

2010 MARINE TURTLE NESTING SUMMARY

CANAVERAL NATIONAL SEASHORE



By

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ABSTRACT

The 2010 marine turtle nesting season was the most successful season recorded at Canaveral National Seashore surpassing the previous record of 4,563 in 2000 by over 1,000 nests. A total of 5,619 nests were laid in 2010: 4,250 Loggerhead, 1,343 Green, and 26 Leatherback. Nest densities were 110.97 per kilometer for the Loggerhead and 35.01 per kilometer for the Green – an overall nest density of 146.71. Loggerhead and Green nests exceeded the number of false crawls with ratios of 1:1.69 and 1:1.03, respectively. Over 98% of the nests were screened to exclude predators. Prior to screening, 3.4% of the nests were partially or totally depredated and 2.8% of the nests were depredated after screens were in place. Overall, the depredation rate (partial and total) for all nests was just over 6.3%. Every twentieth Loggerhead, tenth Green, and all Leatherback nests were marked for excavation. Hatching success rates of 67.2%, 52.8%, and 35.4% were recorded for the indexed Loggerhead, Green, and Leatherback nests, respectively.

INTRODUCTION

Canaveral National Seashore (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 (Apollo Beach) 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) 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, this southern portion of the seashore is subject to public closures during space shuttle launches. The middle 19.31 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.

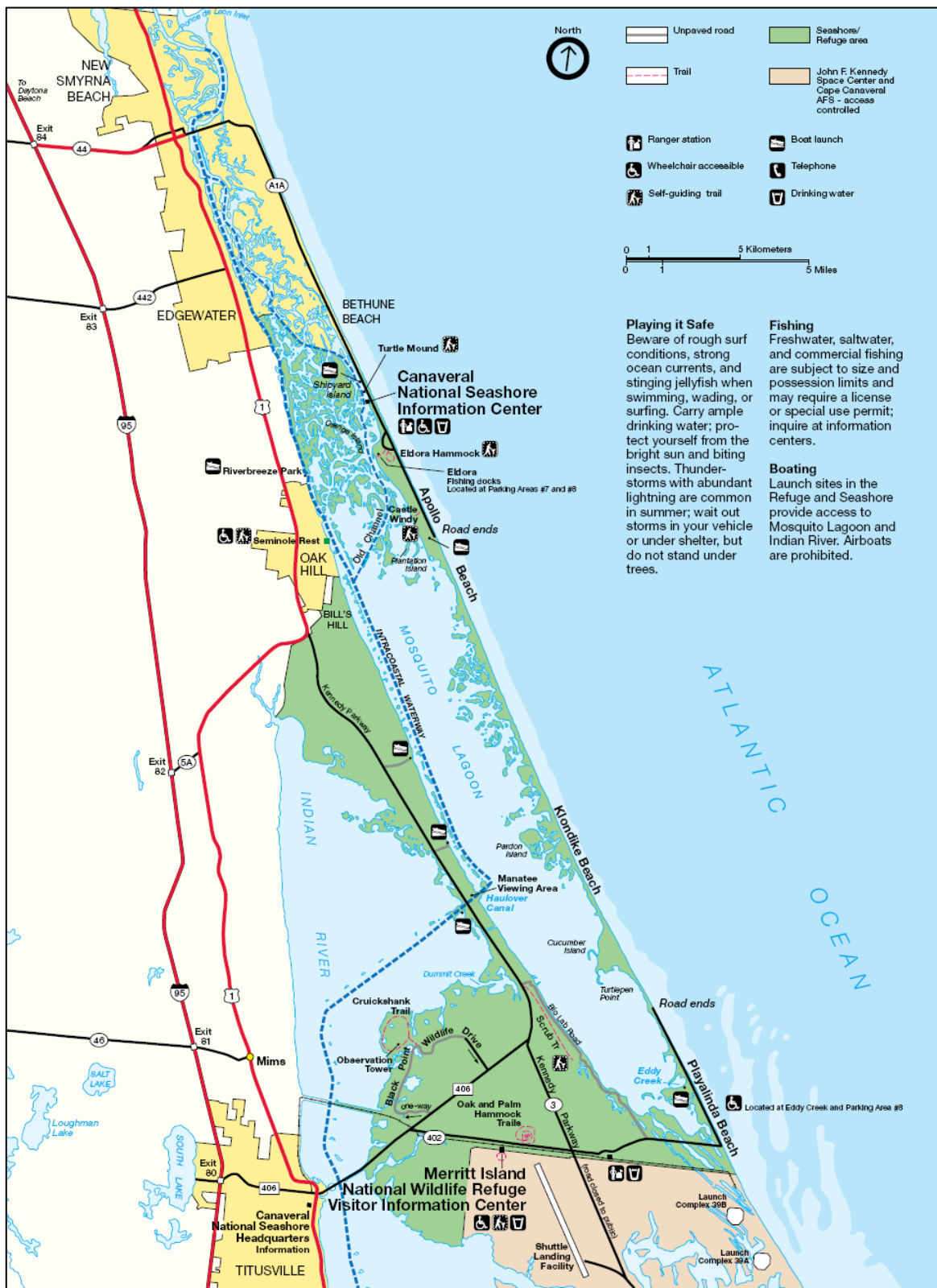


Figure 1. Canaveral National Seashore.

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, but rarely nest on CANA's beaches.

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 between April and June, the earliest and shortest nesting season. Loggerheads are usually observed nesting in the park from May through August, while Greens are recorded slightly later, from June through September. The peak of the nesting season generally occurs between late June and early July when up to 100 nests may be deposited on CANA's beaches each night.

Nest depredation, primarily by raccoons and ghost crabs, pose 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, 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.

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 were 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 26, 2010, the park initiated patrols to record sea turtle emergences (nest and false crawls) and to screen nests along the twenty four miles of beach. Patrols were conducted using all-terrain vehicles (ATVs) towing a one-axle box trailer for equipment. Patrols were expanded to seven days a week on May 15th and continued until August 31st, according to protocol for the state-directed Florida Index Nesting Beach Survey. The beach was patrolled from 23:00 to 07:30 hours, 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. 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, the personnel inspected it to determine if a nest was present. All nests (unless totally depredated by predators) were marked and 4' x 4' squares of 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 nests were marked as index nests for which hatching success was determined. Hatchling success was also established for relocated nests. Nests were excavated 72 hours after first hatchling emergence or, if no sign of emergence, 70 days (80 days for Leatherbacks) after the nest was deposited. For each nest, the following excavation information was recorded: number of hatchlings emerged (empty egg shells), number of unhatched eggs, the number of live and dead hatchlings in nest, and the number of live and dead pipped eggs (hatchling still partially in eggshell). Depredated eggs were added to the total of unhatched eggs prior to analysis.

Daytime patrols were conducted two to three times a week in addition to nighttime patrols to document any status change to recorded nests. The observations included nest tamperers, partial and total depredations, hatches, inundations, nest erosions, or any other notable conditions. On August 24, 2010, patrols were adjusted to 04:00 to 12:30 hours due to a decrease in nesting in order 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 which documented number of nests and false crawls for each species nightly per half mile segment of beach between the periods of May 15, 2010 - Aug 31, 2010.

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 5,619 marine turtle nests were laid on CANA's beaches in 2010: 4,250 Loggerheads, 1,343 Greens, and 26 Leatherbacks (Table 1). No Kemp's ridley turtles nested within CANA this year. Nest densities were 110.97 per kilometer for the Loggerhead species, and 35.01 per kilometer for the Green. The total nest density was 146.71 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 64.55% of the nests laid in the south (Brevard County) and 35.45% in the north (Volusia County) (Table 1).

Table 1. 2010 Nest Totals

	Loggerhead	Green	Leatherback	Kemp's	Total
North District	1563	419	10	0	1992
South District	2687	924	16	0	3627
Total	4250	1343	26	0	5619

Table 2. 2010 Marine Turtle Crawl Survey

	Loggerhead	Green	Leatherback	Total
Nests	4250	1343	26	5619
False Crawls (FC)	2511	1292	2	3805
Nest Density (nests/km)	110.97	35.01	0.68	146.71
FC Density (FC/km)	65.56	33.73	0.05	99.35
FC to Nest Ratio	1:1.69	1:1.04	1:13	1:1.48

Table 2a. 2010 North District Marine Turtle Crawl Survey

	Loggerhead	Green	Leatherback	Total
Nests	1563	419	10	1992
False Crawls (FC)	999	482	0	1481
Nest Density (nests/km)	86.35	23.15	0.55	110.06
FC Density (FC/km)	55.19	26.63	0.00	81.82
FC to Nest Ratio	1:1.56	1:0.87	0:0	1:1.35

Table 2b. 2010 South District Marine Turtle Crawl Survey

	Loggerhead	Green	Leatherback	Total
Nests	2687	924	16	3611
False Crawls (FC)	1512	810	2	2324
Nest Density (nests/km)	133.02	45.74	0.79	178.76
FC Density (FC/km)	74.85	40.10	0.10	115.05
FC to Nest Ratio	1:1.78	1:1.14	1:8	1:1.55

**Figure 2a. Nests, false crawls, and depredations in the North District (Grids 0-44)
Canaveral National Seashore, 2010**

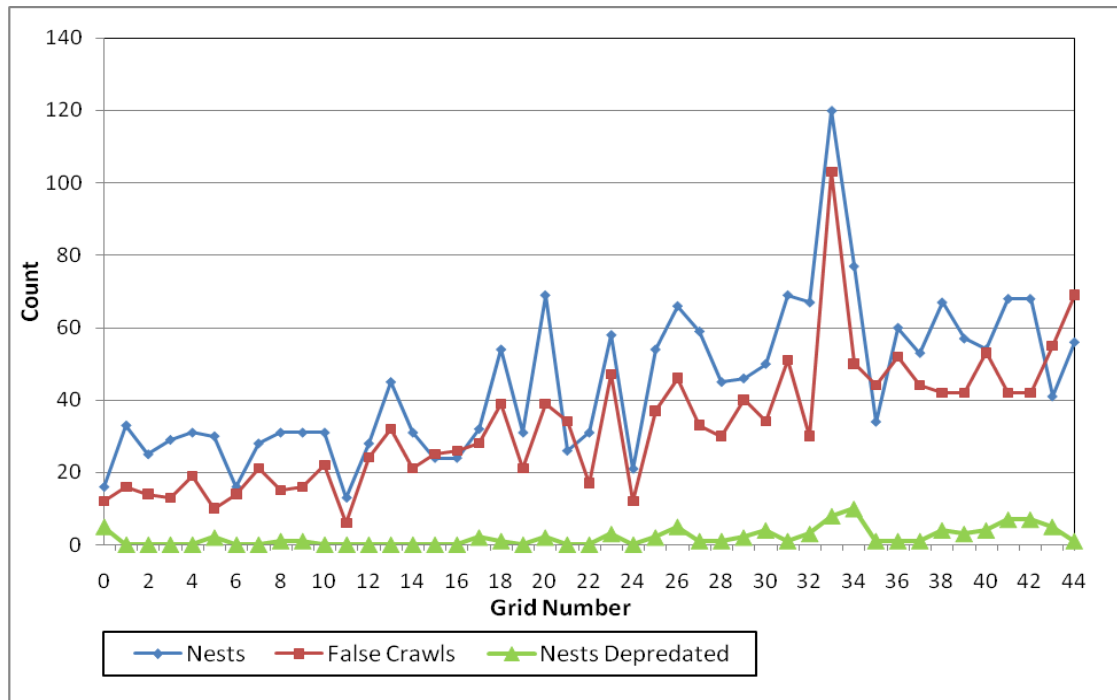
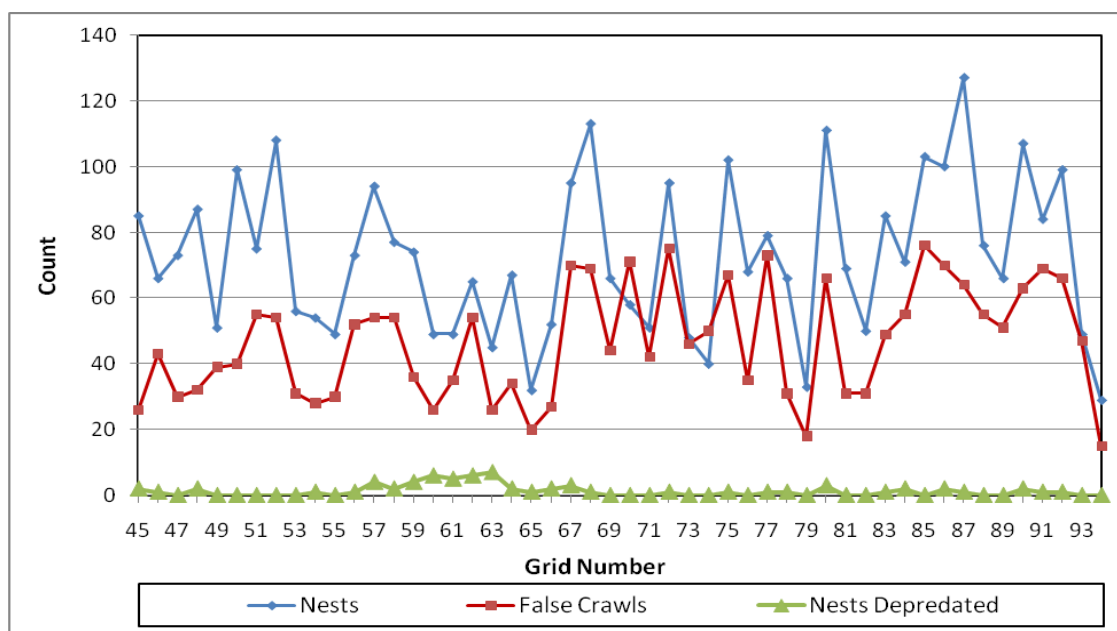


**Figure 2b. Nests, false crawls, and depredations in the South District (Grids 45-94)
Canaveral National Seashore, 2010**



Nest Treatment and Depredation

In 2010, 98.9% of sea turtle nests were screened by park staff. 3.4% percent of the nests were depredated prior to discovery (Table 3). A total of 160 nests (2.8%) were impacted by predators that managed to get around the screening. Overall nest predation was 6.3%. Figures 3a and 3b show the number of nests predated. Table 3 summarizes the impact on nests by predators for the 2010 nesting season.

Table 3a. Nest Depredated Prior to Screening

Initial Encounter	Loggerhead	Green	Leatherback	Total
Not Depredated	4065	1336	26	5427
Partial Depredation	122	7	0	129
Total Depredation	63	0	0	63

Table 3b. Nests Depredated After Screening

	Total Depredation	Partial Depredation	Total
North District	43	50	93
South District	50	17	67
Total	93	67	160

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

	Total Depredation	Partial Depredation	Total
North District	103	173	276
South District	53	23	76
Total	156	196	352

Hatching Success

Index nests were used to estimate hatching success for each species at CANA throughout the 2010 nesting season. The hatching success rates for Loggerhead, Green, and Leatherback nests are 67.2%, 52.8%, and 35.4% respectively (Table 4). 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 $(4250) \times (93.6) \times (67.2\%) \times (90.4\%) = 241,658$. For the Green figures are $(1343) \times (123.4) \times (52.8\%) \times (97.8) = 85,578$. Finally, the Leatherback estimate is $(26) \times (83.1) \times (35.4\%) \times (1) = 764$.

Table 4. Hatching Success of 2010 Index Nests.

	Loggerhead	Green	Leatherback
Nests Inventoried	222	139	26
Nests Excavated	210	136	26
Total Eggs	19655	16776	2161
Avg. Clutch Size	93.6	123.4	83.1
Hatchlings Emerged	13212	8852	764
Hatchling Success	67.2%	52.8%	35.4%
Eroded/Washed Out	4	2	0
Washed Over	61	31	2
Depredated	19	1	0

DISCUSSION

Nesting Totals

The number of sea turtle nests recorded at CANA in 2010 marked a record high with 5619 nests, over 1,000 nests above the record high in 1999 (Table 5, Figure 3a). This year also marked a record high for Greens with 1343, 94 nests above the previous high of 1249 in 2007 (Figure 3b). Loggerhead numbers were the highest in 10 years, only 251 nests below the record high of 4501 in 1999. The Leatherback nest total tied last year's high of 26.

The overall pattern of Loggerhead nesting at CANA is irregular (Tables 5 and 3a). In contrast, the total number of Green sea turtle nests is somewhat predictable, generally alternating between high and low years although since 2004, when several hurricanes hit the Florida coast, the pattern has been less regular. 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).

Table 5. Canaveral National Seashore Sea Turtle Nest Totals 1984-2010.

Year	Loggerhead	Green	Leatherback	Kemp's	Unknown	Total
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, 1984-2009 Canaveral National Seashore, Titusville, Florida

Figure 3a. Loggerhead Sea Turtle Nesting Total, Canaveral National Seashore, 1985-2010

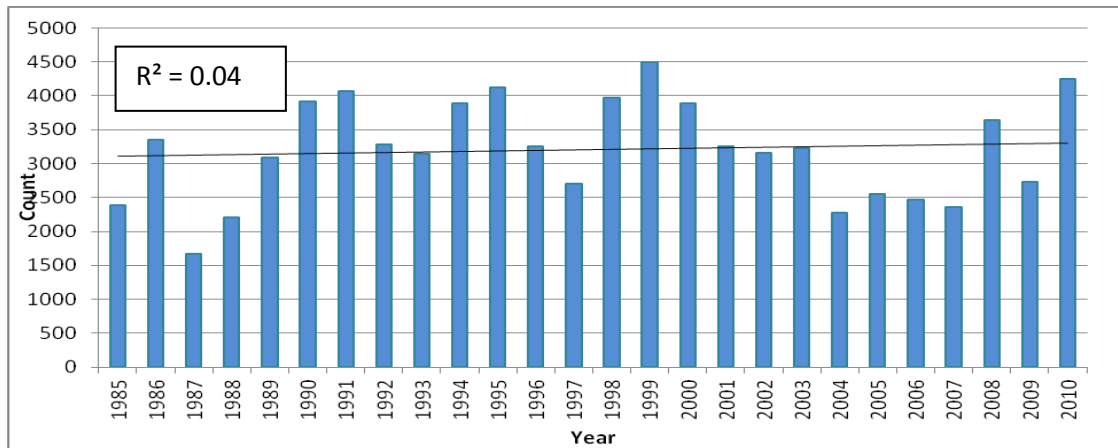


Figure 3b. Green Sea Turtle Nesting Total, Canaveral National Seashore, 1985-2010

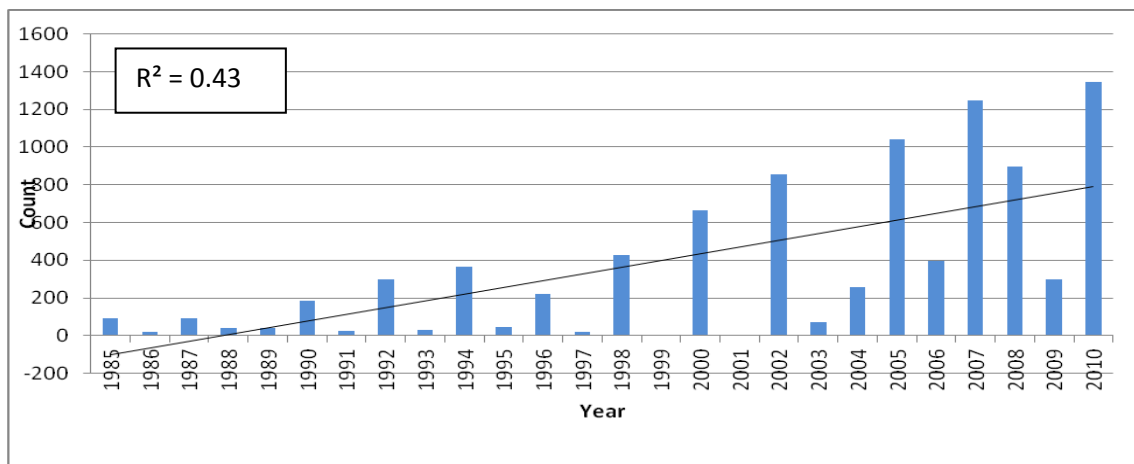


Figure 3c. Leatherback Sea Turtle Nesting Total, Canaveral National Seashore, 1985-2010

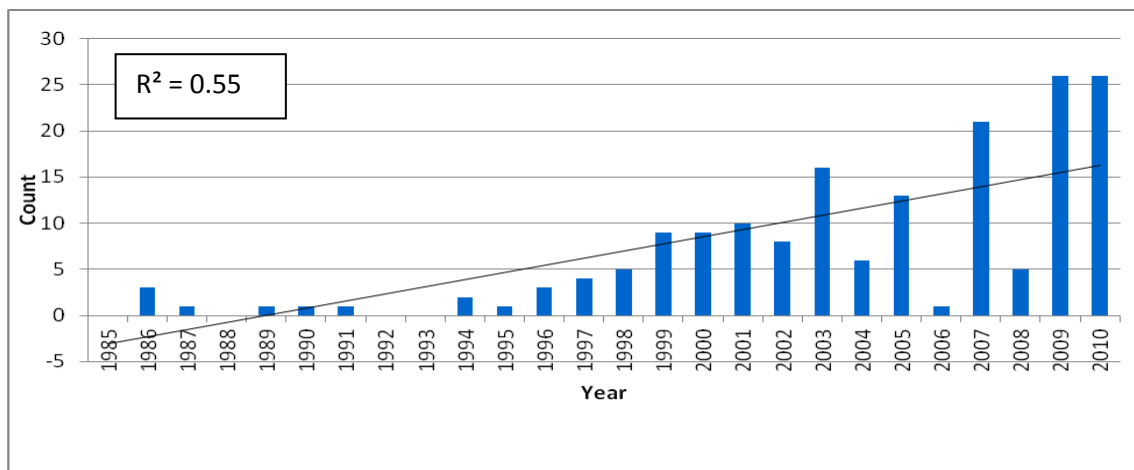


Table 6. False Crawl to Nest Ratio: 1984 – 2008. Canaveral National Seashore.

Year	Loggerhead	Green	Leatherback
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	-	-	-

Screening Activity and Nest Depredation

98.9% of the nests were screened in 2010 (Table 7). The reason the park was able to accomplish this high number is due to the extensive experience of seasonal biological technicians and veteran volunteers. The overall depredation rate decreased from 10.6% in 2009 to 6.3% in 2010 almost 90% percent less than the recorded depredation rates in 1985 when the screening program first began.

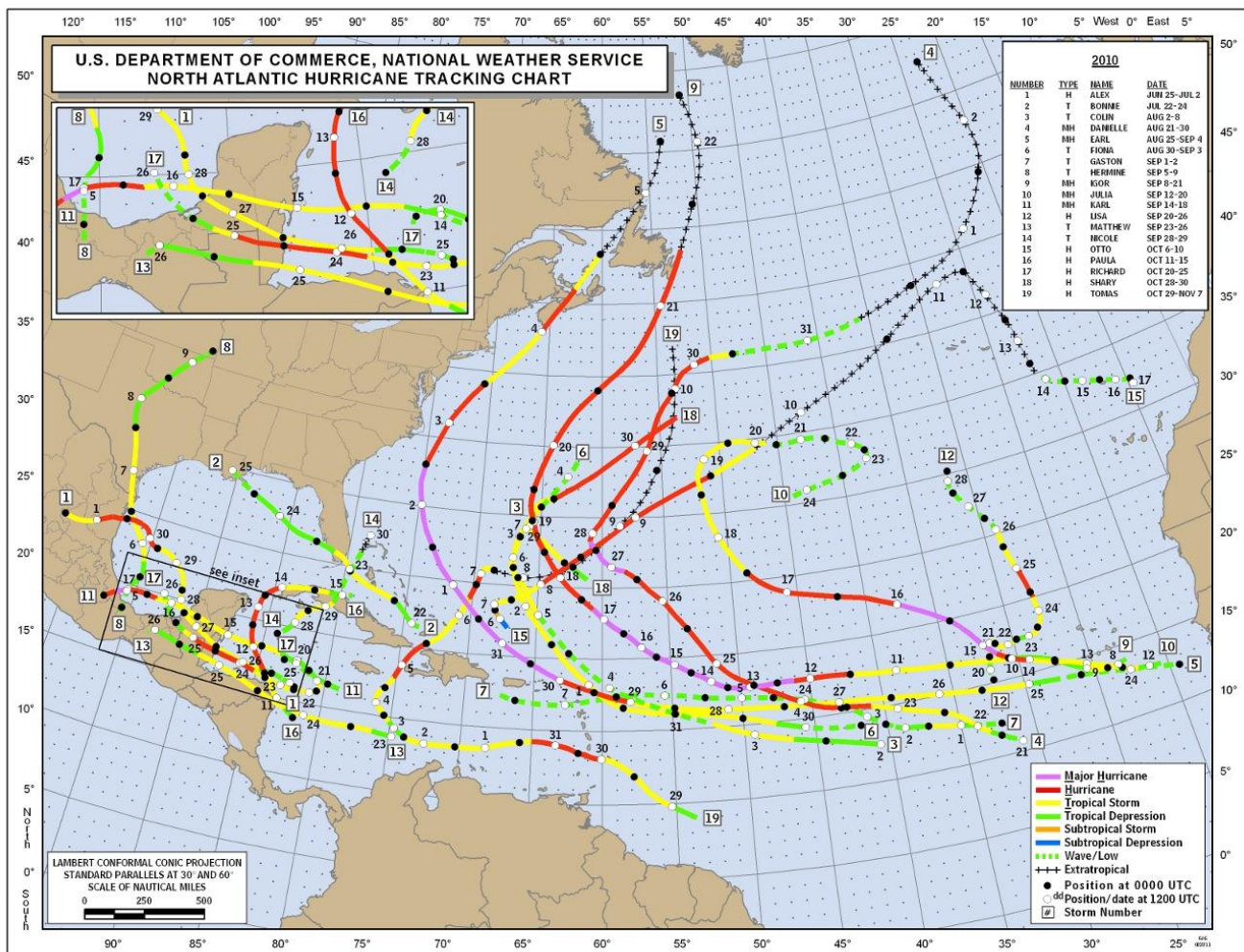
Table 7. Amount of Screening and Depredation of Screened Nests: 1984 – 2008

Year	Nests	Nests Screened*	Screened Nests Depredated (%)	Overall Depredation (%)
2010	5619	5556 (99%)	10.5	6.3
2009	3056	3034 (99%)	6.2	10.6
2008	4543	4366 (96%)	7.5	15
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

Weather and Tidal Influences

There were two tropical storms and one hurricane in the Caribbean and Gulf of Mexico during the 2010 season (see figure 4). Fortunately, none of these storms directly impacted the east coast of Florida. Tropical storms Bonnie, Nicole and Hurricane Earl indirectly impacted CANA's beach in the form of high tides. About 0.1% percent of the indexed sea turtle nests were lost to erosion due to storms, a very negligible amount compared to 2004 when 44%, or over 1000 nests, were lost to high tides and erosion.

Figure 4. The 2010 Atlantic Hurricane Season Track Map.



Relative Hatchling Success

In 2010, the hatchling success for Loggerheads was 67.22%, a slight increase from 2009 (Table 8). This surpassed the target of 60% hatching success established in the 1991 USFWS sea turtle recovery plan. Green success decreased from 55.24% to 52.78%. Leatherback hatching success decreased from 37.44% to 35.35%, continuing a general trend of being lower than the percentages for loggerhead and green sea turtles.

Table 8. Hatchling Success of Sea Turtles at Canaveral National Seashore, 1996-2010.

Year	Loggerhead	Green	Leatherback
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.

Other Notable Events Regarding Sea Turtles at CANA

Two significant events related to sea turtles at CANA occurred in 2010. The first was a cold-stun event in early January. The second was the Deepwater Horizon Oil Spill which began on April 20th. Though neither event directly impacted the 2010 nesting season, these events may impact future nesting seasons.

January 2010 Cold Stun

Mosquito Lagoon is a major nursery for juvenile Green and Loggerhead sea turtles. Beginning January 4th, a ten-day period of unusually cold temperatures immobilized hundreds of sea turtles in the chilly waters. The helpless turtles were pushed ashore and into shallow areas by the wind. Many additional strandings were reported in other areas of the Indian River Lagoon system. The interagency sea turtle stranding network was notified and an incident command system was put into effect.

In an extraordinary interagency effort, the park and many other groups, including NASA, USFWS, Florida Fish & Wildlife Conservation Commission, U.S. Air Force, St. Johns River Water Management District and numerous volunteers, took to the water to retrieve the stranded turtles. The turtles were transferred to several processing facilities, the primary one being established at Merritt Island National Wildlife Refuge. Basic measurements and condition assessments were done before shipping the turtles to more adequate holding facilities such as Sea World, Marineland and other aquaria and rehabilitation centers.

Water temperatures within Brevard County lagoons were below 10°C continuously for ten days. Operations continued until January 14th when weather conditions finally improved. Over 2100 sea turtles, mostly Greens with a few Loggerheads and a single Hawksbill, were rescued from Mosquito Lagoon and nearby waters. Overall, the mortality rate in sea turtles rescued from Brevard County waters was 22%. As the turtles revived, they were sent to rehabilitation facilities or released back into the wild. However, only 3% of the turtles were returned to Mosquito Lagoon. During the recovery operation, two Green sea turtle nests were discovered, and recently confirmed by egg shells collected from the site, on an island in the Indian River Lagoon system. These are the first records of sea turtles nesting in the inshore waters of the Indian River Lagoon.

Deepwater Horizon Oil Spill

At approximately 10 pm on April 20th, 2011, an explosion occurred on the British Petroleum (BP) Deepwater Horizon Drill Rig, claiming the lives of eleven men. An estimated 35,000 to 60,000 bbl/day of oil was released into the Gulf of Mexico throughout the next three months. Sea turtle hatchlings due to emerge from nests on the shores of the Gulf of Mexico would be swimming into oil-contaminated water. Since these hatchlings faced a high probability of mortality, a major inter-agency effort was undertaken to save them. Over 270 nests from the northern Gulf of Mexico were translocated via specially-equipped FedEx trucks to a facility at Kennedy Space Center, less than two miles from CANA. Over the course of the summer, approximately 15,000 hatchlings were released along the coast of central Florida, with 97% being released at Canaveral National Seashore.

ACKNOWLEDGEMENTS

Canaveral National Seashore's sea turtle nest screening program would not be possible without the diligent efforts of many dedicated individuals. John Stiner, Resource Manager, remained an invaluable source of expertise and kept the project running smoothly. Likewise, Candace Carter provided indispensable logistical support and advice. Seasonal employees, Michael Daley, Sean McKenna, and Steven Trull, patrolled the beach each night, dealing with high humidity, bothersome insects, and unexpected obstacles to locate new nests as soon as possible. Centennial employees, Jonnie Gove and Jennifer Nyman, provided day patrols and data management. Kaila Thorn, Hollins University intern and Jennifer Chandler and Lily Thompson, Student Conservation Association (SCA) interns, patrolled the beach, assisted with end-of-season screen removal, maintained several databases, analyzed data, and helped with composition of the final report with John Stiner and Candace Carter. Additionally, many volunteers assisted with the night patrols, sacrificing sleep and comfort to further the cause of sea turtle conservation.

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