>FC to Nest Ratio</b>	1:1.51	1:1.08	1:3.29	1:1.25

**Table 2a. 2013 North District Marine Turtle Crawl Survey**

	Loggerhead	Green	Leatherback	Total
<b>Nests</b>	1551	1126	9	2686
<b>False Crawls (FC)</b>	1073	1215	4	2292
<b>Nest Density (nests/km)</b>	85.69	62.32	0.50	126.63
<b>FC Density (FC/km)</b>	59.28	67.13	0.22	126.63
<b>FC to Nest Ratio</b>	1:1.45	1:0.93	1:3.00	1:1.73

**Table 2b. 2013 South District Marine Turtle Crawl Survey**

	Loggerhead	Green	Leatherback	Total
<b>Nests</b>	2207	3026	14	5247
<b>False Crawls (FC)</b>	1414	2646	3	4063
<b>Nest Density (nests/km)</b>	109.26	149.80	0.69	259.75
<b>FC Density (FC/km)</b>	70.00	130.99	0.15	201.13
<b>FC to Nest Ratio</b>	1:1.56	1:1.14	1:4.67	1:1.29

### **Nest Treatment and Depredation**

In 2013, only 67% (5,293) of sea turtle nests were screened by park staff (Table 4). A total of 497 nests (6.3%) were depredated prior to discovery (Table 3a). A total of 143 nests (1.8%) were observed impacted by predators after nests were screened or marked. Overall observed nest predation was 8.1%. Figures 2a and 2b show the number of nests predated in each quarter-mile segment of the beach. Table 3c summarizes the impact on nests by predators for the 2013 nesting season.

**Table 3a. Nest Depredated Prior to Marking/Screening**

<b>Initial Encounter</b>	Loggerhead	Green	Leatherback	Total
Not Depredated	3337	4077	22	7436
Partial Depredation	206	53	0	259 (3.3%)
Total Depredation	215	22	1	238 (3.0%)

**Table 3b. Nests Observed Depredated After Marking/Screening**

	Total Depredation	Partial Depredation	Total
North District	5	3	8
South District	93	42	135
Total	98	45	143 (1.8%)

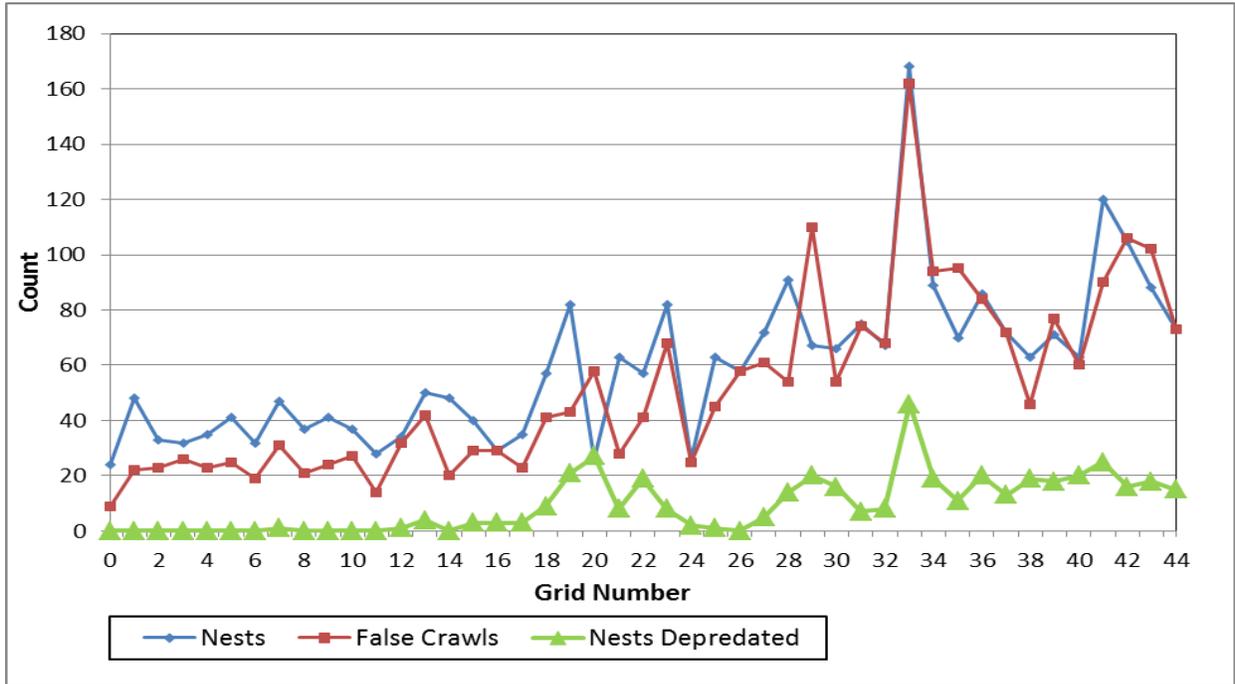
**Table 3c. Overall Depredation (initial encounter and observed subsequent depredations)**

	Total Depredation	Partial Depredation	Total
North District	198	230	428
South District	138	74	212
Total	336	304	640 (8.1%)

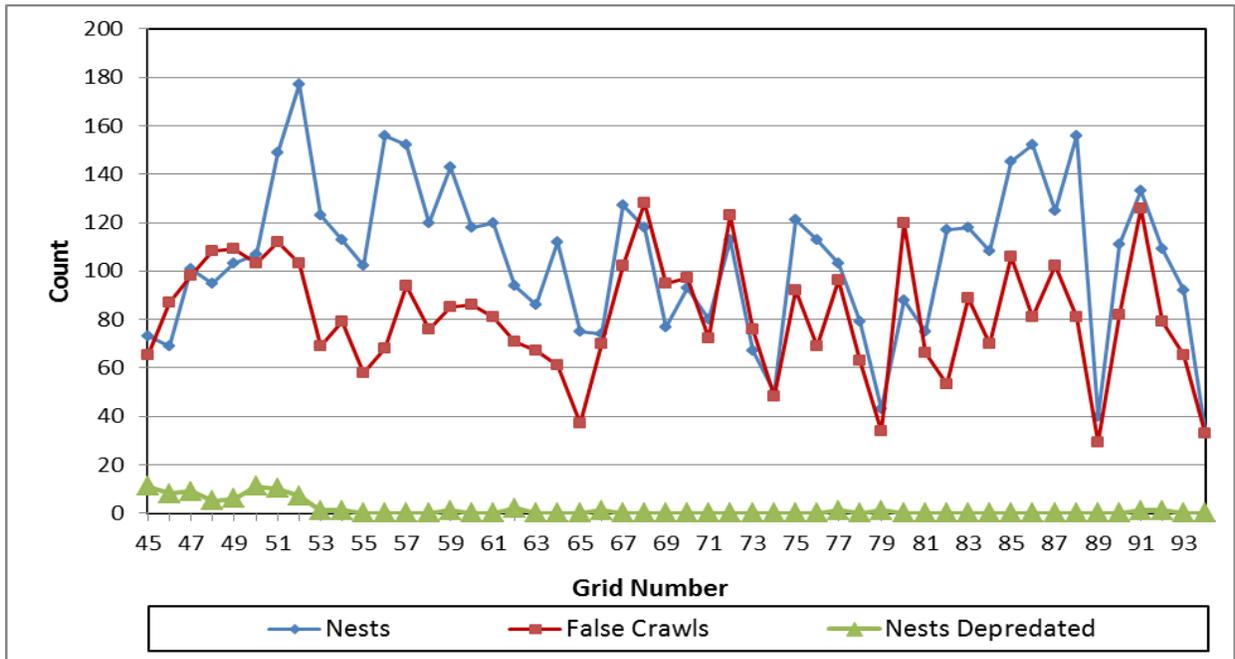
### **Screening Activity and Nest Depredation**

Due to high numbers of nesting Greens, the park only placed protective screens on about 36% of the Green nests. Overall, 67% (5,293) of the nests were screened in 2013 (Table 4). Still, the extensive experience of seasonal biological technicians and veteran volunteers were a tremendous asset in marking all the nests. The overall observed depredation rate was 8.1% in 2013. At times the park was unable to conduct regular daytime patrols to record depredations, therefore the actual number would be higher. However, the depredation rate still remained significantly below the rates recorded in the 1980s when the screening program first began.

**Figure 2a. Nests, false crawls, and depredations in the North District (Grids 0-44) Canaveral National Seashore, 2013.**



**Figure 2b. Nests, false crawls, and depredations in the South District (Grids 45-94) Canaveral National Seashore, 2013.**



**Table 4. Amount of Nests Screened and Depredation of Screened Nests: 1984 – 2013**

<b>Year</b>	<b>Nests</b>	<b>Nests Screened</b>	<b>Marked Nests Depredated (%)</b>	<b>Overall Depredation (%)</b>
2013	7933	5293 (67%)*	1.8	8.1
2012	5998	5824 (97.1%)	1.8	8.1
2011	5140	5078 (98.8%)	5.4	5.0
2010	5619	5556 (99%)	10.5	6.3
2009	3056	3034 (99%)	6.2	10.6
2008	4543	4366 (96%)	7.5	15.0
2007	3627	3581 (99%)	7.5	10.2
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 (98%)	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

\* In 2013, not all nests were screened due to high nest numbers and lack of screening supplies.

### **Hatching Success**

Index nests were used to estimate hatching success for each species at CANA throughout the 2013 nesting season. The hatching success rates for Loggerhead, Green, and Leatherback nests are 66.1%, 57.7%, and 21.6% respectively (Table 5a). The estimated number of hatchlings that emerged from the nests for each species at CANA is calculated as follows: (number of nests) x (average clutch size) x (% hatching success) x (% not eroded away or totally depredated). For the Loggerhead, figures are (3758) x (95.8) x (66.1%) x (68.8%) = 163,724. For the Green figures are (4152) x (107.1) x (57.7%) x (73.3%) = 188,073. The Leatherback estimate is (23) x (75.5) x (21.6%) x (87%) = 324.

### **Relative Hatching Success**

In 2013, the hatching success for Loggerheads was 66.1%, a slight decrease from 2012 (Table 6). Green success decreased from 68.2% to 57.7%. Leatherback hatching success decreased dramatically from 50.5% to 21.6%, the lowest recorded at CANA.

### **Relocated Nests**

Nests were relocated, typically within 8 hours, if located in high foot traffic areas, in danger of erosion, or initially damaged by predators causing broken eggs to foul the remainder of the nest. This season the average hatching success of relocated nests was less than half the overall hatching success (Table 5b).

**Table 5a. Hatching Success of 2013 Index Nests.**

	<b>Loggerhead</b>	<b>Green</b>	<b>Leatherback</b>
<b>Nests Marked</b>	186	225	23
<b>Nests Excavated</b>	128	165	20
<b>Total Eggs</b>	12,264	17,678	1,510
<b>Avg. Clutch Size</b>	95.8	107.1	75.5
<b>Hatchlings Emerged</b>	8,099	10,250	326
<b>Hatching Success</b>	66.1%	57.7%	21.6%
<b>Eroded/Washed Out</b>	47	54	2
<b>Depredated (total)</b>	11	6	1

**Table 5b. Hatching Success of 2013 Relocated Nests.**

	<b>Loggerhead</b>	<b>Green</b>	<b>Leatherback</b>
<b>Nests Marked</b>	38	19	-
<b>Nests Excavated</b>	33	14	-
<b>Total Eggs</b>	3156	1529	-
<b>Avg. Clutch Size</b>	95.6	109.2	-
<b>Hatchlings Emerged</b>	992	811	-
<b>Hatching Success</b>	31.4%	53%	-
<b>Eroded/Washed Out</b>	5	5	-
<b>Depredated (total)</b>	0	0	-

**Table 6. Hatchling Success of Sea Turtles at Canaveral National Seashore, 1996-2013.**

<b>Year</b>	<b>Loggerhead</b>	<b>Green</b>	<b>Leatherback</b>
2013	66.1%	57.7%	21.6%
2012	68.6%	68.2%	50.5%
2011	64.42%	56.09%	46.30%
2010	67.22%	52.78%	35.35%
2009	65.25%	55.24%	37.44%
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.

## DISCUSSION

### Nesting Totals

The number of sea turtle nests recorded at CANA in 2013 is the highest documented since record keeping began in 1985 (Table 7), with nearly 2,000 nests above the previous record-breaking season of 2012. This year also marked a new record high for Greens, more than tripling the previous high of 1374 in 2011 with a total of 4154 nests (Figure 3b). Loggerhead numbers decreased from 5154 last year to 3758.

The overall pattern of Loggerhead nesting at CANA is irregular with nest numbers fluctuating from year to year (Table 7 and Figure 3a). In contrast, the total number of Green sea turtle nests is somewhat predictable in a biennial pattern, with an increase one year followed by a decline the next (Figure 3b). Since 2009 the pattern has deviated somewhat, possibly affected by storm activity. Seasonal nesting trends of the Leatherback turtle are difficult to discern as they do not return to specific beaches to nest and can nest on multiple beaches each season (NOAA 2010). Overall numbers for the Leatherback, although low at CANA, have shown a definite increase over the past 15 years (Figure 3c).

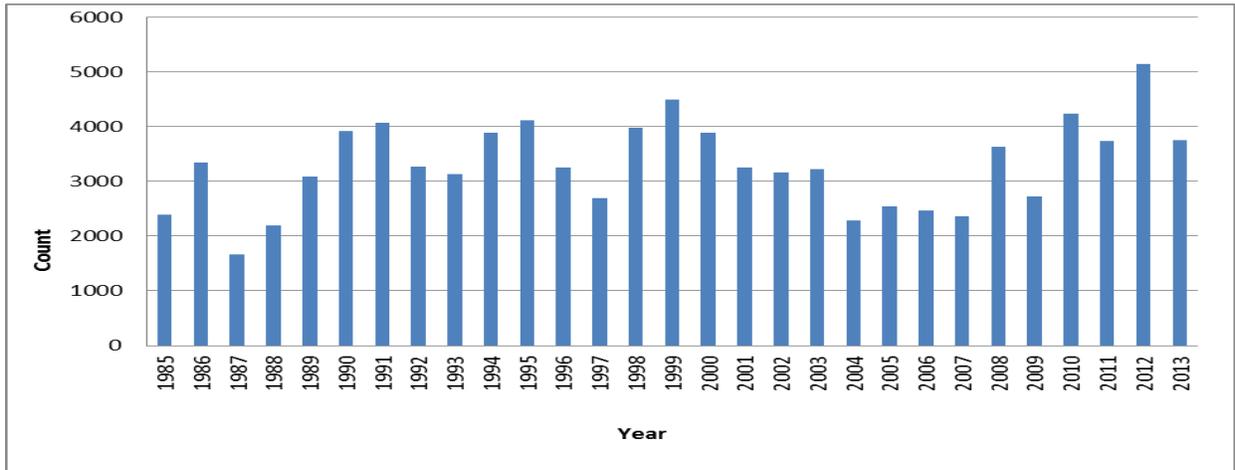
**Table 7. Canaveral National Seashore Sea Turtle Nest Totals 1984-2013.**

<b>Year</b>	<b>Loggerhead</b>	<b>Green</b>	<b>Leatherback</b>	<b>Kemp's</b>	<b>Unknown</b>	<b>Total</b>
2013	3758	4152	23	0	0	7933
2012	5154	816	27	1	0	5998
2011	3742	1374	24	0	0	5140
2010	4250	1343	26	0	0	5619
2009	2729	301	26	0	0	3056
2008	3637	899	5	2	0	4543
2007	2356	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

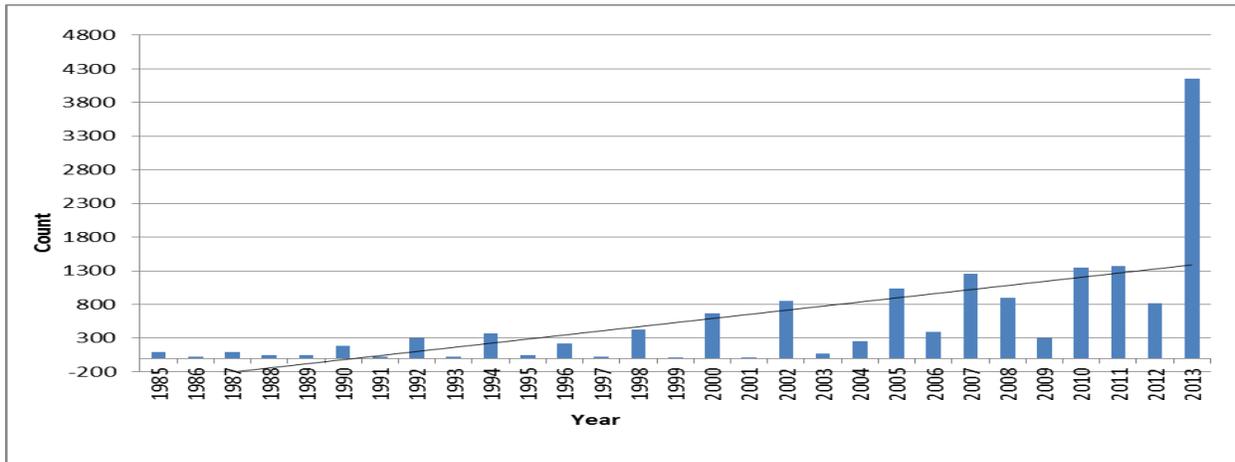
\* Individual breakdown not available

Taken from yearly Sea Turtle Nesting Summaries, 1984-2013 Canaveral National Seashore, Titusville, Florida

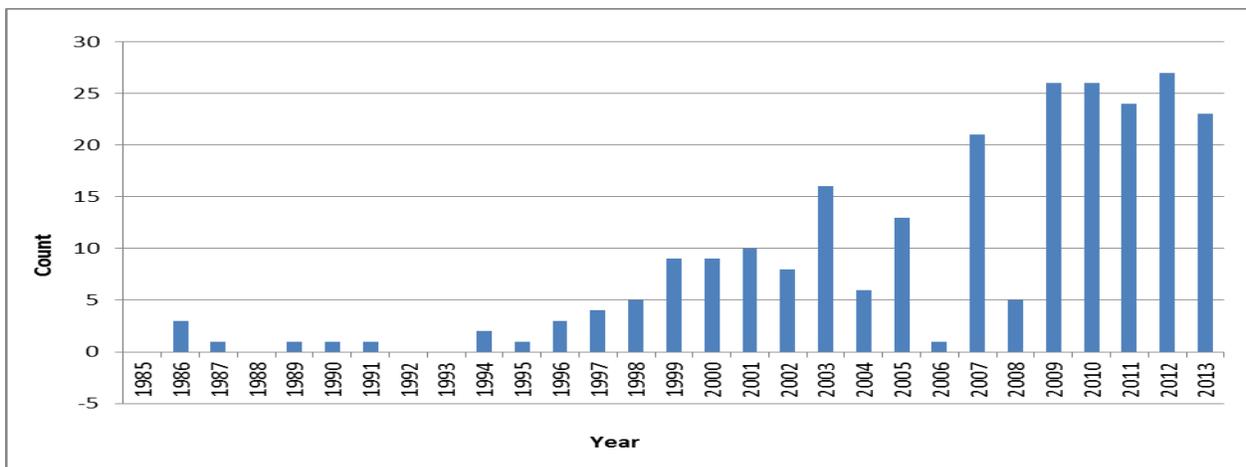
**Figure 3a. Loggerhead Sea Turtle Nesting Total, Canaveral National Seashore, 1985-2013**



**Figure 3b. Green Sea Turtle Nesting Total, Canaveral National Seashore, 1985-2013**



**Figure 3c. Leatherback Sea Turtle Nesting Total, Canaveral National Seashore, 1985-2013**



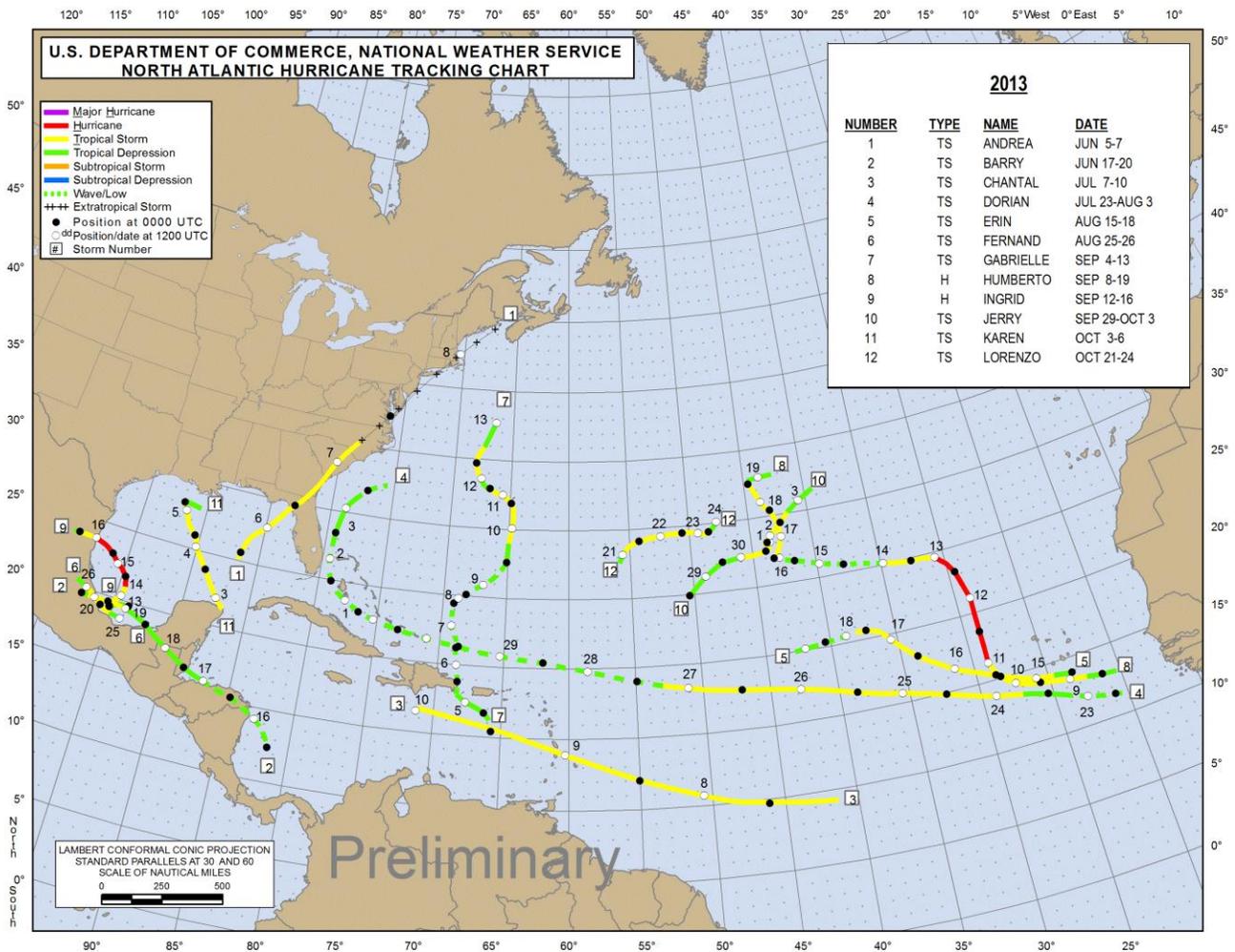
**Table 8. False Crawl to Nest Ratio: 1984 –2013. Canaveral National Seashore.**

<b>Year</b>	<b>Loggerhead</b>	<b>Green</b>	<b>Leatherback</b>
2013	1:1.56	1:1.14	1:4.67
2012	1:1.41	1:1.10	-
2011	1:2.31	1:1.41	-
2010	1:1.69	1:1.04	1:13.0
2009	1:1.46	1:0.90	1:3.71
2008	1:1.41	1:1.06	1:5.00
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	-	-	-

## Weather and Tidal Influences

There were two tropical storms that impacted the East Coast of the United States during the 2013 nesting season. Tropical Storm (TS) Andrea moved directly over the Northeast corner of Florida in early June, while TS Dorian impacted the east coast in late July. Both tropical storms brought rain, high tides, and forceful winds, pulling nest identification stakes, screens, and sea turtle nests out to sea. Several other storm events in the Caribbean, including TS Gabrielle impacted CANA with beach erosion due to winds and high surf. Late in the nesting season, several high-surf events washed out many remaining nests. Approximately 24% of the indexed sea turtle nests were lost to erosion due to storms, as represented by the Index nests for each species (Figure 4). Although this is a significant amount, it much less than 2004 when 44% of the 2,542 nests were lost to high tides and erosion.

**Figure 4. The 2013 Atlantic Hurricane Season Track Map.**



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