

CAPE LOOKOUT NATIONAL SEASHORE

2014 SEA TURTLE MONITORING AND MANAGEMENT REPORT



Shackleford Banks Kemp's Ridley (*Lepidochelys kempii*) Sea Turtle Nest 009. Keith Rittmaster, NC Maritime Museum Photo 2014.

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INTRODUCTION

Cape Lookout National Seashore (CALO) began monitoring marine turtles in 1976. Baseline data was collected for a portion of South Core Banks during an extensive six-year study from 1978 - 1983. Nesting turtles were tagged and nests marked during nightly patrols. Since 1984 Cape Lookout has conducted daytime monitoring to document strandings, protect nest sites, relocate nests in danger of being flooded and protect hatchlings. Cape Lookout is a significant northern nesting beach and supports among the highest number of loggerhead sea turtle (*Caretta caretta*) nests in North Carolina. The seashore also provides nesting habitat for leatherback (*Dermochelys coriacea*), green (*Chelonia mydas*), and Kemp's ridley (*Lepidochelys kempii*) sea turtles. This report will summarize the 2014 project and consolidate many years of data. In addition to providing CALO with management data, the information gathered on CALO beaches continues to be an important link for many state, federal, and private Atlantic coast sea turtle managers.

COOPERATING AGENCIES

Cape Lookout National Seashore cooperates with numerous agencies, including the North Carolina Wildlife Resources Commission (NCWRC), the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) on sea turtle protection. The North Carolina Sea Turtle Program Coordinator receives all original stranding reports and annual nesting activity reports. NCWRC also issues Cape Lookout National Seashore an Endangered Species permit for possession and disposition of stranded marine turtles and relocation of nests.

SITE DESCRIPTION

Cape Lookout National Seashore is located in the southern Outer Banks of North Carolina between Beaufort and Ocracoke Inlets. The seashore consisted of four barrier islands during the nesting season. The northernmost island, North Core Banks (NCB) is approximately 18 miles long, extending from Ocracoke Inlet to Old Drum Inlet. The last 4 miles of NCB extends from Old Drum Inlet to Ophelia Inlet and is referred to as Middle Core Banks (MCB). South Core Banks (SCB) extends southward from Ophelia Inlet almost 24 miles to Barden Inlet. The Core Banks have a northeast to southwest orientation and exhibit a low profile landscape. The fourth island, Shackleford Banks (SB) is 9 miles long and has an east-west orientation with a higher dune system and larger areas of vegetation. All islands in the park are subject to constant and dramatic change by the actions of wind and waves.

METHODS

All three of the main islands comprising the Seashore were monitored regularly for turtle nesting activity. Student Conservation Association interns and NPS staff patrolled NCB and SCB daily searching for nesting activity from May 1st to September 15th. Each patrol began early in the morning so that the island was checked for turtle activity by 12:00 PM. The MCB section of NCB was monitored irregularly due to difficult access. Shackleford Banks was monitored three times a week. Sea turtle crawl activities were recorded and nests were marked according to protocol. Sea turtle monitoring and management is outlined in the Interim Protected Species Management Plan (National Park Service 2006). In addition to these program procedures the seashore participated in a genetic mark-recapture study of nesting female loggerheads using DNA derived from eggs. The

study was coordinated by the NCWRC for North Carolina and included the other Northern Recovery Unit states of Georgia and South Carolina. One egg from each nest was collected and preserved so DNA could be sampled at the University of Georgia genetic laboratory. As part of this study sea turtle crawl and nest activity was entered onto an online database at www.seaturtle.org.

Nest losses to tidal flooding and predation are the primary threats to nesting success at CALO. Nests laid in the tidal wash zone, primary berm, and back swale are considered in danger of erosion or tidal flooding. Nests laid in locations likely to repeated flooding were relocated to a higher elevation on the primary dune. Relocated nests were moved into the nearest of six designated areas and vehicles were detoured to the back road around these areas when nests neared hatching. Smaller vehicle detours were erected around those nests that were not relocated and were outside other vehicle closures. Vehicle closures provide a rut-free corridor from the nest site to the ocean, preventing hatchlings from being run over or becoming entrapped in tire ruts and dying from predation or desiccation (Hosier et al., 1981). Camping and campfires were not permitted in the closures to prevent disturbance of hatchlings by artificial lights. Light barriers were placed at nests with possible exposure to artificial light (lighthouse, vehicles, mainland glow) to minimize disorientation (CPSU, 1986).

Any signs of predation were noted and the approximate numbers of eggs or hatchlings destroyed were recorded. To discourage raccoon (*Procyon lotor*) predation, wire screens anchored by rebar were placed over all nests. Wire cages were used on SCB, if needed, on nests between the lighthouse and Power Squadron Spit, the area with the most predation problems from raccoons in

the past. Nests and possible nests were monitored for hatching activity through November. Nests were excavated after hatching to determine nest success. Possible nests were treated as nests through the nesting and hatching time frame. If the possible nest hatched it was added to the nest category and if it failed to show hatching activity after 75-90 days the site was excavated. It then was classified as a nest if eggs were found or as a crawl if no eggs were found.

RESULTS

The monitoring procedures used at CALO prior to 1990 were significantly different than those used after that year. Records from those years will not be included in this report. 1990 marked the beginning of monitoring procedures following the USFWS Index Nesting Beach program

NESTING RESULTS

The first recorded nesting activity in 2014 was on May 9 and the last on August 21, for a 105 day nesting season. A total of 276 activities were documented of which there were 127 nests and 149 false crawls, (Table 1.). There were 125 loggerhead, 1 Kemp's and 1 green nests. Figure 1 illustrates the daily nesting activity for the season. Original nest locations are in Appendix 1 maps.

Table 1. 2014 Sea Turtle Activities by Study Area.

	North Core Banks	South Core Banks	Shackleford Banks	CALO Total
NESTS	33	83	11	127
CRAWLS	34	111	4	149

The number of nests found in 2014, 127 nests, was slightly below the annual average of 137 nests for CALO (Fig. 2 and 3). South Core Banks continued to have more nests than the other islands in 2014 (Figure 4.). The nesting density was 11 nests per mile from mile 41 to mile 44.

Figure 1. Daily Number of Nests at 7 Day Increments from May 9 to August 21.

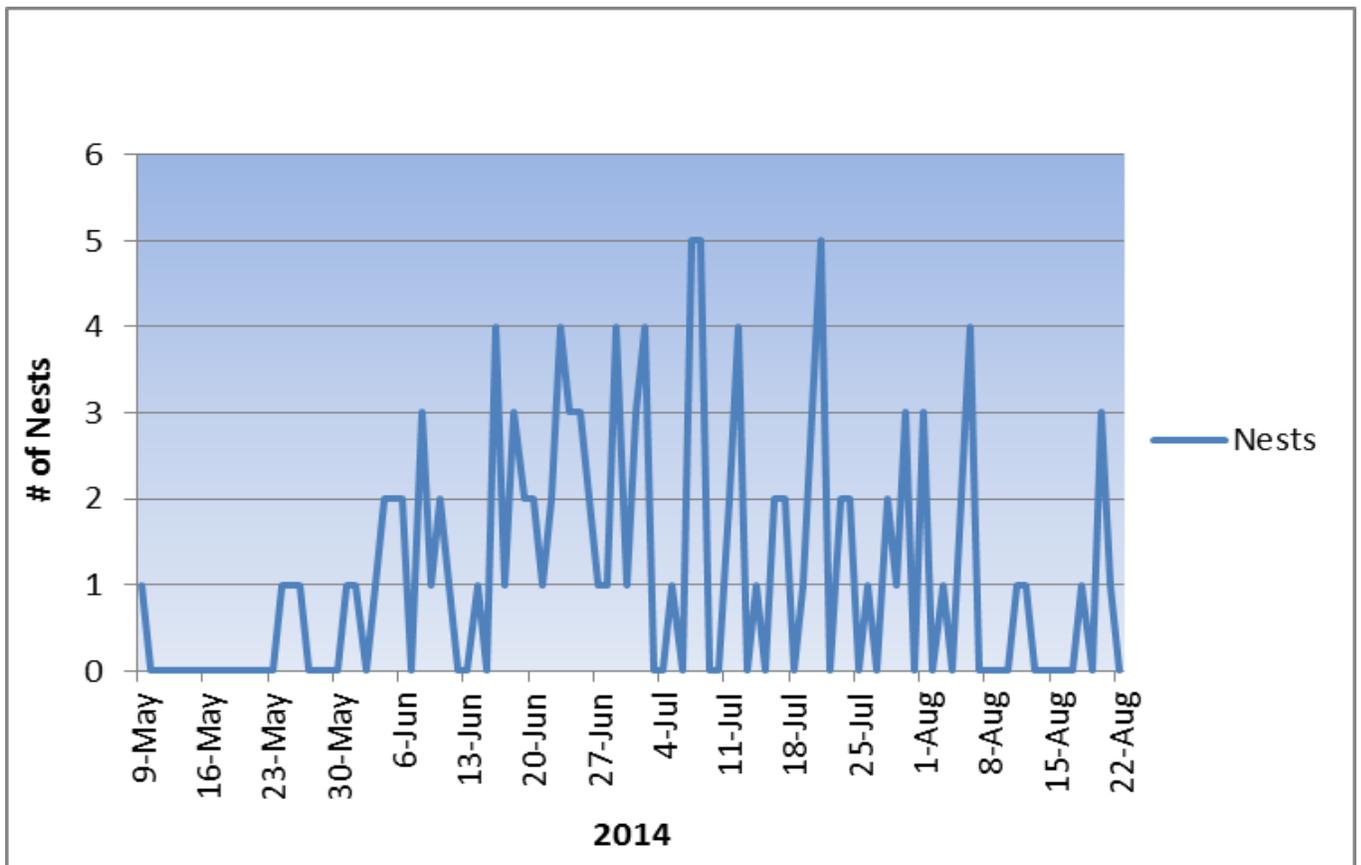


Figure 2. Cape Lookout Sea Turtle Activities 1990-2014.

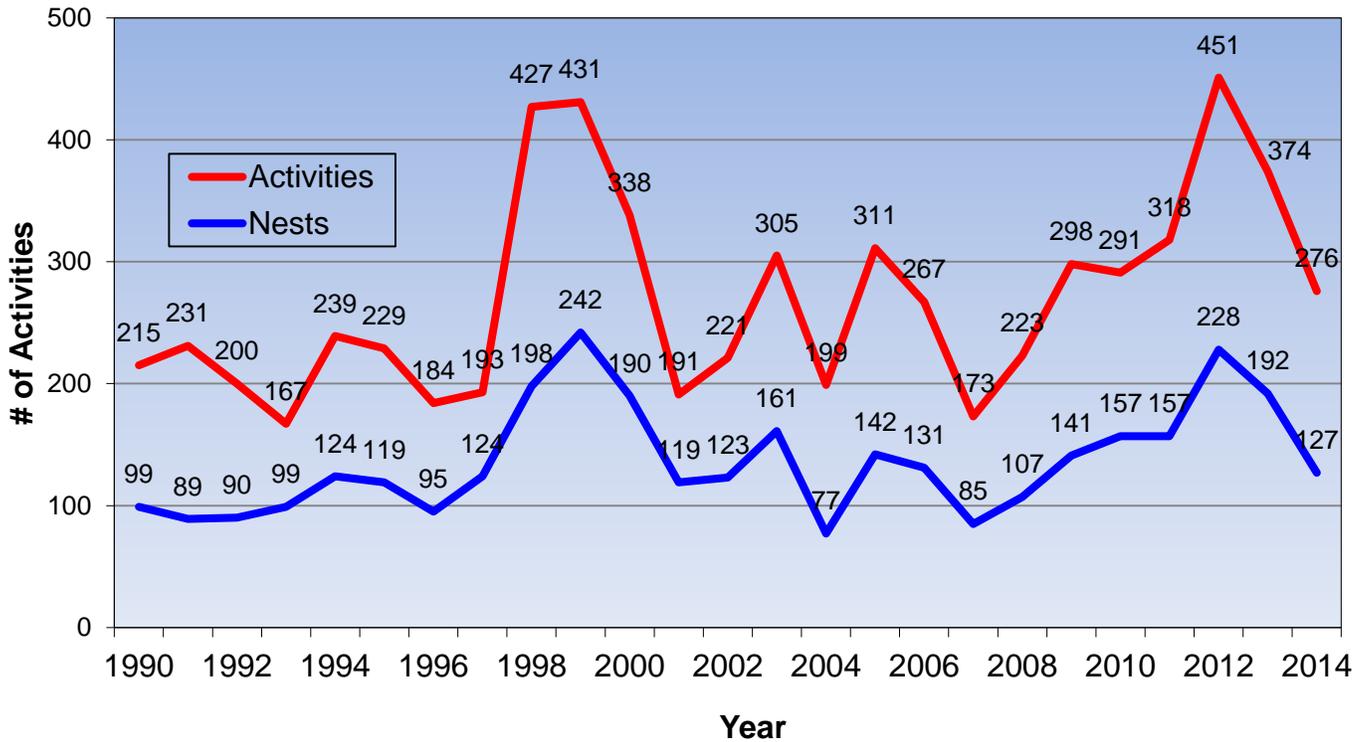


Figure 3. Cape Lookout Sea Turtle Nests 1990-2014.

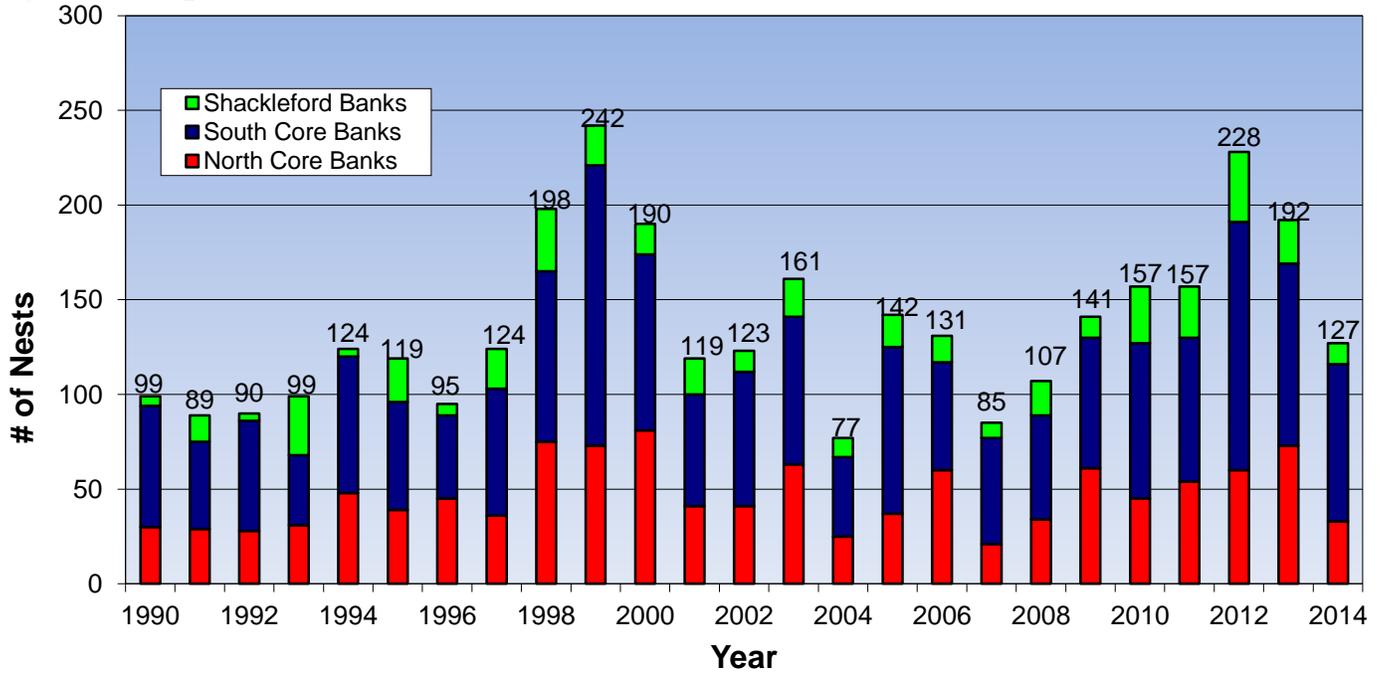


Figure 4. 2014 Turtle Nests by Mile Section



HATCHING RESULTS

Follow-up of nesting activity involved observing nest and dig sites for signs of hatching, recording relevant data, and excavating the site. By collecting hatch information, it can often be determined if predators, human disturbance or environmental occurrences have adversely affected a nest.

Nest hatching began on July 16th and ended on October 22th, for a 99 day nest hatching period. The last nest was inventoried on November 18th at day 90 of incubation on North Core Banks. A known total of 13,077 eggs, 7,190 hatchlings, and 162 hatched dead were counted. The total hatch success, number of total hatched eggs divided by number of total eggs, was 55%. The total emergence success of 54% (7,028 emerged) was calculated by subtracting the total hatched dead from the total hatched and dividing by the total of eggs (Table 2). This is the same calculation for each individual nest emergence success. The emergence success reported on www.seaturtle.org for Cape Lookout is 43%, which subtracts live hatchlings that were still in the nest. The seashore has not traditionally subtracted the live hatchlings in the nest which receive emergence assistance and to remain consistent with 25 years of data will report emergence success based on the traditional calculation. The emergence success range was from 0% to 99%. The average clutch size was 114 eggs. It took an average of 65 days for nests to incubate to hatch. The range of incubation was from 55 days to 75 days. Eleven nests were lost to erosion events, with unknown clutch size. One nest was completely destroyed by a predation event and the clutch size was undetermined. A total of 52 nests were over-washed by the ocean. Twenty nine of these 52 nests hatched. The emergence success for these 52 flooded nests was 30%.

In order to account for the 12 nests lost with unknown egg counts we have calculated an estimated emergence success of 49 % in 2014 (Table 2). The average clutch size for the seashore was given to those nests as the number of eggs, allowing them to be calculated into the estimated emergence success. The seashore total of 12 lost nests at an average clutch of 114 eggs equals 1368 eggs with 0% emergence success.

Table 2. SEA TURTLE HATCH SUMMARY 1990-2014.

Year	Nests	Avg. Clutch	Flooded	Avg. Incu	Eggs	Emerged	EMR % *	Est.Total EMR%**
1990	99	115	1	57	10,376	7,369	71%	69%
1991	89	115	6	62	8,393	5,197	62%	61%
1992	90	114	4	63	9,419	6,791	73%	71%
1993	99	115	9	59	10,365	7,544	74%	74%
1994	124	120	3	62	14,459	11,296	79%	79%
1995	119	115	38	57	12,357	6,157	51%	47%
1996	95	115	16	65	10,091	5,602	57%	53%
1997	124	122	3	63	14,824	10,740	73%	73%
1998	198	114	39	62	19,672	13,315	69%	61%
1999	242	116	90	62	23,224	11,751	53%	44%
2000	190	111	2	67	19,527	13,471	69%	65%
2001	119	113	5	65	12,358	9,555	79%	75%
2002	123	119	7	61	13,657	10,758	79%	75%
2003	161	119	45	65	16,440	10,067	61%	53%
2004	77	104	36	64	7,309	3,139	43%	40%
2005	142	111	54	60	12,423	6,569	53%	42%
2006	131	125	19	61	14,808	10,843	73%	66%
2007	85	109	19	60	8,759	6326	72%	68%
2008	107	111	60	60	11063	6868	62%	57%
2009	141	116	77	64	15130	7574	50%	46%
2010	157	105	80	57	14666	7956	54%	49%
2011	157	114	30	56	12910	8186	63%	46%
2012	228	111	84	62	25293	16,188	64%	64%
2013	192	108	35	64	19,744	13,409	68%	65%
2014	127	114	52	65	13,077	7,028	54%	49%

*emergence success for nests with known egg and hatch totals

**includes an estimate of egg totals for nests lost and not excavated

In 2014, a total of 37 nests were relocated. The emergence rate for relocated nests was 69% and the emergence rate for non-relocated nests was 46% (Table 3). Of the 127 nests, 115 were inventoried and 12 nests were washed away/predated with an unknown egg count and/or unknown success.

Table 3. 1990-2014 EMERGENCE SUCCESS FOR RELOCATED vs. NON-RELOCATED NESTS

YEAR	PERCENT OF NESTS RELOCATED	EMERGENCE RATE-RELOCATED	EMERGENCE RATE-NON RELOCATED*	PERCENT OF NESTS EXCAVATED
1990	69	71%	74% (67%)	94
1991	63	57%	76% (72%)	97
1992	43	71%	76% (74%)	97
1993	54	74%	73% (73%)	90
1994	79	80%	73% (73%)	96
1995	55	61%	38% (31%)	86
1996	73	56%	64% (48%)	89
1997	74	69%	86% (86%)	95
1998	59	77%	55% (41%)	85
1999	51	49%	59% (40%)	79
2000	63	66%	74% (61%)	93
2001	50	81%	76% (68%)	89
2002	45	73%	84% (77%)	93
2003	41	47%	75% (58%)	86
2004	44	63%	23% (20%)	97
2005	34	42%	61% (42%)	79
2006	39	85%	64% (54%)	90
2007	24	79%	70% (65%)	95
2008	30	57%	64% (57%)	92
2009	25	61%	46% (41%)	92
2010	13	75%	51% (45%)	89
2011	27	36%	78% (49%)	62
2012	22	74%	61% (61%)	99.5
2013	28	61%	71% (67%)	95
2014	29	69%	46% (40%)	90
<i>AVERAGES</i>	45	65%	65% (56%)	90

* Number in parentheses is an estimate including nests with unknown egg totals

Since 1990 the twenty five year average emergence success is 65% for relocated nests and 65% for non- relocated nests (Table 3).

Hatch Results by Species

The 125 loggerhead, 1 Kemp’s Ridley, and 1 green turtle emergence successes were 53%, 49% and 93%, respectively (Table 4.). The Kemp’s Ridley incubation period was unknown since the hatch was missed. The Kemp’s Ridley was on Shackleford Banks and could only be checked three times a week. It did receive three flooding events which may explain the lower emergence success.

Table 4. Loggerhead, Kemp’s Ridley, and Green Sea Turtle Hatch Summary, 2014.

	Loggerhead	Kemp’s	Green
NESTS	127	1	1
# EGGS	12826	103	148
# HATCHLINGS	7003	50	137
# HATCH DEAD	162	0	0
EMERGENCE SUCCESS	53%	49%	93%
AVERAGE CLUTCH	114 eggs	103	148 eggs
AVERAGE INCUBATION	65 days	UNK	59 days

Predation

In 2014, one nest was completely lost to raccoon predation on Shackleford Banks. The raccoon dug under the wire screen and destroyed the nest. Another nest on SB lost 13 eggs to raccoon predation. On SCB one nest lost 44 eggs to raccoon predation before it was found. The nest contents of an old nest on SCB was dug up by a coyote after it was hatched, inventoried and the metal screen removed. Ghost crab predation was recorded for eight nests in the seashore.

Human Disturbance

Off-road vehicles disregarding beach closures threaten the survival of hatchlings. Hatchlings are at risk of being directly crushed and/or becoming trapped in tire ruts. At night vehicle lights could disorientate hatchlings. These threats are identified in the loggerhead sea turtle recovery plan second edition, 2008. In 2014, park law enforcement staff issued zero violation notices for vehicular sea turtle closure violations.

STRANDINGS

Collecting information from stranded turtles is also an important phase of the CALO Sea Turtle Monitoring Program. CALO documents strandings, collects data for the N.C. Sea Turtle Project Coordinator and the National Marine Fisheries Service (NMFS) and assists in the transportation of live strandings to rehabilitation facilities.

Seventy four strandings occurred at CALO in 2014. All strandings were reported to the NCWRC and were documented with a “Sea Turtle Stranding and Salvage Network” stranding report. Green turtles accounted for the majority of the strandings (32). There were also 24 loggerheads, 17 Kemp’s ridleys, and 1 unknown. Forty three turtles stranded on the inshore soundside and 31 turtles stranded on the offshore oceanside. There was only one live stranding, which was a cold stun from November. The live stranded turtle was transported out of the park and sent to Topsail Sea Turtle Hospital or NC Aquarium at Pine Knolls Shore. Turtles were scanned for external and Passive Integrated Transponder (PIT) tags. Two tagged turtles were found in 2014. One loggerhead was found dead on 9/4/14 on SB and it had been tagged on 5/8/14 in the Cape Lookout Bight by NOAA-Beaufort scientist. The animal had propeller scars on the carapace. Another tagged loggerhead was found dead on 11/17/14 on the Cape Lookout Bight shoreline of SCB with some undetermined wounds to the skull. It was originally tagged at Hammocks Beach State Park on Bear Island while nesting in 2006. The female was encountered again in 2013 while nesting on Bear Island. Figures 5, 6, and Table 5 provide stranding data by year, month, and species from 1990 to 2014.

Figure 5. Sea Turtle Stranding Totals at CALO (1990-2014) with a simply linear regression line.

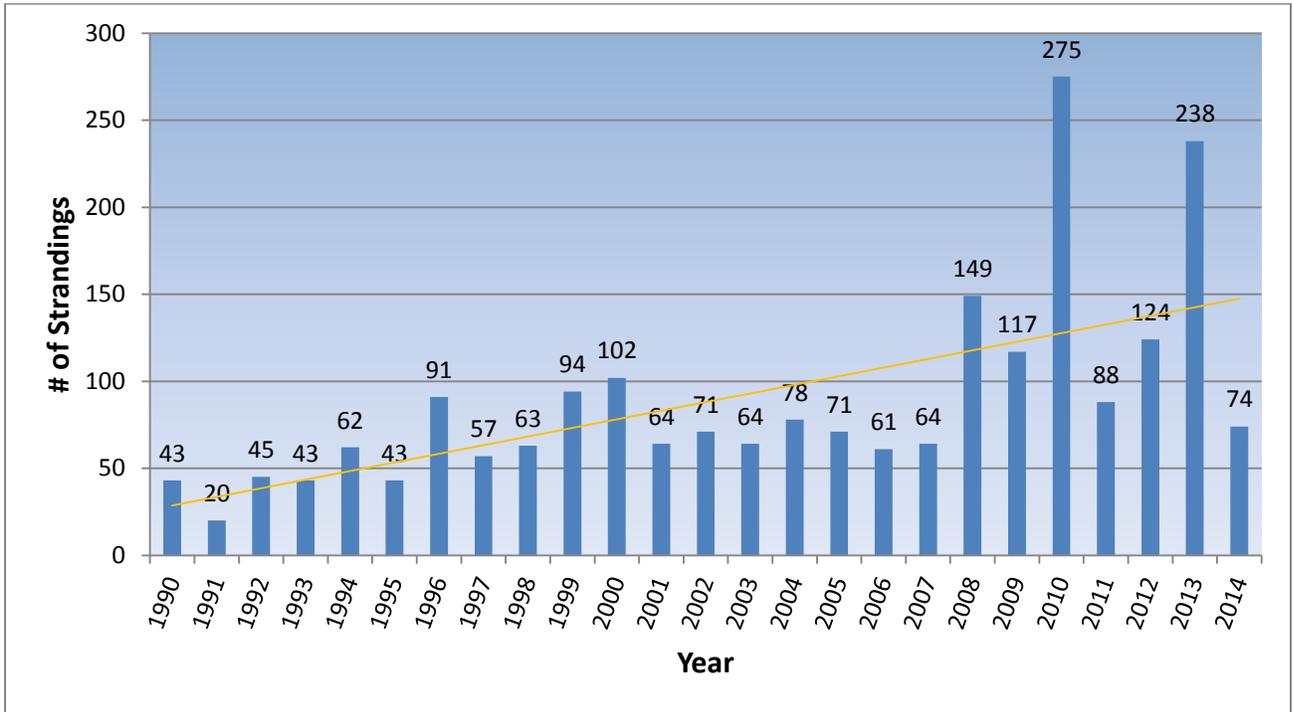


Figure 6. 2014 Sea Turtle Strandings at CALO by Month.

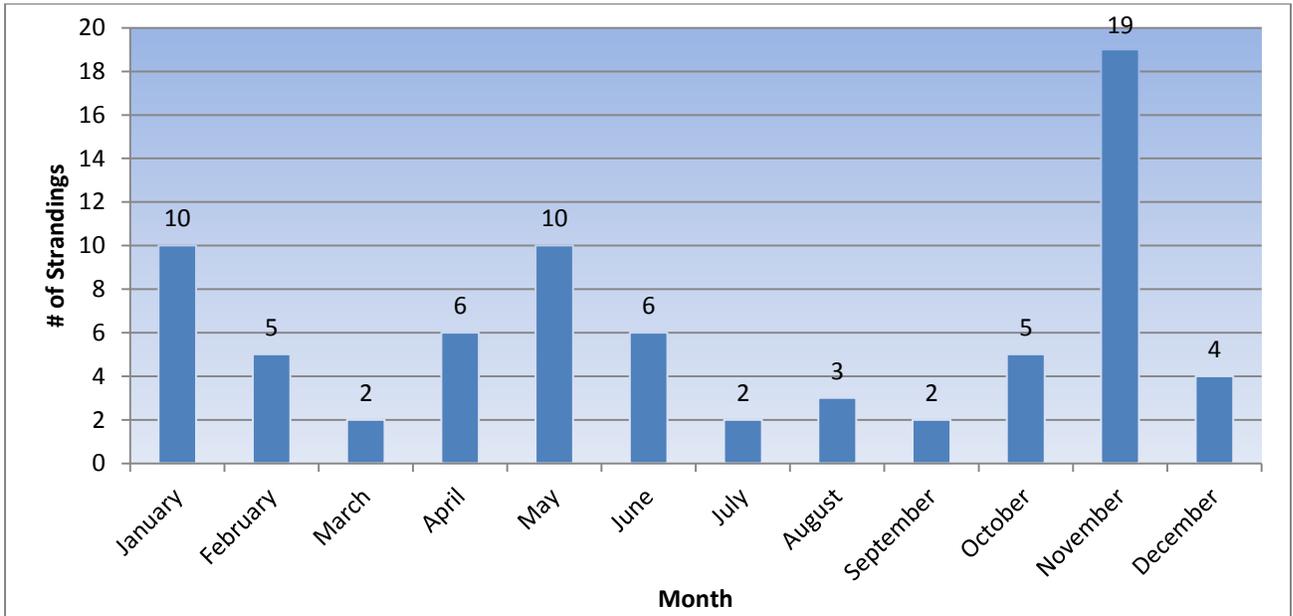


Table 5. CALO SEA TURTLE STRANDINGS 1990 – 2014.

YEAR	Stranding Totals	Logger-head	Green	Kemp's Ridley	Leather-back	Hawksbill	Unknown
1990	43	33	7	1	2	0	0
1991	20	16	2	1	0	0	1
1992	45	30	13	1	1	0	0
1993	43	29	6	5	2	0	1
1994	62	30	24	5	2	0	1
1995	43	27	7	6	1	0	2
1996	91	63	21	4	3	0	0
1997	57	49	1	7	0	0	0
1998	63	43	8	12	0	0	0
1999	94	36	41	15	2	0	0
2000	102	46	40	11	4	0	1
2001	64	38	15	9	2	0	0
2002	71	33	26	5	7	0	0
2003	64	44	9	7	2	1	1
2004	78	45	28	4	1	0	0
2005	71	37	21	6	0	2	5
2006	61	35	16	8	0	0	2
2007	64	19	38	1	0	0	6
2008	149	29	116	2	0	0	3
2009	117	36	66	14	0	0	1
2010	275	131	116	27	0	0	0
2011	88	18	44	26	0	0	0
2012	124	25	73	25	1	0	0
2013	238	26	187	23	1	0	1
2014	74	24	32	17	0	0	1

DISCUSSION

The nesting season started on May 9th and the hatching season ended on October 22nd for a combined total of 166 days. The relatively wet and cooler summer prolonged incubation lengths for nests. The average incubation rate of 65 days in 2014 was 3 days longer than the 25 year average of 62 days.

Hurricane Arthur struck on July 3rd in the middle of the nesting season. Fortunately the storm moved over Cape Lookout very quickly and impacts to sea turtle nesting were minimal. Only nine nests were washed away. Nests did receive some overwash from the hurricane, but it was only one tide cycle before the storm was gone. Only two additional nests were washed out by other tropical systems in the Atlantic Ocean. There were a total of four undetected nests that were later discovered after the lay date. Three of these nests were inside of Ocracoke Inlet on NCB where the erosion and high tides made it difficult to survey on a daily basis. Another undetected soundside nest was discovered in the Cape Lookout Bight.

There were fewer sea turtle strandings than the previous six years, largely due to an absence of cold stunning events in 2014. CALO only had one cold stun turtle come ashore in 2014. The majorities of turtles have stranded on inshore beaches and have been juveniles. There has also been a trend of more juvenile greens and Kemp's ridleys than loggerheads in the past five years at the seashore. The seashore continued to participate (5th year) in the genetic mark-recapture study of the northern recover unit of sea turtles in 2014. Results can be viewed at www.seaturtle.org.

U.S. Fish and Wildlife Service Biological Opinion and Performance Measures

The USFWS provided CALO a biological opinion in November 2006 that included two performance measures on sea turtles for the Interim Protected Species Management Plan. The first performance measure requires that the sea turtle false crawl to nest ratio is less than or equal to 1:1 (annually). In 2014, there were 149 false crawls and 127 nests for a ratio of 1.17:1. The second performance measure states we should have 20 percent or greater of the statewide average number of sea turtle nests for the previous five years. There was an average of 975 nests for the previous five years (2009-2013) in North Carolina. In 2014 CALO only carried 13% of the state's total sea turtle nests for the previous five years (Table 6).

Table 6. CALO False Crawl to Nest Ratios and Percentages of North Carolina Averages (2007-2014).

Year	CALO Ratio	CALO # of False Crawls	CALO # of Nests	NC Previous 5 Year Nest Average	CALO %
2007	1.01 : 1	86	85	671.2	13
2008	1.08 : 1	116	107	642.8	17
2009	1.1 : 1	157	141	651.8	22
2010	0.85 : 1	134	157	707.8	22
2011	1.02 : 1	161	157	750.8	21
2012	0.98 : 1	223	228	789.6	29
2013	0.95 : 1	182	192	897.4	21
2014	1.17 : 1	149	127	975.2	13

Literature Cited

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Hosier, P.E., M. Kochhar, and V. Thayer. 1981. Off-road vehicle and pedestrian track effects on the sea-approach of hatchling loggerhead turtles. *Environmental Conservation* 8:158-161.

USFWS and NMFS. 2008. Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*) Second Revision.

APPENDIX I
2014 GIS SEA TURTLE ACTIVITY MAPS

Figure 7. 2014 North Core Banks Sea Turtle Activities

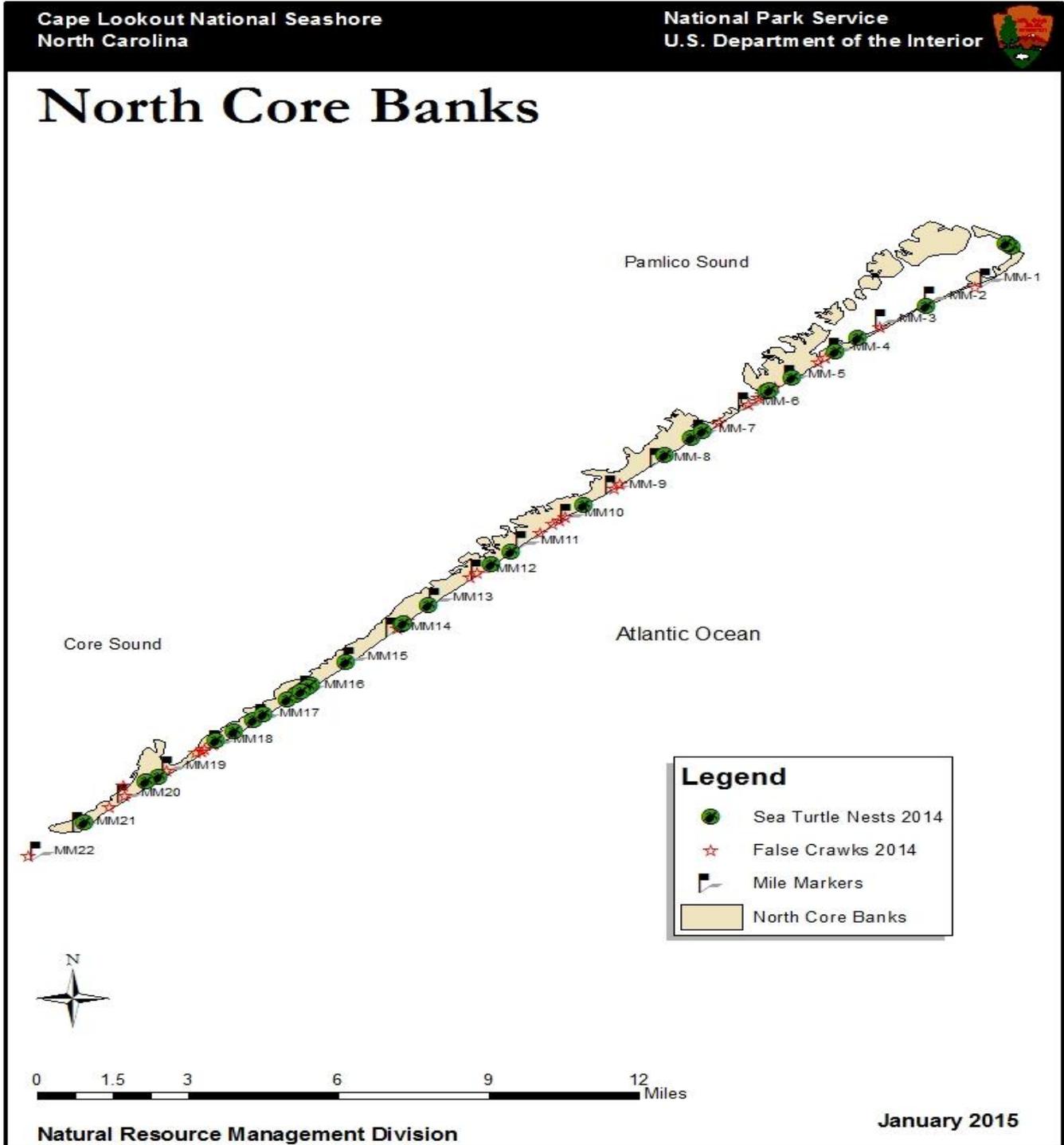


Figure 8. 2014 South Core Banks Sea Turtle Activities.

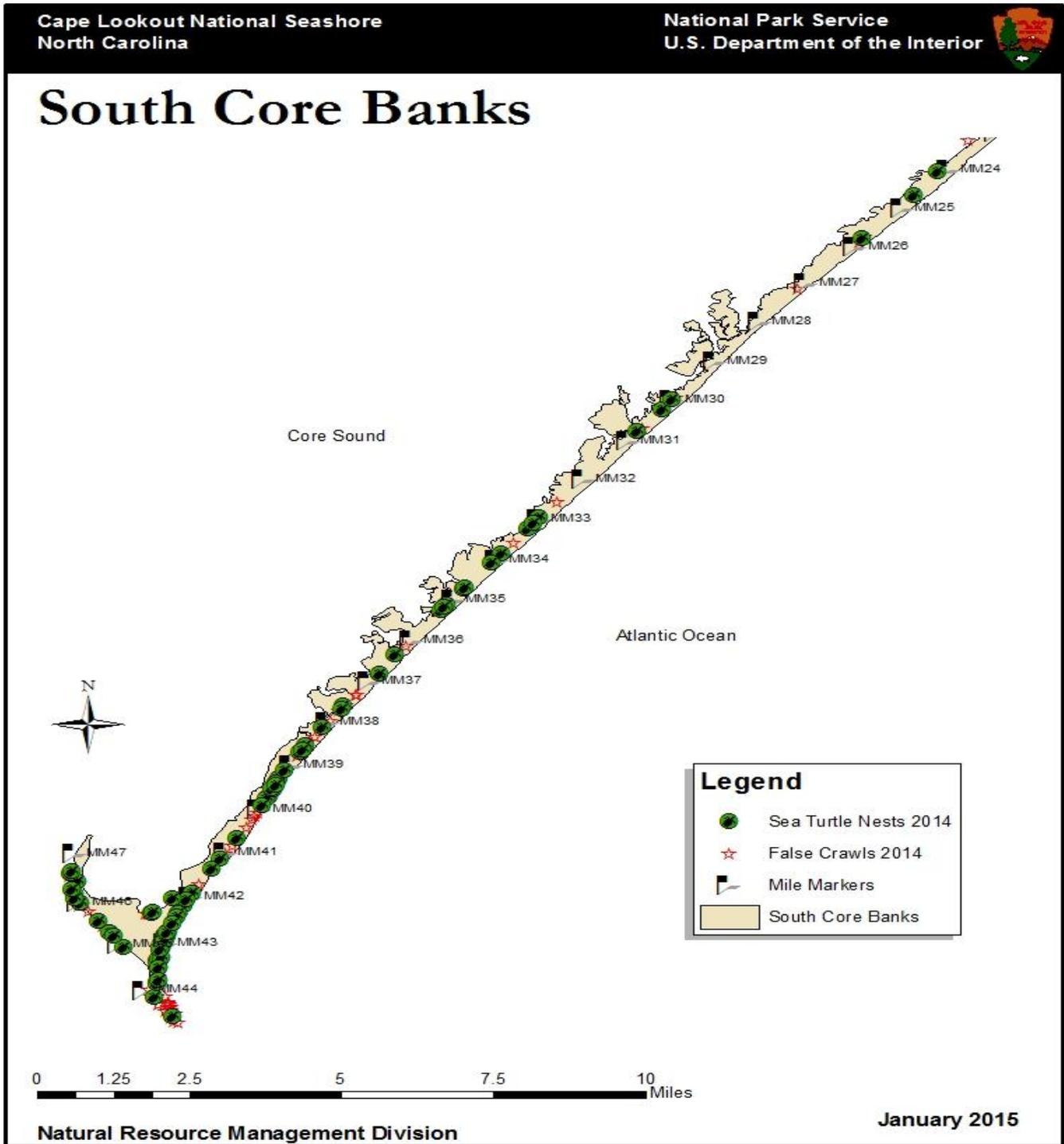


Figure 9. 2014 Shackleford Banks Sea Turtle Activities.

