

**CAPE HATTERAS NATIONAL SEASHORE
2008 SEA TURTLE ANNUAL REPORT**



Green sea turtle after nesting at Cape Point (7/9/08)

National Park Service
Cape Hatteras National Seashore
1401 National Park Drive
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INTRODUCTION

Five species of sea turtles can be found along the Cape Hatteras National Seashore (CAHA) – the loggerhead (*Caretta caretta*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), and Kemp’s ridley (*Lepidochelys kempii*). In the 1970’s, the leatherback, Kemp’s ridley and hawksbill were listed under the Federal Endangered Species Act as endangered and the loggerhead as threatened (likely to become endangered within the foreseeable future). The green, listed on July 28, 1978, is designated as threatened in its entire range except in the breeding populations in Florida and on Mexico’s Pacific coast, where it is listed as endangered.

Non-breeding sea turtles of all five species can be found in the nearby waters during much of the year. CAHA lies near the extreme northern limit of nesting for three of the five sea turtle species including: the loggerhead, green, and leatherback; loggerheads being the most common. Documented nest numbers have fluctuated greatly within the last 20 years with only 11 nests recorded in 1987, and a maximum of 112 nests in 2008. The Kemp’s ridley and hawksbill are not known to nest at CAHA, but are known to occur here through strandings.

The beaches of CAHA have been consistently monitored since 1987. CAHA follows management guidelines defined by the North Carolina Wildlife Resources Commission (NCWRC) in the *Handbook for Sea Turtle Volunteers in North Carolina*. The quality of surveys has improved over time and has developed into the current standardized protocols. Each year data has been collected and analyzed to gain a better understanding of sea turtle use within CAHA. This report summarizes the monitoring and results for 2008.

2008 Consent Decree

In October 2007, Defenders of Wildlife and the National Audubon Society, represented by the Southern Environmental Law Center (plaintiffs) filed a lawsuit against CAHA alleging inadequacies in management of protected species at CAHA and failure to comply with the requirements of the off-road vehicles (ORV) executive order and National Park Service (NPS) regulations regarding ORV use.

In April 2008, the U.S. District Court Judge signed a Consent Decree to settle the lawsuit. The Consent Decree was agreed to by the plaintiffs and the NPS; and by Dare and Hyde Counties and a coalition of local ORV and fishing groups (Cape Hatteras Access Preservation Alliance) which participated in the lawsuit as interveners. The Consent Decree, which is enforceable by the court, provides for specific protection mandates and requires CAHA to complete the ORV plan and required special regulation by Dec.31, 2010 and April 11, 2011 respectively.

The Consent Decree affected management of sea turtle nests and public recreation near nests in the following ways:

- Nighttime driving is restricted between the hours of 10 pm-6 am, from May 1st – September 15th. After September 15th nighttime driving is allowed only with a NPS permit for no fee. In winter months (November 1st – May 1st) nighttime driving is not

restricted on CAHA. Also, any sea turtle nests still incubating after September 15th required full-beach (dune to surf) closures until hatching.

- On September 15th, all unhatched turtle nests on ORV beaches that have reached their hatch window (50-55 days of incubation) receive a full beach closure. A full beach closure extends from the water to the dune line, thus prohibiting ORV access behind these nests. After final excavation of these nests, the closure is removed.

The Consent Decree will remain in effect until the NPS completes the ORV Management Plan and Special Regulation. Any further questions about the Consent Decree can be addressed by visiting the CAHA website at www.nps.gov/caha or contacting the Outer Banks Group Headquarters at (252) 473-2111.

COOPERATING AGENCIES

CAHA cooperates with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) on sea turtle protection. All original stranding reports and annual nesting activity reports are submitted to the North Carolina Sea Turtle Program Coordinator at the NCWRC. An annual permit is issued to CAHA by NCWRC under the authority of the USFWS for the possession and disposition of stranded marine turtles and relocation of nests.

SITE DESCRIPTION

CAHA is located along the northern Outer Banks region of North Carolina. Consisting of more than 30,000 acres distributed along approximately 64 miles of shoreline, it is part of a dynamic barrier island system spreading across three barrier islands—Ocracoke, Hatteras, and Bodie—spanning Dare and Hyde counties. The former U.S. Coast Guard housing area in Buxton and eight village enclaves are excluded from CAHA boundaries. The villages include Rodanthe, Waves, Salvo, Avon, Buxton, Frisco, and Hatteras on Hatteras Island and Ocracoke Village on Ocracoke Island. On the oceanside of the villages, federal ownership was established as a 500-foot strip measured landward from the mean low water at the time of acquisition. Fishing piers located in Rodanthe, Avon, and Frisco are operated as park concessions. The 5,880-acre Pea Island National Wildlife Refuge, located at the northern end of Hatteras Island, is within the authorized boundary of CAHA, but owned and administered for refuge purposes by the USFWS.

METHODS

Ocean beaches of CAHA were patrolled daily from May 1st to September 15th in search of turtle crawls/nesting activity and strandings. After September 15th, the beaches were surveyed three to four times a week for possible late nests and/or hatchling emergence events from possible missed nests through November 15. Volunteers in the Park (VIP'S) and park staff monitored approximately 70 miles of beach covering Bodie, Hatteras, and Ocracoke Islands. For purposes

of sea turtle management, Bodie Island District covered from Ramp 1 to Ramp 30; Hatteras District from Ramp 30 south to Hatteras Inlet on the north side; and Ocracoke District from the south side of Hatteras Inlet south to Ocracoke Inlet (see Appendix A, Map 1). Efforts began as early as possible (between 5:00 am and 6:30 am) so that all beaches had been patrolled by no later than 12:00 p.m.

Nests were either left in place or relocated for environmental reasons. In general, nest relocation has been discouraged under recommendations of the NCWRC and USFWS; therefore, relocation was confined to nests that were threatened with loss from erosion and nests that were laid below the high tide line that would receive frequent tidal inundation. Nests were considered confirmed when the nest cavity with eggs was located. In 2008, there was one situation where eggs were believed to be present (based on presence of primary and secondary body pits) but could not be found. Rather than abandoning the site because staff could not locate eggs (recognizing the possibility of human error), the activity was categorized as a “dig” but treated as a nest until 90 days into ‘incubation,’ when the absence of any emergence confirmed the dig was a false crawl. GPS coordinates were recorded for all turtle activities.

A temperature reading device (HOBO) was placed among the eggs for the purpose of recording the incubation temperature of all CAHA nests, as a part of ongoing temperature dependant sex determination study. This is the second year that CAHA has operated this study.

A transponder ball was buried at a set distance and depth in front of all nests and “dig” sites. A series of three PVC posts were placed in line with and behind the nest with measurement distances recorded. The nest site was protected with four or eight 2”x2” wooden posts with signs stating the area was closed to entry for a sea turtle nest and should not be disturbed. String with flagging was placed between the sign posts and the area was monitored for signs of violations and/or predation during daily morning patrols.

The closure was expanded 50-55 days into nest incubation to encompass the area 30-50 feet duneward of the nest site down to the tide line. Width of the closures (running parallel to the shoreline) varied from 75/150/350 feet, depending on type and levels of recreational use on that particular beach. For example, a nest on a remote beach would receive a closure of 75 feet in width; a nest in a heavy pedestrian use area such as a village would be 150 feet in width; and a nest in an ORV area would be 350 feet in width. If a nest was located on a beach open to ORV use, large signs were posted to notify drivers that the established closure included the shoreline at all tides. When possible, an ORV corridor was maintained duneward of the nest. Reflective arrows and detour signs were clearly posted to alert drivers of the change in traffic pattern. If a nest was laid high up on the beach or in the dunes and did not allow for traffic to be detoured around it, the beach was completely closed from dune to the surf as well as for a width of 350 feet. The perimeter of the closure was well posted and large signs warned visitors at ORV ramps of “No through traffic to the next ramp”. The public was notified of closures that would temporarily limit ORV traffic through weekly access reports published by the park. The reports were posted at visitor centers and ramps and distributed to the local tackle shops. Many of the local fishing and ORV groups also posted this information on their fishing web boards. Within the closure all vehicle tracks were smoothed over manually with rakes or with a steel mat

attached to an ATV, so as not to impede hatchlings attempting to reach the surf (NMFS, USFWS 1991).

As hatchlings can become disorientated by artificial light, silt fencing was installed at all nest sites 50 days into incubation in order to block sources of light pollution from nearby villages or ORV's operating with headlights after dark. The fencing was placed in a "U" shape behind the nest and extended oceanward to the high tide line. Sites were then checked on a daily basis for hatching events. Most nests hatched during the evening/night hours either in one event, known as a boil, or intermittently over several nights, known as a trickle.

All nests were examined when possible after hatching to determine productivity rates. Nests were excavated at a minimum of 72 hours after hatching, except in cases when nests were excavated early due to impending storms. In cases where hatching events or dates were unknown, nest cavities were unearthed 80-90 days after the laying date according to NCWRC guidelines. Hatching closures were promptly removed after completion of each nest excavation.

All species of sea turtles that strand on CAHA are documented in cooperation with the NCWRC and the National Marine Fisheries Service (NMFS). Handling and collection permits are issued to the park by the NCWRC and all reports are submitted to them within 24 hours of a stranding event. Live animals were transported to a permitted rehabilitation facility for immediate care. A stranding report was completed for each animal documenting such information as species, condition, sex, carapace measurements, tags, wounds or abnormalities, and evidence of fishing gear entanglement or other possible causes leading to injury or death. When possible, photos were taken of each stranding. Samples were collected from some of the strandings for an ongoing DNA and aging study. Flippers, eyes and muscle tissues were collected from select individuals and are transferred to the NMFS Beaufort laboratory. When possible, stranded turtles were necropsied by CAHA staff in order to determine sex, health condition, and occurrences of human interaction.

When possible, fresh dead green hatchlings removed from the nests were frozen for later analysis and examination.

RESULTS

Nesting

Sea turtle nest numbers encountered at CAHA vary from year to year. The yearly nest numbers used in this report were taken from a thorough search of the turtle database represent the most accurate turtle management data for CAHA (Figure 1).

The first recorded nesting activity for the 2008 season occurred on Hatteras Island with a loggerhead false crawl on May 10th. The first recorded nest of the season was laid on Hatteras Island on May 18th. The last recorded nest of the season was laid on Hatteras Island (in Frisco Village) on August 24th. One nest on lighthouse beach (NH74) was found only at the time of

hatching, and was missed by turtle patrol when laid. The nesting season lasted for 107 days. A total of 215 activities were documented of which 112 were confirmed nests and 103 were false crawls (Table 1). The one “DIG” was found to be a false crawl, and is included in the false crawl number total. The 112 nests on CAHA (108 loggerhead nests and 4 green nests) constituted 13.2% of the North Carolina’s (NC) total nests (840 loggerhead nests and 8 green nests). No leatherback nests were recorded at CAHA, and none were reported elsewhere in the state of NC.

Of the confirmed nests found this season, 75 (67%) were found in Hatteras District, 24 (21.4%) were found in Ocracoke District, and 13 (11.6%) were found in Bodie Island District (Figure 2). For maps of all turtle nests and false crawls refer to Appendix A, Maps 2-11.

There were two storms that caused severe damage to sea turtle nests on CAHA in 2008, resulting in a total of six nests that could not be excavated due to storm activity (4 washed away during storms, 2 unable to be found after storms). All six of these nests are assumed to have 0% hatching or emergence success as the storms hit prior to the hatch window of each nest.

Figure 1. CAHA Sea Turtle Nest Numbers from 2000-2008.

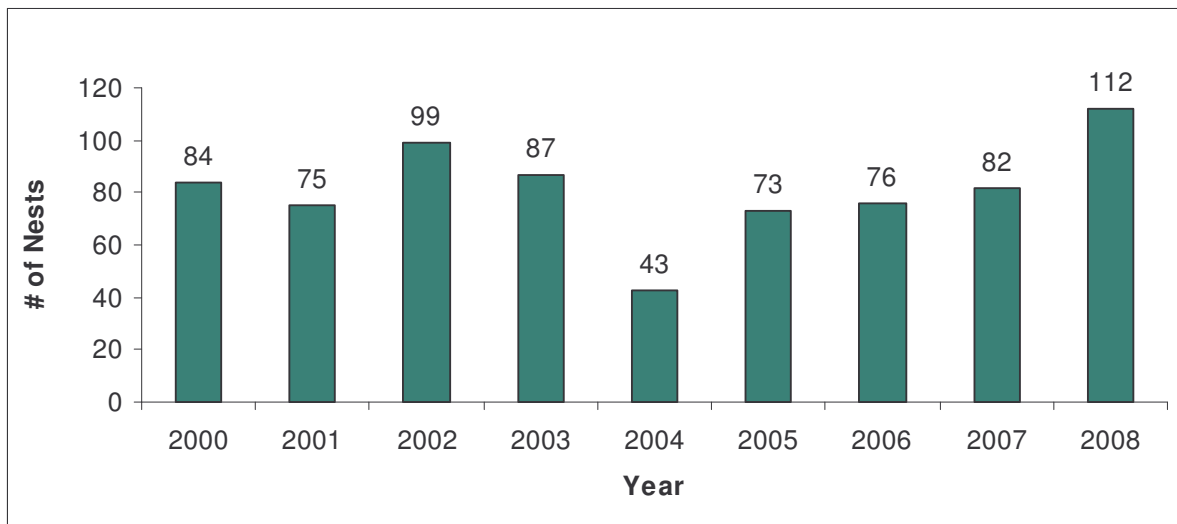


Table 1. Nest Activity by District in 2008.

	Bodie	Hatteras	Ocracoke	CAHA Total
Nests	13	75	24	112
False Crawls	10	56	37	103*

* Includes one 'DIG' that was later found to be a false crawl

Table 2. Percentage of Total Nests for North Carolina.

Year	CAHA Nests*	NC Nests**	%
2000	84	784	10.7
2001	75	663	11.3
2002	99	708	14
2003	87	867	10
2004	43	354	12.1
2005	73	673	10.8
2006	76	801	9.5
2007	82	567	14.5
2008	112	848***	13.2

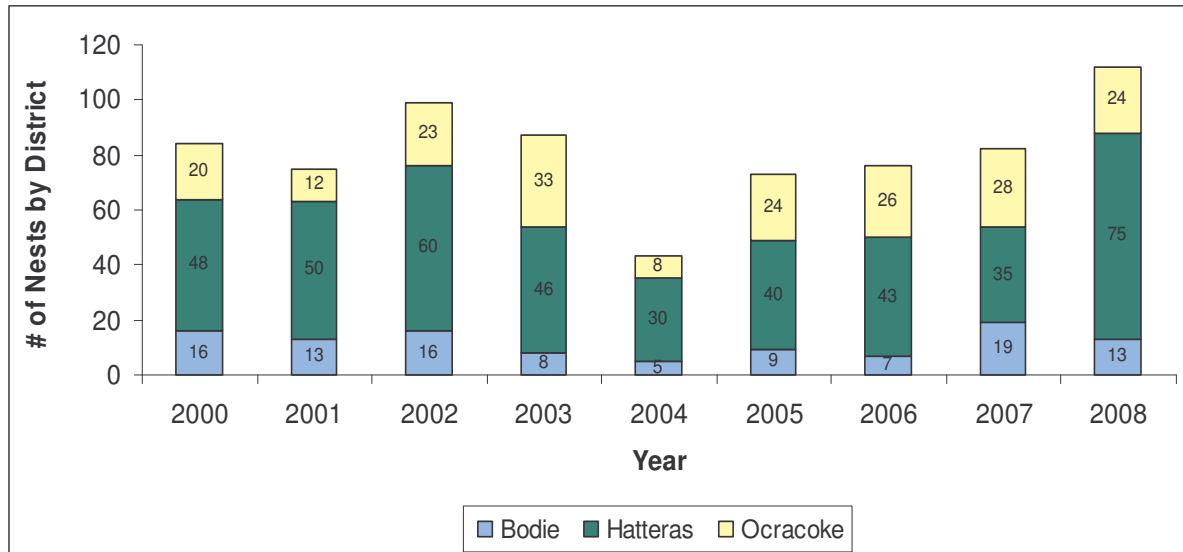
*from CAHA

**from M. Godfrey, NCWRC

***preliminary results from M. Godfrey, NCWRC

Of the confirmed nests found this season, 75 (67%) were found in Hatteras District, 24 (21%) were found in Ocracoke District, and 13 (12%) were found in Bodie Island District (Figure 2). For maps of all turtle nests and false crawls refer to Appendix A, Maps 2-11.

Figure 2. Nest Numbers by District from 2000-2008.



False Crawls

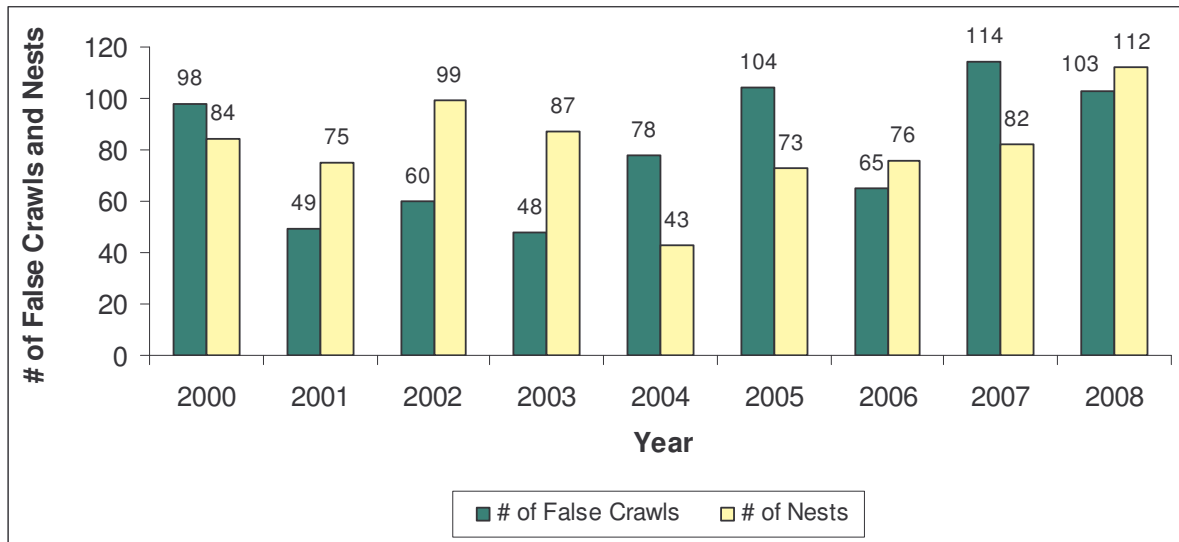
During the 2008 breeding season, 103 false crawls or aborted nesting attempts were recorded (Table 1). This total includes the one dig where no hatching activity was observed. False crawls accounted for 48% of the total turtle activities within the park. The majority of false crawls occurred in Hatteras District where 56 (54%) false crawls were documented; 37 (36%) occurred in Ocracoke District and 10 (10%) occurred in Bodie District. Loggerheads accounted for 101 (98%) of the total false crawls and the remaining 2 (2%) were identified as greens.

In 2008 103 false crawls and 112 nests were documented, resulting in a .92:1 false crawl to nest ratio. Therefore CAHA met the target level of a false crawl to nest ratio of less than or equal to 1:1 annually. CAHA has met the desired target level in 5 of the last 9 years (Table 5).

Table 4. False Crawl to Nest Ratios for CAHA (2000-2008)

Year	# of False Crawls	# of Nests	Ratio
2000	98	84	1.17:1
2001	49	75	.65:1
2002	60	99	.61:1
2003	48	87	.55:1
2004	78	43	1.81:1
2005	104	73	1.42:1
2006	65	76	.86:1
2007	114	82	1.39:1
2008	103	112	.92:1

Figure 3. Nests to False Crawls by Year for CAHA (2000-2008)



Nests and False Crawls by Beach Type

In 2008, Resource Management (RM) staff recorded the type of beach each nest and false crawl was located on at the time the activity occurred. This has become of particular interest as people have attempted to correlate recreation activities with the propensity for turtles to have successful nesting attempts. Nine separate beach types were identified and used to categorize the nests and false crawls. The descriptions of these beach types are listed below:

- ORV: ORV open access site
- Village: Village beaches (Rodanthe, Waves, Salvo, Avon, Buxton, Frisco, and Hatteras)
- Ped High: High use pedestrian only access beaches outside of villages (Lifeguarded beaches, beaches in front of campgrounds, and beaches within 0.3 miles of an access parking lot)
- Ped Low: Low use pedestrian only access beaches (any part of the beach that is not open to ORVs, not in a village, does not receive high visitation, and is not closed for resource management activity)
- Limited: Beaches that are open, but access is limited due to one or more resource management closures
- Ped Cor: Beaches that are designated as a pedestrian corridor
- RC-Ped Cor: Nest or false crawl extends into a resource closure that is located duneward of a pedestrian corridor
- RC-Ped: Pedestrian only access beaches outside of villages that are closed for resource management activity
- RC-ORV: ORV access beaches that are closed due to resource activity

It is important to recognize that these beach types changed on a daily basis during nesting and hatching season. Therefore, there is not a ‘total miles of beach’ per beach type. Due to this limitation, it is difficult to make a definitive assessment on how the level of recreation influences sea turtle nesting activity.

Table 3. Nests and false crawls by beach type on CAHA in 2008

Beach Type	# of Nests by Management District			# of False Crawls by Management District		
	Bodie	Hatteras	Ocracoke	Bodie	Hatteras	Ocracoke
ORV	5	21	7	3	19	10
Village	3	12	0	3	12	0
Ped High	0	6	6	0	5	11
Ped Low	0	8	10	0	2	13
Limited	0	3	0	1	0	1
Ped Cor	0	1	0	0	1	0
RC-Ped Cor	0	2	0	0	1	0
RC-Ped	0	3	0	0	2	2
RC-ORV	5	19	1	3	14	0

Hatching

Follow-up of nesting activity involved observing nest sites and the dig for signs of hatching, recording relevant data, and excavating the site. Nests were excavated no earlier than 72 hours post-hatching, unless it was felt that an early excavation was needed in order to uncover live hatchlings that were entombed due to environmental conditions or in the approach of an impending storm. The last nest was excavated on December 15th, 2008 on day 113 of the nest’s incubation.

Of the 112 known nests, 76 (68%) nests had an emergence success of greater than or equal to 1%. Of the 112 nests, 84 (75%) had a hatching success of greater than or equal to 1%. The average clutch size was 109 (average calculated from the 106 nests with known clutch size). Four excavations could not be conducted due to storm activity which resulted in the nests being washed out. Two nests were not excavated as recurrent overwash made locating the nests impossible. Nests took an average of 59.7 days to incubate (average calculated from the 65 nests with known lay and emergence dates). Some emergences may have gone undetected because of low emergence rates or as a result of rain, wind, or tide.

A total of 11573 eggs were excavated post hatching and 5965 (51.5%) of these eggs produced hatchlings that emerged from the nests on their own (Table 3). An additional 1133 live hatchlings were discovered during nest excavations and were released. The overall hatching success was therefore 61.3% (hatching success calculated by adding emerged hatchlings to # of hatchlings found during excavations, and then divided by total number of eggs laid). For detailed information regarding specific numbers, dates and locations refer to Appendix B for nests and Appendix C for false crawls.

Table 5. Sea Turtle Hatch Summary 2001-2008

Year	Nests	Avg. Clutch	Average Incubation (days)	Total Eggs	# Emerged	EMR%
2001	75	111.7	64.5	6257	3402	54%
2002	99	108.7	58.6	10108	7201	71%
2003	87	115.7	69.1	4627	2708	58%
2004	43	103.4	58.5	2999	1609	53%
2005	73	114.6	58	6072	4142	68%
2006	76	114.8	62.9	7059	4444	63%
2007	82	112.1	60.7	9078	6075	58%
2008	112	109.0	59.7	11573	5965	52%

Nest Relocation

Of the 112 nests, 93 (83%) were protected at the original nest site and 19 (17%) were relocated (Table 4). Nests were relocated in all districts. A total of 2159 eggs were relocated and 1070 hatchlings emerged for an emergence rate of 49.6% for relocated nests. The emergence rate for non-relocated nests was 52%. In addition, there were a total of 4 nests that were relocated in the approach of an impending storm at the direction of the NCWRC. 3 of these nests are not included in the relocation totals as the majority of their incubation occurred at their original location. The 4th was relocated when it was originally located, and then moved again when a storm created an escarpment directly in front of the nest, resulting in the washout of 26 eggs.

The highest number of relocations took place in the Hatteras District where 14 (19%) of 75 nests in the district were relocated. Only one (4%) of the 24 nests on Ocracoke was relocated and four (31%) of the 13 nests were relocated in the Bodie District (Figure 4). Of the 19 relocated nests, 18 (95%) were moved because of natural factors such as being laid at or below the high tide line

or due to erosion. One (5%) nest was moved due to the fact that ghost crabs had predated 17 eggs within a nest prior to turtle patrol identifying the nest in the morning. Yolk had dripped into the rest of the nest, increasing the probability that the nest would continue to experience a high rate of predation either from ghost crabs or mammalian predators. The eggs were rinsed and relocated directly duneward of the original nest site.

Table 6. Relocated Nests by Management District in 2008

Nest Type	Bodie	Hatteras	Ocracoke	Total
In Situ Nests	9	61	23	93
Relocated Nests	4	14	1	19
Total	13	75	24	112

Strandings

During much of the year, both breeding and non-breeding sea turtles can be found in nearby waters, especially inshore sounds. A stranded turtle is a non-nesting turtle that comes to shore either dead, sick or injured. Much can be learned about sea turtle biology and life history through the documentation of such stranding events. This information also assists regulatory agencies in implementing and modifying conservation measures for protection of the species.

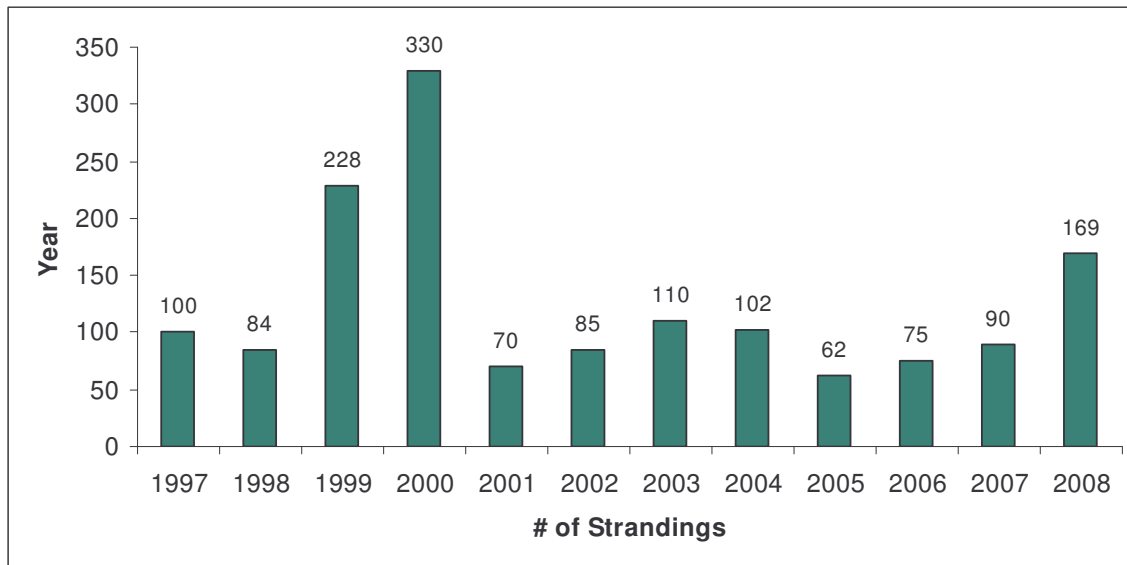
In 2008, 169 stranded sea turtles were documented (Table 7, Figure 4) of which 39 were on ocean beaches and 130 were on the soundside shoreline. Strandings on the oceanside were easily found and responded to, whereas most of the soundside shoreline was only monitored for strandings in accessible areas (i.e., ORV areas, pedestrian beaches, and soundside ramps). Therefore it is likely that there are a high number of soundside strandings that are not reported. Park-wide, 39 (23.1%) were identified as loggerhead, 34 (20.1%) were Kemp’s ridley, 94 (55.6%) were green, 2 (1.2%) were leatherbacks, and none were hawksbills or could be unidentified.

Table 7. Sea Turtle Strandings at CAHA from 1997-2008.

Year	Totals	Species Composition						Location	
		Logger-head	Kemp's Ridley	Green	Leather-back	Hawksbill	Unk.	Ocean	Sound*
1997	100	65	17	11	3	0	4	unk.	unk.
1998	84	45	26	10	2	0	1	unk.	unk.
1999	228	150	56	22	0	0	0	140	88
2000	330	252	31	43	2	0	1	240	90
2001	70	41	11	11	4	1	2	46	23
2002	85	54	6	23	0	0	2	54	31
2003	110	87	8	11	2	1	1	88	21
2004	102	38	11	42	5	0	6	47	55
2005	62	33	3	20	1	1	4	41	22
2006	75	45	11	16	2	0	1	65	10
2007	90	32	5	50	1	0	2	46	44
2008	169	39	34	94	2	0	0	39	130

* Includes any stranding found on spits, islands, and soundside shoreline

Figure 4. Sea Turtle Stranding Totals at CAHA (1997-2008)

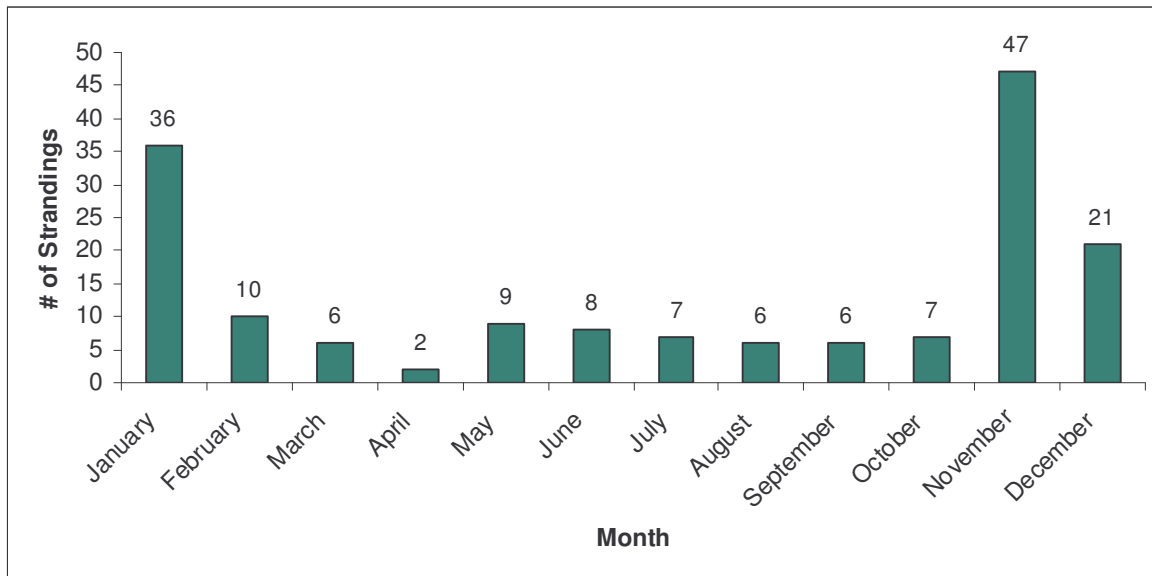


The total number of turtles found dead was 149 (88.2%). Of the 20 live strandings, all were transferred to the North Carolina Aquarium on Roanoke Island for rehabilitation. Most of these strandings were a result of ‘cold stunning’ where water temperatures become too cold for sea turtles to function normally. Often, these turtles had pre-existing conditions that made them more susceptible to a cold stun event. Examples of pre-existing conditions include old boat strike wounds, plastic (e.g. wrappers, toys) in the GI tract, etc. Necropsies were performed on 81

of the 149 dead strandings (54%). Additionally, some strandings have been frozen and saved for later necropsy training sessions. Cause of death in most cases was unknown; however 5 strandings had obvious signs of human interaction (prop wounds, hooks, or plastic). Additionally, a large amount of Kemp’s Ridley and green turtles had signs of fisheries interactions from entanglement or drowning. The largest number of strandings occurred in the month of November, when 47 turtles (28%) were documented (Figure 5). This is relatively unusual, as most often strandings occur in the fall (September/October) as well as spring (May). The NCWRC and NMFS are currently looking into the large number of strandings that occurred from early November into the winter of 2008 and again in the fall/winter of 2008/2009.

Injuries and abnormalities for each stranded turtle were recorded on a stranding report. Samples, including eyes, flippers, tags, and muscle samples were collected from stranded turtles according to NCWRC guidelines. All turtles in 2008 were responded to by NPS staff or volunteers. Turtles that stranded soundside in the villages are included in the stranding totals.

Figure 5. Monthly Total of Sea Turtle Strandings at CAHA in 2008.



DISCUSSION

Storm Activity

Loss of nests to storm activity continues to negatively impact hatch success. While CAHA was spared from the full force of a hurricane this season, the beaches felt the effects of a tropical storm and several nor’easters. Dates with very large high tides included September 1-6 (TS Hannah), September 17-27 (September nor’easter), and October 14-24 (October nor’easter). There were a total of six nests that were washed out entirely or could not be found post-storms (NBH08, NBH12, NH47, NH70, NH72, and N007). All of these nests were assumed to have 0

emergence and hatching success due to storm activity. Eleven additional nests saw a severe decrease in nest success (little or no emergence and/or hatching) due to TS Hannah, and five from the September nor'easter. There were several other nests that also experienced reduced nest success due to storm overwash, but the decrease could not be correlated with one particular storm event. Many nests were excavated early (prior to the impending storm) with consultation with NCWRC in order to save pre-emergent hatchlings from overwash that would have resulted in drowning. Post-storm, all remaining nests were checked for compaction, which can cause live hatchlings to become entombed in the egg chamber.

Predation

Sea turtle nests and hatchlings were predated at multiple nest sites in 2008 by both ghost crabs and mammalian predators. There was no red fox predation this year as occurred in 2007. Cat tracks were found in and around turtle closures throughout the season, particularly in the villages. Many of these incidents occurred on nights when hatchlings were known to emerge. It is unknown exactly how many hatchlings during the season were predated by domestic/feral cats, but at NH69 in Frisco, it is estimated that more than 30 hatchlings were predated by cats in one night. Trapping efforts by the USDA that began in 2002 have reduced the threat of predation on Bodie and Hatteras Islands. In 2008 the USDA continued to trap on CAHA, thereby reducing the threat of mammalian predation on all three islands. In 2008, CAHA RM staff also trapped predators such as fox, mink, feral cats, and raccoons within the park boundary from January to July. The majority of the trapping efforts at CAHA are focused on areas where predation of protected species has been known to occur.

Loss of eggs and hatchlings to ghost crabs continues to be documented. At least 25 nests had recorded predation loss due to ghost crabs (eggs, hatchlings, or both). There were several incidents where ghost crab tracks were found within the silt fencing on nights when hatchlings were known to emerge. It is unknown how many total hatchlings were predated by ghost crabs in 2008. During excavations, a total of 156 eggs (1.3%) were found to have been predated. Ghost crab predation was found on all Districts. In some cases, ghost crabs were found within the nest cavities predated on hatchlings during excavation.

Other Egg Mortality

Upon excavation, six nests were found to have unhatched eggs with the egg contents exhibiting a bright pink color and/or aqua blue color (yolk sac, amniotic fluid, etc.). A total of 330 eggs (2.9%) were affected. The locations of these nests were widely spread through all three districts. It was hypothesized that the unusual color was or came from a bacteria or fungus. It is unclear if the pink substance was the cause of the eggs not hatching or if the substance only showed up in eggs that were unhatched.

Another nest on Ocracoke (NO05) experienced 0 hatchling and emergence success. During excavation, it was found that all eggs had stopped developing very early in development. While this is common in nests that have experienced severe overwash, this nest had not been inundated throughout incubation. It is suspected that the loss of this nest was due to disease.

Human Disturbance

It is unknown to what extent human activities disrupt nesting activities. Although CAHA remains open to pedestrians 24 hours a day, Park staff is not available around the clock to safeguard and monitor the natural resources.

Many Park visitors, especially in front of the villages, leave their recreational beach equipment and chairs or loungers on the beach overnight. This equipment and furniture can cause turtles to forgo laying eggs by hampering or trapping animals attempting to locate a nesting site (NMFS, USFWS 1991). This is the eighth season that RM staff has tied notices to personal property found on the beach after dawn, advising owners of the threats to nesting sea turtles as well as safety issues and NPS regulations regarding abandoned property. The date and time items are tagged is clearly written on each tag. Items left on the beach 24 hours after tagging are removed by NPS staff. Not all tagged items are removed within 24 hours as staff patrolling on ATVs cannot safely remove the property from the beach. At other times, not all abandoned property can be removed because of the abundance encountered and staff availability.

Artificial light is known to disturb nesting females and can disorient hatchlings. Outdoor lights, un-shaded indoor lights, beach fires and vehicle headlights outshine the natural glow of the moonlight on the ocean waves misguiding hatchlings away from the sea as well as possibly deterring nesting females. Filter fencing is a high maintenance and costly response to lighting issues. Fencing is often washed out by incoming tides, buried by winds and/or completely uprooted by storm activity. Nest sites in their hatching window are checked and maintained daily; however, this does not help hatchlings at nest sites where the filter fence has been knocked down during the night. Hatchlings may become entangled in the fencing if it is not properly maintained. No problems with hatchlings becoming entangled in the filter fencing were documented in 2008. CAHA will continue to use the filter fencing until a better option is identified. Since 2005, the majority of or all turtle nests within their hatching window receive filter fence treatment. This treatment was continued in 2008. Filter fencing was removed from all nests prior to a pending storm for the safety of nests and emerging hatchlings.

Beaches fronting villages are closed to ORV use in the summer months to provide for the safety of an increased pedestrian population. While many of these beaches are wide enough to support sea turtle nesting, problems that come with the high amount of human activity and density of development (i.e. lighting within the villages) make these beaches less than optimal nesting sites. With an increase in visitor use, the potential of human disturbance of nesting turtles increases. There are concerns that turtles may be deterred from nesting on beaches of their first choice and forced to lay eggs at a less optimal site.

Potential Incidental Take / Human Disturbance

All species of sea turtles nesting on CAHA are protected under the Endangered Act of 1973. Under the ESA, “take” is any human induced threat to a species that is listed. Take is defined as “to harass, harm, pursue, hunt, shoot, wound, kill, capture or collect, or to attempt to engage in any such conduct.” On CAHA, this can include the death, harassment, or disorientation of

nesting females and/or hatchlings due to human influence. It is difficult to document all of these potential take incidents, but those reported from the 2008 season are listed below.

NBH02: Nest run over prior to turtle patrol arriving in the morning. No eggs were observed broken, but the incident may have resulted in reduced nest success due to compaction.

NBH06: Pedestrian tracks and foot drags from the north edge of the closure extending to center at the location of turtle nest. The way sand is disturbed suggests someone or a domestic pet may have dug into the nest cavity and then attempted to cover the hole and wipe out the tracks.

NH04: Nesting turtle harassed by visitors during nesting attempt. Nest was laid below high tide line. Nest was located in the morning and relocated.

NH04: Hatchlings emerging from nest crawled ~300 meters into a campfire to the south. Hatchlings were recovered and released by visitors with the campfire. It is unknown how many hatchlings became disoriented and how many were recovered prior to entering the fire. Additionally, disorientation incidents like this one often result in high levels of predation by ghost crabs.

NH15: Fifteen hatchlings crawled beyond their filter fencing and then headed duneward of the expanded closure. Five exited the closure through the back and ended up in the tire tracks directly in front of Ramp 44. These five were presumed dead but could not be located. The other ten hatchlings did head back to the water.

NH24: Bare footprints were found inside the expanded turtle closure and inside the filter fencing. Area was jumped up and down on by at least one person. The incident resulted in the death of at least five pre-emergent hatchlings, and may have caused 12 late stage eggs to not survive to hatching.

NH23: Forty hatchlings severely disoriented at nest to the east of Ramp 49. Hatchlings crawled ~200 feet east of the nest and made it outside the eastern boundary of the closure. Most did make it to the water, but it is unknown how many did not due to ruts or predation.

NH27: Four hatchlings found stuck in footprints in intertidal zone of closure. Hatchlings released during night of same day.

NH50: In the approach of TS Hannah, filter fencing was removed from several nests for their protection. This nest hatched during this time. Approximately 60 hatchlings were disoriented by village lights and crawled over the primary dune line into a motel parking lot. At least one hatchling was hit by a vehicle on Hwy 12. Others were predated by ghost crabs. Over 50 hatchlings were collected and immediately released.

NH59: Visitors reported finding hatchlings behind a full beach closure south of Frisco village in the dunes. Hatchlings were taken to the water and released. It is unknown how many became disoriented and what percentage were found and redirected

NH71/NH73 (both nests within the same unexpanded turtle closure): Visitor in Hatteras Village walked into unexpanded turtle closure and put rotting bait fish onto a nest site, possibly with the intention of increasing predation. Twelve eggs were predated by ghost crabs. The predated eggs were removed and the nest cavity recovered. The bait was removed from the area.

Several nests on South Beach: After TS Hannah, when the beaches were legally closed, many vehicles did drive on the South Beach area, where the majority of turtle closure signs had been washed away. Prior to RM staff having the opportunity to check the protection of these nests, at least one of these was run over by vehicles. As many of these nests had reduced nest success due to the storm, it is unknown whether this incident had any effect and of what magnitude.

Closure Violations

In 2008, there were numerous violations to turtle closure, some more serious than others. Although closure signs were highly visible and could be easily read, law enforcement staff documented violations at turtle closures throughout the nesting and hatching seasons. Entry into a turtle nesting area would require people to pass under, drive through flagged string tied between signed posts, or pass below signs by the tide line. Signs were posted as low on the beach as possible. Because of extremely high sign loss near the shoreline at all expanded turtle nests, the two standard closure signs closest to the water were replaced with carsonite, which seemed to hold better in the moist sand. As carsonite is extremely costly, staff started roping them together so that if the tide washed them out, staff would have a better chance of recovering them.

The most common type of violation occurred with pedestrians in the intertidal zone of expanded turtle closures. At 50-55 days of incubation, when turtle closures are expanded, the new closure extends to the mean low tide line. Each nest was clearly marked on each side at the tide line that visitors should not walk in front of the nest. Access is nearly always available behind the nest at the dune line or behind the primary dune. However, due to the difficulty in keeping signs in below the high tide line, many visitors walked in the intertidal zone in front of nests. It is unknown how many hatchlings were affected by the huge number of visitors in the intertidal zones. This problem was reported most often on Village beaches, high pedestrian beaches (such as Lighthouse Beach), and popular ORV beaches (such as near Ramp 49). As footprints are often washed out prior to the area being checked, this type of violation is highly under-documented.

It was found that some visitors also walked up into expanded turtle closures near the filter fencing and nest. In some occasions, visitors ducked under string and flagging in order to enter/exit turtle closures. While only one incident resulted in a known loss of hatchlings (see below), it is unknown if other hatchlings were affected by the presence of visitors within closures. This type of violation was most reported in front of Frisco campground, where a high number of visitors walked over the dune line from the campground and entered the closures from the dune side to get to the beach, despite the fact that the area was well signed.

Domestic pets constitute another form of violation. In 2008 there were at least 15 reports of dogs and/or dog tracks within turtle closures. Often these were accompanied by multiple sets of

footprints. There was one incident where a dog may have dug into a turtle nest that was within an un-expanded closure, but the circumstances of that occurrence are unclear (see below). There was another incident where visitors on Frisco beach found a turtle crawl prior to turtle patrol arriving in the morning. Despite the fact that they knew a nest was there, they allowed their dogs off leash and did not react when their dogs began digging in the area of the nest. Because the nest was not already within a closure, this is not considered a closure violation. The dogs did not hit the egg chamber. Dogs were primarily found to be a problem in the Rodanthe/Salvo/Waves area as well as in Frisco Villages.

Domestic and/or feral cats continue to be a problem in 2008. Cat tracks were found within at least 20 turtle closures over the season, most commonly in the villages. Cat predation was difficult to document, but it is known that cats posed a serious threat to emerging hatchlings, particularly in Frisco.

ORV violations of turtle closures were relatively rare. There were several accounts of vehicles driving below (ocean-side) of expanded turtle closures in the morning before any washed out signs in the intertidal zone could be replaced. It is unknown how many hatchlings were affected by these actions, either by being run over or by being stuck in tire tracks. There were no observed losses to this type of violation.

There were several violations that were considered to be serious or intentional violations. These violations often resulted in broken signs and/or string, but may or may not have caused any incidental take of sea turtles. These violations are listed below.

NBH02: An ORV drove into the dune side of an expanded turtle closure and broke a sign and string. Vehicle did not approach the nest.

NBH03: An ORV entered a full beach closure at the dune line. The ORV went up into the dunes, and then slid down into the closure breaking a sign and string. The vehicle then got stuck and someone used the sign to dig the ORV out.

NBH06: Pedestrian tracks and foot drags from the North edge of the closure extending to center at the location of turtle nest. The way sand is disturbed suggests someone or a domestic pet may have dug into the nest cavity and then attempted to cover the hole and wipe out the tracks.

NH29: Back right post of nest (not expanded) was found kicked and broken about a foot above sand level. Footprints did not go over the nest.

NH24: Bare footprints were found inside the expanded turtle closure and inside the filter fencing. Area was jumped up and down on by at least one person. The incident resulted in the death of at least five pre-emergent hatchlings, and may have caused 12 late stage eggs to not survive to hatching.

NH61/NH68 (Both nests within the same closure): ORV drove into the east side of two expanded turtle closures in intertidal zone. Vehicle exited through the west side of the closure at the dune line, breaking string. The vehicle then made a U-turn outside of the closure, returning

through the closure the same way but in the opposite direction. The vehicle did not approach the nest.

NH68: ORV tracks through string into closure and exited through string on the other side of closure.

NH71/NH73 (both nests within the same unexpanded turtle closure): Visitor in Hatteras Village walked into unexpanded turtle closure and put rotting bait fish onto a nest site, possibly with the intention of increasing predation. Twelve eggs were predated by ghost crabs. The predated eggs were removed and the nest cavity recovered. The bait was removed from the area.

US FISH AND WILDLIFE BIOLOGICAL OPINION (BO)

In accordance with the BO received from USFWS August 14th, 2006, RM staff performed daily nest surveys on the ocean beach from May 1st to September 15th. Daily nest checks were performed until the last nest was removed from the beach. This annual report fulfills the reporting requirements of the BO.

Performance measures targets for sea turtles consist of having a total of 10% of the statewide average number of nests for the previous five years and having a sea turtle false crawl to nest ratio of less than or equal to 1:1 annually. Re-initiation of consultation with USFWS is required if the total number of nests is fewer than 10% of the State's total annual nesting number and/or if the false crawl to nest ratio is greater than 1.3:1 annually. The first measure was met with 112 nests, making up 17.2% of the state's average of 652.4 nests over the last five years. The second measure was met with a .92:1 false crawl to nest ratio.

LITERATURE CITED

National Marine Fisheries Service and Fish and Wildlife Services. 1991 Recovery Plan for U.S. Population of Loggerhead Turtle. National Marine Fisheries Service, Washington D.C.