

**CAPE HATTERAS NATIONAL SEASHORE
SEA TURTLE MONITORING
2013 ANNUAL REPORT**



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ABSTRACT

In 2013, 254 sea turtle nests (229 loggerhead nests, 24 green nests, and one Kemp's Ridley nest) and 231 false crawls were documented at Cape Hatteras National Seashore (CAHA). The first nesting activity was documented on May 19, 2013 and the last nesting activity was documented on September 11, 2013. Mean hatch success for all nests was 65% while mean emergence success was 56%. A total of 189 stranded sea turtles were documented within CAHA in 2013.

INTRODUCTION

Five species of sea turtles can be found in 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 (ESA) as endangered and the loggerhead as threatened. The green population that nests in the Northwest Atlantic was listed on July 28, 1978, and is designated as threatened.

Non-breeding sea turtles of all five species can be found in the near-shore waters during much of the year (Epperly 1995). CAHA lies near the extreme northern limit of nesting for four of the five sea turtle species, including the loggerhead, green, Kemp's ridley and leatherback. Hawksbill sea turtles are not known to nest at CAHA, but are known to occur here through strandings. The occasional Kemp's ridley nest has been documented in North Carolina over the past five years and in 2011 CAHA documented its first Kemp's ridley nest.

CAHA has been monitoring sea turtle activity since 1987 and standard operating procedures have been developed during this time. This report summarizes the monitoring results for 2013, comparisons to results from previous years, and the resource management activities undertaken for turtles in 2013. CAHA follows management guidelines defined by the North Carolina Wildlife Resources Commission (NCWRC) in the *Handbook for Sea Turtle Volunteers in North Carolina*, species recovery plans, and the Cape Hatteras National Seashore Off-Road Vehicle Management Plan and Special Regulation (ORVMP).

ORV Management Plan

On February 15, 2012 the ORVMP was enacted at CAHA. It was developed from 2007-2012 and included a special regulation detailing requirements for off- road vehicle (ORV) use at CAHA. A copy of the ORVMP and other related documents are available electronically at <http://parkplanning.nps.gov/caha>. It includes establishment of an ORV permit system to drive on CAHA beaches. It also establishes survey times and frequency and buffer requirements for sea turtle nests and hatchlings. This was the second year the ORVMP guided the management of protected species, including sea turtles, at CAHA.

The Record of Decision indicates that CAHA will "conduct a systematic review of data, annual reports, and other information every 5 years, after a major hurricane, or if necessitated by a significant change in protected species status (e.g. listing or de-listing), in order to evaluate the effectiveness of management actions in making progress toward the accomplishment of stated objectives". As part of the Reporting Requirements of the Biological Opinion (BO) for the Off-

road Vehicle Management Plan (November 15, 2010), "an annual report detailing the monitoring and survey data collected during the preceding breeding season (as described in alternative F, in addition to the additional information required in the ...Terms and Conditions) and summarizing all piping plover, seabeach amaranth, and sea turtle data must be provided to the US Fish and Wildlife Service (USFWS), Ecological Services Office by January 31 of each year for review and comment".

In the November 15, 2010 BO, the USFWS determined that the level of anticipated take is not likely to result in jeopardy to the loggerhead, green, or leatherback sea turtle species. Through the actions taken by the resource management staff, CAHA has complied with the reasonable and prudent measures that are necessary and appropriate to minimize the take of sea turtles at CAHA. Protection was provided to sea turtles that came ashore to nest, incubating nests were monitored and protected, and emerging hatchlings were provided protection from ORVs. Proposed activities and access to nesting sea turtles, incubating turtle nests, and hatching events were timed and conducted to minimize impacts on sea turtles and sea turtle productivity. Resource management staff also responded to stranded sea turtles and coordinated the transport and delivery of live strandings to appropriate care facilities. The non-discretionary terms and conditions for sea turtles were also met by providing the USFWS with this annual report. This annual report summarizing monitoring efforts and data collected during the 2013 breeding season aids in fulfilling the reporting requirements of the November 15, 2010, BO.

Cooperating Agencies

CAHA cooperates with the National Marine Fisheries Service (NMFS), USFWS, and NCWRC on sea turtle protection. All nesting activity and stranding reports are reported to the North Carolina Sea Turtle Program Coordinator at NCWRC through the seaturtle.org website. 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.

METHODS

Nesting Activity

Monitoring for sea turtle nesting activity began on May 1, 2013. Patrols utilizing UTVs (or 4X4s during inclement weather) were conducted in the morning, beginning approximately at dawn. Each nesting activity was recorded as either a false crawl or nest. All nests were confirmed by locating eggs at the nest site. One egg was taken from each clutch for research purposes. The decision to relocate the nest or for the nest to remain in situ was made at the time of nest discovery. If no eggs were laid, the nesting activity was considered a false crawl and recorded by collecting a GPS point at the apex of the crawl. All sea turtle "activities" were reported to NCWRC using the Sea Turtle Nest Monitoring System (STNMS) through the seaturtle.org website.

All nests were protected from human disturbance by installing a 10 x 10 meter signed area around the nest site. At day 50 – 55 of incubation, a closure beginning approximately 10 meters behind the nest and extending to the water line was installed, varying in width from 25 to 105 meters. This closure protected the nest site and hatchlings from human disturbance during hatching events. Each nest site was checked daily in order to document any disturbances or

hatching events. Nests were not observed from Oct 1 to Oct 16, 2013 due to the government wide shutdown.

Approximately three to five days after an initial hatching event, nests were excavated and closures were removed. Resource management staff collected required data to determine hatch and emergence success for each nest excavation. Live hatchlings discovered upon excavation of the nest were collected and released at or after dusk the same day. Monitoring efforts to locate new nests ended Sept 25, 2013.

Stranding Activity

A stranded turtle is a non-nesting turtle that comes to shore either sick, injured, or dead. Data were collected for each reported or observed stranding. Whenever possible, further data was collected by performing a necropsy on dead strandings. Live stranded turtles were transported to a facility for treatment and recovery. All data were reported to NCWRC using the Sea Turtle Rehabilitation and Necropsy Database (STRAND) through the Seaturtle.org website.

An increased effort to locate stranded turtles began in early November and continued throughout the winter due to the increased chance of “cold stunned” turtles. Searches for cold stunned turtles emphasized CAHA’s sound side shorelines where the majority of cold stunned turtles have been found in the past. Cold stunning refers to the hypothermic reaction that occurs when sea turtles are exposed to prolonged cold water temperatures. Initial symptoms include a decreased heart rate, decreased circulation, and lethargy followed by shock, pneumonia and possibly death (from http://www.nero.noaa.gov/prot_res/stranding/cold.html).

RESULTS

Nesting

A total of 254 nests (229 loggerhead nests, 24 green nests, and one Kemp’s Ridley) were observed at CAHA in 2013. Of the confirmed nests, nine (3.5%) were found on Bodie Island, 187 (73.6%) on Hatteras Island, and 58 (22.8%) on Ocracoke Island (Appendix B, Maps 1 – 4). This was the most nests recorded at CAHA in a single nesting season (Figure 1) since this data has been collected. The first recorded nest for the 2013 season occurred on May 19 and the last nest was recorded on September 11. While nesting occurred throughout this period, peak nesting occurred from July 15 – 21 (Figure 2).

Figure 1. CAHA Sea Turtle Nest Numbers 2008–2013.

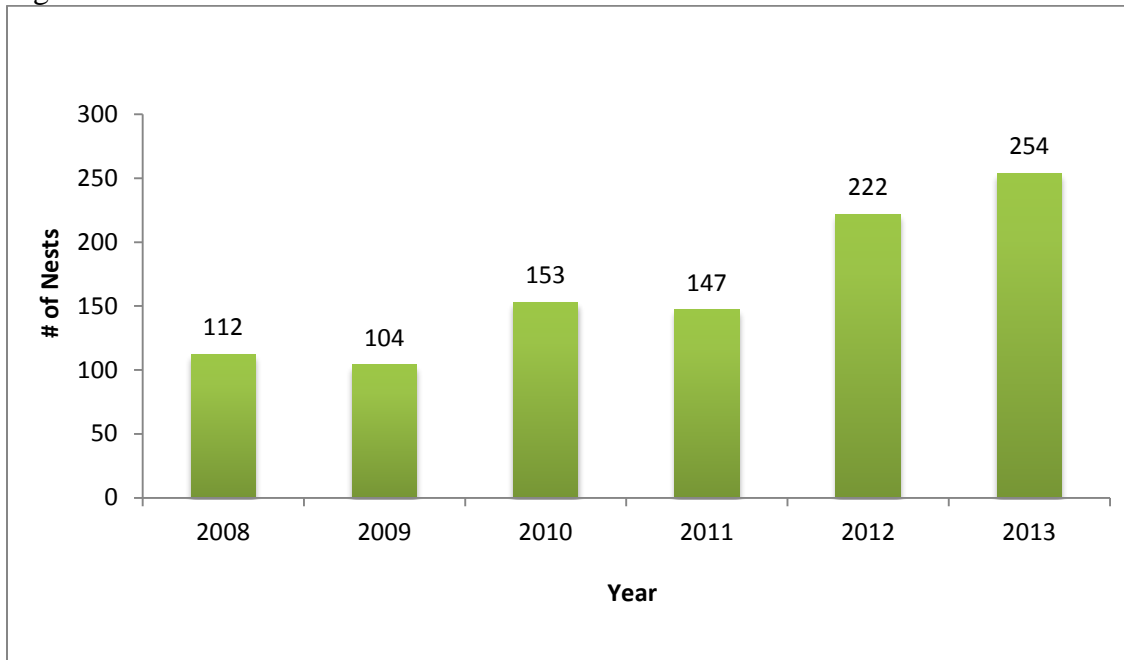
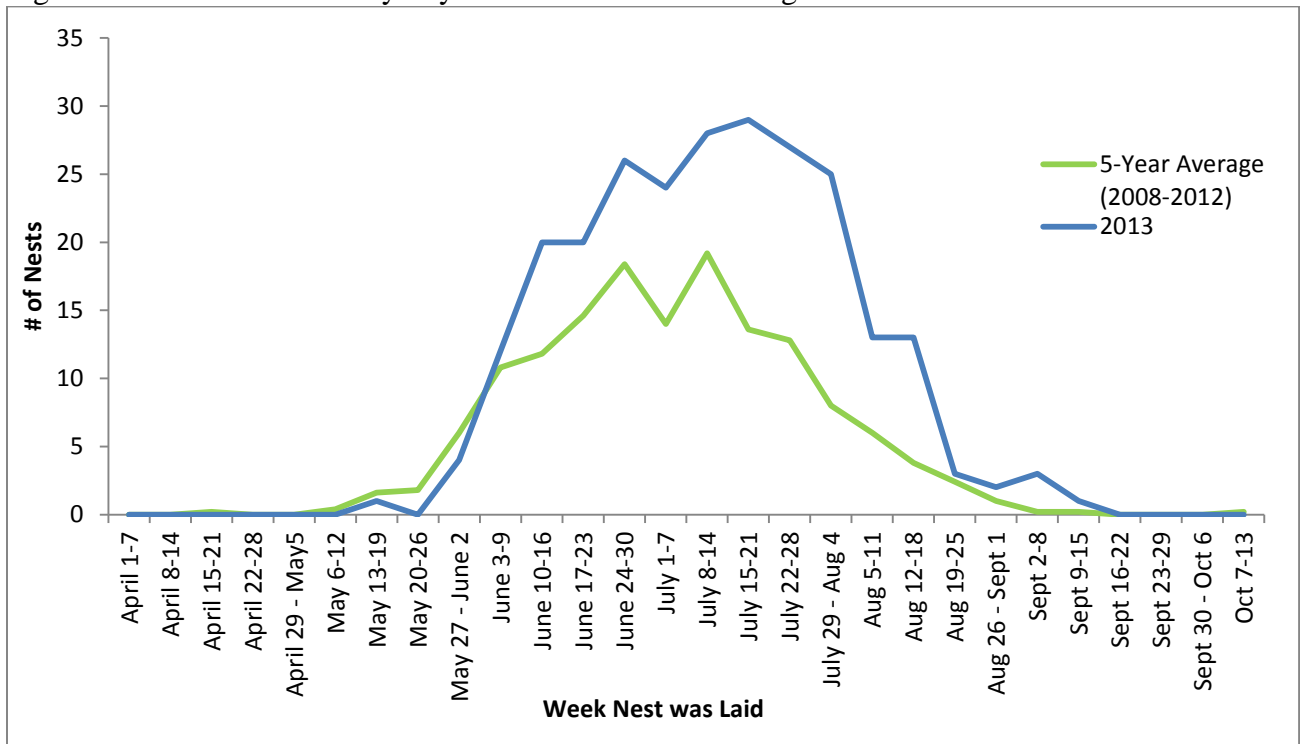


Figure 2. Number of Nests by Lay Date for 2013 and Average of Previous Five Years.



Nest Relocation

Of the 254 nests, 66 (26.0%) were relocated. Most nests were moved due to natural factors including location of nest at or below high tide line or the nest was laid in an area susceptible to erosion, etc. One nest was relocated from CAHA property to Pea Island NWR due to a beach

nourishment project (see “NC Department of Transportation Patrol [NCDOT]” in Discussion). Relocation methods recommended by NCWRC, found in the *Handbook for Sea Turtle Volunteers in North Carolina* (2006), were followed.

False Crawls

During the 2013 breeding season, 231 false crawls or aborted nesting attempts were recorded. False crawls accounted for 47.6% of the 485 total turtle activities. Of the 231 false crawls, seven (3.0%) was documented on Bodie Island, 170 (73.6%) on Hatteras Island, and 54 (23.4%) on Ocracoke Island (Appendix B, Maps 5 – 8). There were 19 documented green turtle false crawls while loggerheads accounted for the remaining 212 false crawls.

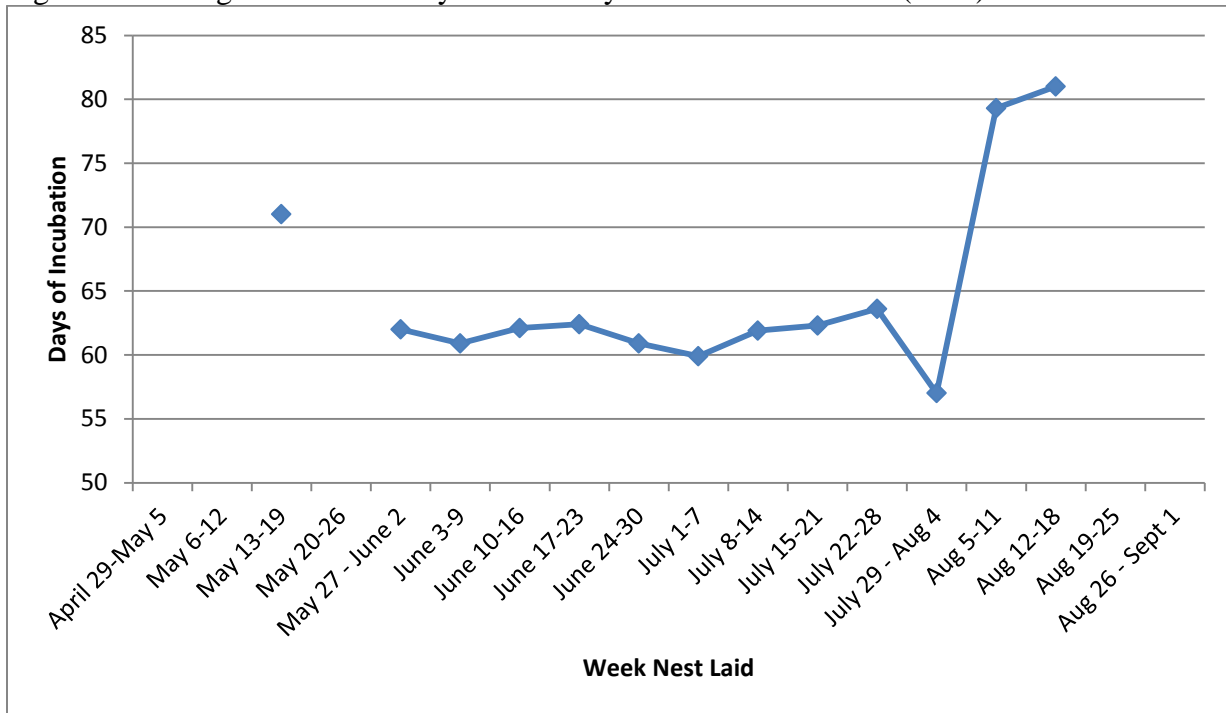
Hatching

In 2013, the mean clutch count was 116.9 eggs per nest (Table 1 and Appendix A). The mean clutch count was determined using total egg counts at the time of relocation from relocated nests only. Average incubation period of nests with known lay and emergence dates was 62.3 days (Table 1 and Appendix A). Incubation periods depend mostly upon sand temperature (Bustard and Greenham 1968) and ranged from 50 days to 89 days (Figure 3). Some emergences went undetected due to rain, wind, and tide. Other emergences went undetected due to a government wide shutdown from October 1 – 16, 2013. No monitoring of nests was completed during this time.

Table 1. Sea Turtle Hatch Summary 2008-2013.

Year	Nests	Mean Clutch	Mean Incubation (days)	Emergence Success
2008	112	109.0	59.7	52%
2009	104	114.9	65	31%
2010	152	110.9	57	48%
2011	147	115.8	58.5	48%
2012	222	105.3	60.1	73%
2013	254	116.9	62.3	56%

Figure 3. Average Incubation Days of Nests by Week Nest was Laid (2013).



Mean emergence success was calculated by taking the unweighted mean of all the individual nest emergence successes. Emergence success is the total number of hatchlings that emerged unaided from the nest cavity, relative to the total number of eggs in the nest. Any hatchlings found during excavations were not considered to have emerged. Mean emergence success for 2013 was 56% (Appendix A). Mean hatch success was calculated by taking the unweighted mean of all the individual nest hatch successes. Hatching success is the percentage of eggs in a nest that produce hatchlings. Any hatchlings found during excavations, live or dead, were considered hatched. Mean hatch success for 2013 was 65% (Appendix A).

Strandings

In 2013, 189 stranded sea turtles were documented within CAHA (Table 2 and Appendix B, maps 9 - 12). Volunteers associated with The Network for Endangered Sea Turtles (N.E.S.T.) assisted Resource Staff by reporting and sometimes responding to observed strandings.

Table 2. Sea Turtle Strandings at CAHA by Species, 2008–2013.

Year ¹	Stranding Totals	Species Composition					
		Logger-head	Kemp's Ridley	Green	Leather-back	Hawksbill	Unk.
2008	169	39	34	94	2	0	0
2009	297	53	57	183	2	0	2
2010	444	100	108	235	0	0	1
2011	148	50	46	49	0	0	3
2012	126	34	32	50	2	0	8
2013	189	38	52	94	1	0	4

¹Total stranding numbers for 2008-2011 include some strandings that occurred outside of CAHA boundaries.

Of the 189 strandings, 44 (23.3%) were found alive and transferred to the North Carolina Aquarium on Roanoke Island or a similar facility for rehabilitation.

Efforts were made to necropsy dead strandings to determine possible cause of death, sex, any abnormalities, and to collect requested samples for ongoing research. Sex was determined in 67 strandings (44 female, 23 male). Samples collected during necropsies, including eyes, flippers, muscle, and tags, were provided to cooperating researchers. Probable cause of death, when possible, was determined by NCWRC (Table 3). During periods of cold water temperatures (7-10° C), sea turtles are most prone to stranding due to hypothermia (Spotilla 2004), which is often referred to as “cold stunning”.

Table 3. Probable Cause of Sea Turtle Strandings at CAHA by Month, 2013.

Month	No Apparent Injuries	Cold Stun	Other	Watercraft	Entanglement	Pollution / Debris	Disease	Shark	Unable to Assess	Total
January	22	30	0	0	0	0	0	0	0	52
February	13	4	1	0	0	0	0	0	0	18
March	3	0	0	0	0	0	0	0	0	3
April	2	0	0	0	0	0	0	0	0	2
May	6	0	0	3	1	0	0	0	0	10
June	2	0	1	0	0	0	1	0	0	4
July	0	0	0	3	0	1	0	0	1	5
August	2	0	0	0	0	0	0	1	0	3
September	3	0	0	0	0	0	0	0	0	3
October	1	0	0	0	0	0	0	0	0	1
November	26	23	5	2	2	0	0	0	0	58
December	13	11	3	0	0	1	0	0	2	30
Total	93	68	10	8	3	2	1	1	3	189

DISCUSSION

Turtle Sense: Developing a Sensor to Detect Hatching and Emergence at Sea Turtle Nests
 CAHA collaborated with Thomas Zimmerman (IBM), Samuel Wantman (Nerds Without Borders-NWB), and Eric Kaplan (Hatteras Island Ocean Center-HIOC), to develop a sensor that is placed in turtle nests to monitor movement and temperature fluctuations. The hope is to be able to correlate the measurements with hatching and emergence events. The above named individuals donated their technical knowledge and expertise and CAHA provided funding for the materials needed to build the sensors and install them in the field. The "Turtle Sense" project is still very much in its infancy and CAHA is fortunate to be chosen as the pilot study area.

In 2013, the initial year of the study, four prototype sensors were deployed. The sensors were placed on top of the uppermost eggs at the time of nest discovery and then connected to communication towers closer to expected hatch time. Data collected by the sensors was transmitted every two hours and a computer model analyzed the data. The project got off to a late start and sensors were placed in late season nests. Unfortunately, none of the turtle nests that were being monitored hatched. We hope to utilize the nest monitoring technology that has been

developed thus far during the 2014 turtle nesting season. This is an ongoing research and development project. As such it may take a few years and a number of trials before the sensors function properly and the data they produce can be relied upon.

DNA Study

Since 2010, CAHA, along with all other North Carolina, South Carolina, and Georgia beaches, has participated in a genetic mark-recapture study of Northern Recovery Unit nesting female loggerheads using DNA derived from eggs. The study is coordinated by the Georgia Department of Natural Resources, the University of Georgia, and NCWRC. One egg from each nest is taken and sampled for maternal DNA. This allows each nest from North Carolina, South Carolina, and Georgia to be “assigned” to a nesting female. This research ultimately will answer questions about the total number of nesting females in the population, the number of nests each female lays per season, distance between nests laid by individual females, and other information that is important to understanding the population dynamics of sea turtles. Currently, the results of this study are preliminary and remain the copyright of the project coordinators.

Predation

Ten hatchlings from one nest were observed to be predated by mink (Appendix A). No other mammalian predation was documented, however tracks from mammalian predators were observed at nest sites on mornings following hatching events.

A total of 81 eggs, from 18 nests were predated by ghost crabs prior to nest excavations. Ghost crab predation of nine hatchlings was also documented, but the full extent of hatchling predation by ghost crabs is unknown. Observations were made of ghost crabs in the act of predated hatchlings. These observations occurred within nest cavities during excavations as well as after hatching events inside of ghost crab holes in the vicinity of the nest site.

Late Nest Management

A late nest refers to one that is laid on or after August 1 and incubates for longer than 90 days. In 2013, ten nests fit these criteria. Mean hatch success for late nests was 10.41% and mean emergence success was 0.19% (one nest had three hatchlings emerge, date unknown). Following NCWRC recommendations, after 90 days of incubation, an excavation began of the nests. If a viable embryo was observed, the excavation stopped and the nest was left in place. If hatching activity was not observed after 100 days of incubation, the closure extending to the water was removed and the nest site itself remained protected by a smaller closure. The eggs were then checked approximately every 10 days for viability. Nests were fully excavated when no viable embryos were observed.

Nesting Activity on Private Property Adjacent to CAHA

Superintendent’s Order #25 was effective beginning in May 2013. This order established CAHA protocols which personnel implemented when sea turtle nesting activity was observed on private property. In these instances, property owners were contacted in order to request access to their property for data collection and to carry out possible protection measures. This season, two sea turtle nests and two false crawls were discovered to have been laid on private property within the villages on Hatteras Island. One of these nests and one false crawl was observed by NCDOT

staff (please see “NCDOT Patrol” below). Data was able to be collected for all activities and is included in this report.

NC Department of Transportation Patrol

The northern limit where NPS staff patrolled for sea turtle activity extended to 100m beyond the Rodanthe pier. Using GIS software, it was determined that this location marks the boundary where US Government property and private property meet. Most of the remaining stretch of beach was patrolled by NCDOT beginning at Sea Oats Dr. and extending to the S-curves where Rodanthe meets Pea Island National Wildlife Refuge (Pea Island NWR). NCDOT patrolled this area for the entire 2013 nesting season as mandated by protocols from the Beach Renourishment Project that could take place in this area in 2014. Two sea turtle activities (one nest, one false crawl) were documented by NCDOT. As per protocol, the nest was re-located to Pea Island NWR where monitoring was done by USFWS staff. Data from both activities were provided to CAHA and included in this report.

Incidental Take / Human Disturbance

All species of sea turtles nesting at CAHA are protected under the ESA 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.” Harm is further defined to include significant habitat modification or degradation that results in the death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. It is unknown to what extent human activities disrupted sea turtle nesting activities during the 2013 nesting season. People on the beach at night can disturb female turtles during the egg laying process. From the time a female exits the surf until she has begun covering her nest, she is highly vulnerable to disturbance, especially prior to and during the early stages of egg laying. Much of CAHA’s shoreline remains open to pedestrians and CAHA staff is unable to monitor the entire shoreline for nesting turtles 24 hours a day. CAHA minimized some of these effects by closing the shorelines to non-essential ORV use from 9:00 p.m. until 7:00 a.m. to provide for sea turtle protection.

Closure Violations

Closure violations are documented whenever possible by resource management staff. A total of 133 pedestrian violations of turtle closures were documented. Twelve off-road vehicle and 15 dog violations were also documented. No direct loss of eggs or hatchlings was documented due to a closure violation.

Artificial Lighting

This year, misorientation (directed movement of a hatchling towards an inappropriate object or goal) or disorientation (lack of directed movement towards a specific area or goal) was documented at two nests, resulting in the death of 43 hatchlings (Appendix A). Another 19 live hatchlings were observed to be affected by artificial lights. These hatchlings were collected and released into the water. Since the majority of nests are not observed during hatching events, the extent of hatchling loss due to artificial lighting is unknown. Artificial light is known to disturb nesting females and disorient hatchlings. Outdoor lights, beach fires, and headlights may deter nesting females from laying their nests along stretches of optimal beach. Hatchlings use natural light to navigate toward the water. When artificial lights are brighter than the natural light

reflecting off the surface of the ocean, hatchlings will become disoriented and crawl away from the shoreline and toward these brighter lights and the dunes. This causes hatchling mortality due to exhaustion and increased chance of predation.

CAHA continues to try and decrease the effects of artificial lighting on sea turtles. Since 2005, black silt fencing has been utilized around most turtle nests to decrease the amount of artificial light shone onto the beach, thereby decreasing the negative effects of light on hatchlings. In 2012, a Superintendent's Order was established that sets outdoor lighting guidelines within CAHA's boundaries. This season, CAHA staff worked with cooperating agencies on an educational public outreach campaign focusing on the effects of artificial lighting on sea turtles. Brochures and light switch stickers were printed and dispersed to the public as well as placed in many rental homes on Hatteras Island.

The ORVMP regulates off-road night driving, which has the potential to decrease disturbance from headlights on nesting female turtles and hatchlings. Night driving was prohibited from May 1 through September 15 from 9:00 p.m. to 7:00 a.m. Starting September 16, 2013 night driving was systematically re-opened as nests were excavated and closures removed. Starting November 16, 2013 night driving was not restricted due to nests.

Recreational Beach Items

Recreational beach items (i.e. shade canopies, furniture, volleyball nets, etc.) that remain on the beach at night can cause turtles to abort their nesting attempt (NMFS, USFWS 1991). These items can cause a visual disturbance for nesting turtles and/or can act as a physical impediment. During the 2013 nesting season resource management staff continued to tie 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 National Park Service (NPS) regulations regarding abandoned property. Items left on the beach 24 hours after tagging were subject to removal by CAHA staff.

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APPENDICES

Appendix A: 2013 CAHA Project Summary Report and Guide

Appendix B: Maps

Map 1: Bodie Island Sea Turtle Nests, 2013

Map 2: North Hatteras Island Sea Turtle Nests, 2013

Map 3: South Hatteras Island Sea Turtle Nests, 2013

Map 4: Ocracoke Island Sea Turtle Nests, 2013

Map 5: Bodie Island Sea Turtle False Crawls, 2013

Map 6: North Hatteras Island Sea Turtle False Crawls, 2013

Map 7: South Hatteras Island Sea Turtle False Crawls, 2013

Map 8: Ocracoke Island Sea Turtle False Crawls, 2013

Map 9: Bodie Island Sea Turtle Strandings, 2013

Map 10: North Hatteras Island Sea Turtle Strandings, 2013

Map 11: South Hatteras Island Sea Turtle Strandings, 2013

Map 12: Ocracoke Island Sea Turtle Strandings, 2013

Appendix A. 2013 Project Summary Report/Guide for CAHA Sea Turtle Nests

Sea Turtle Nest Monitoring System Project Summary Report

Survey N Boundary	Ramp 1, Bodie Island (excludes Pea Island NWR)		
Survey S Boundary	South Point, Ocracoke		
Length of Daily Survey (km) <i>km = miles x 1.6</i>	104 km (~65 mi)	Total Kilometers Surveyed	15392
Total Days Surveyed	148	Days per Week Surveyed	7
Time of Day Surveyed	Morning	Number of Participants	19
Date Surveys Began	5/1/2013	Date Surveys Ended	9/25/2013
Date of First Crawl	5/19/2013	Date of Last Crawl	9/11/2013
Date of First Nest	5/19/2013	Date of Last Nest	9/11/2013
Total Nests	254	Undetected	3
Nesting Density (nests/km)	2.44	Disoriented/Misoriented	2
<i>In Situ</i>	188	Washed Away Tide/Storm	8
Relocated	66 (26.0%)	Depredated	27
False Crawls	231	Unknown	1
Mean Clutch Count	116.9	Incubation Duration (All)	62.3
Hatchlings Produced	19426	Incubation Duration (<i>In situ</i>)	62.9
Hatchlings Emerged	16860	Incubation Duration (Relocated)	60.8

MEAN HATCH SUCCESS		MEAN EMERGENCE SUCCESS		NEST SUCCESS		BEACH SUCCESS	
64.90%		56.10%		76.5%		52.3%	
63.7%	68.3%	55.0%	59.6%	72.1%	89.2%	254	485
<i>IN SITU</i>	<i>RELOCATED</i>	<i>IN SITU</i>	<i>RELOCATED</i>	<i>IN SITU</i>	<i>RELOCATED</i>	TOTAL NESTS	TOTAL CRAWLS

Eggs Lost (Total Eggs Lost = 366)			
Research	235	Ghost Crab	81
Shallow Nest	22	Tide / Storm	11
Birds	3	Broken eggs	5
Other	9		
Hatchling Loss (Total Hatchling Loss = 82)			
Misorientation	43 (19 live)	Ghost Crab	9
Mink	10	Other	1

Sea Turtle Nest Monitoring System Project Summary Report Guide

Survey N Boundary -This is the most northern point of the area surveyed for the particular year.

Survey S Boundary -This is the most southern point of the area surveyed for the particular year.

Length of Daily Survey – This is the total cumulative length in kilometers that was surveyed each day.

Total Kilometers Surveyed – This is automatically calculated by multiplying the Length of Daily Survey times the Total Days Surveyed.

Total Days Surveyed - This is the total number of days surveyed based on the survey start and end dates and number of days per week surveyed.

Days per Week Surveyed – This is the number of days per week that is surveyed throughout the nest laying portion of the season.

Time of Day Surveyed – Approximately 5 separate daily surveys are conducted at CAHA. Technicians attempt to start all surveys at dawn.

Number of Participants – This is the total number of participants conducting surveys for the particular year.

Date Surveys Begin and End – Date of first and last survey day. A survey is complete coverage of your survey area. It is not considered a survey when only checking individual nests.

Date of First and Last Crawl – This is automatically filled in using information completed in the Activity Log.

Date of First and Last Nest – This is automatically filled in using information completed in the Activity Log.

Total Nests – total number of nests (includes undetected nests). This does not include possible nests. Possible nests should be changed either to a nest or false crawl before submitting report.

In Situ Nests – total number of *in situ* nests.

Relocated Nests – total number of nests relocated regardless of reason.

False Crawls – total number of false crawls. This number is calculated from the Activity Log.

Nesting Density – number of nests (includes undetected nests) divided by length of daily survey.

Undetected Nests – number of nests that were undetected during the season.

Disoriented/Misoriented – number of nests that were reported as disoriented or misoriented.

Washed Away Storm or Tide – number of nests that were completely lost to a storm or the tide. A nest is considered lost only if nest lost is selected in the loss log.

Depredated – number of nests that were depredated. This should include nests that are depredated by any predator, including the following: Ghost Crab, Raccoon, Fox, Dog, Human, Poaching, Fire Ants, Birds, Cat, Coyote, Hog, Mink, Armadillo.

Mean Clutch Count – calculated from relocated nests.

Hatchlings Produced – This is calculated by adding up all the > 50% shells.

Hatchlings Emerged - This is the total number of shells > 50% minus (live + dead hatchlings in nest). This number is calculated from inventory data only.

Incubation Duration (All, *In Situ*, Relocated) - This is calculated by taking the mean of all individual nest incubation durations for each group (all, *in situ* and relocated). This does not include undetected nests or any nests without both a date laid and a date of emergence.

Mean Hatch Success (All, *In Situ* and Relocated) - This is calculated by taking the unweighted mean of all the individual nest hatch successes for each group (all, *in situ* and relocated). Any nest that has an inventory date or is marked as lost is included in the calculation. Any nest marked as exclude from calculations is not included in this calculation.

Mean Emergence Success (All, *In Situ* and Relocated) - This is calculated by taking the unweighted mean of all the individual nest emergence successes for each group (all, *in situ* and relocated). Any nest that has an inventory date or is marked as lost is included in the calculation. Any nest marked as exclude from calculations is not included in this calculation.

Nest Success (All, *In Situ* and Relocated) - This is calculated by counting the number of nests that hatched with $\geq 10\%$ emergence success divided by the number of nests laid for each group (all, *in situ* and relocated).

Beach Success – This is calculated by counting the number of nests laid divided by the total number of crawls (total crawls = nest crawls + false crawls).

Eggs Lost – This is the total number of eggs lost calculated from the egg/hatchling loss log.

Hatchling Loss – This is the total number of hatchlings lost calculated from the egg/hatchling loss log. Hatchlings found alive but impacted by a loss event are included in parentheses (e.g. disorientation or misorientation).



Map 1: Bodie Island Sea Turtle Nests, 2013





Map 2: North Hatteras Island Sea Turtle Nests, 2013





Map 3: South Hatteras Island Sea Turtle Nests, 2013





Map 4: Ocracoke Island Sea Turtle Nests, 2013





Map 5: Bodie Island Sea Turtle False Crawls, 2013





Map 6: North Hatteras Island Sea Turtle False Crawls, 2013





Map 7: South Hatteras Island Sea Turtle False Crawls, 2013





Map 8: Ocracoke Island Sea Turtle False Crawls, 2013





Map 9: Bodie Island Sea Turtle Strandings, 2013



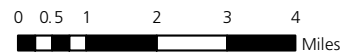


Map 10: North Hatteras Island Sea Turtle Strandings, 2013



Sea Turtle Strandings 2013

- Loggerhead
- ▲ Green
- ◆ Leatherback
- Kemp's Ridley
- ◆ Unknown





Map 11: South Hatteras Island Sea Turtle Strandings, 2013





Map 12: Ocracoke Island Sea Turtle Strandings, 2013

