CAPE LOOKOUT NATIONAL SEASHORE

2015 SEA TURTLE MONITORING AND MANAGEMENT REPORT

North Core Banks False Crawl Activity Number 133. NPS Photo 2015.

National Park Service
Cape Lookout National Seashore
131 Charles Street
Harkers Island, NC 28531

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 (*Dermochelyes coriacea*), green (*Chelonia mydas*), and Kemp's ridley (*Lepidochelys kempii*) sea turtles. Each year data have been collected, analyzed, and presented to management in hopes of better protecting the marine turtle population. This report will summarize the 2015 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 forth 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

NCB, SCB, and SB 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 in accordance with the 2nd Revision of the Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (2008). 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, Lamont et al. 2002, Van de Merwe et al. 2012). Camping and campfires were not permitted in the closures to prevent disturbance of hatchlings by artificial lights.

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, as needed, on nests between the lighthouse and Power Squadron Spit, an 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 a possible nest hatched it was added to the nest category and if it failed to show hatching activity after 75-80 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

This report includes monitoring data from 1990 to present when monitoring became standardized following the USFWS Index Nesting Beach program

NESTING RESULTS

The first recorded nesting activity in 2015 was on May 8 and the last on September 8, for a 123 day nesting season. A total of 525 activities were documented of which there were 247 nests and 278 false crawls, (Table 1.). There were 232 loggerhead and 15 green nests. Figure 1 illustrates the daily nesting activity for the season. Mapped original nest locations are in Appendix 1.

Table 1. 2015 Sea Turtle Activities by Study Area.

	North Core Banks	South Core Banks	Shackleford Banks	CALO Total
NESTS	92	133	22	247
CRAWLS	109	153	16	278

The number of nests found in 2015, 247, was the highest on record and well above the annual average of 141 nests for CALO (Fig. 2 and 3). South Core Banks continued to have more nests than the other islands in 2015 (Figure 4.).

Figure 1. Daily Number of Nests at 7 Day Increments from May 8 to September 8.

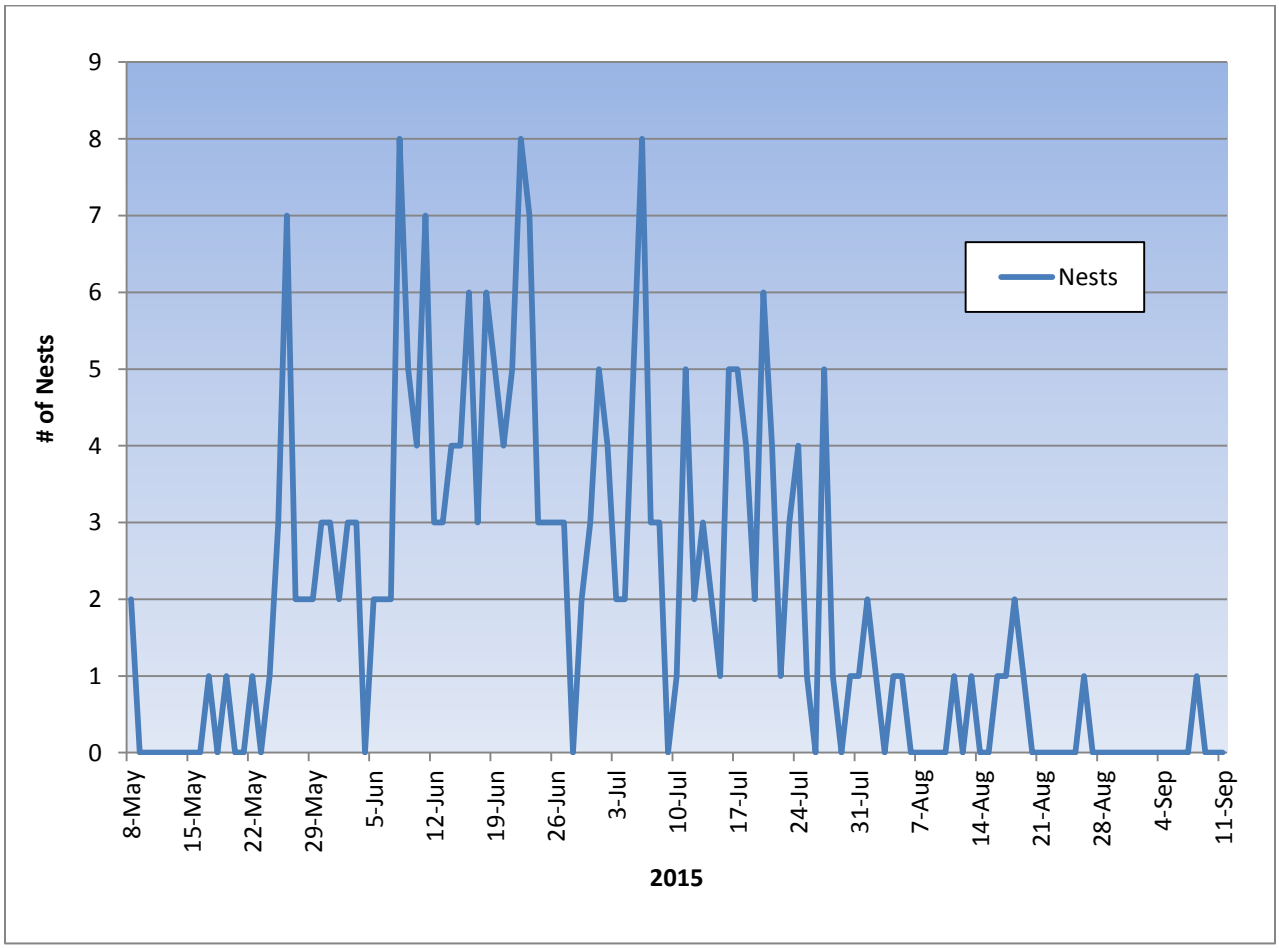


Figure 2. Cape Lookout Sea Turtle Activities 1990-2015

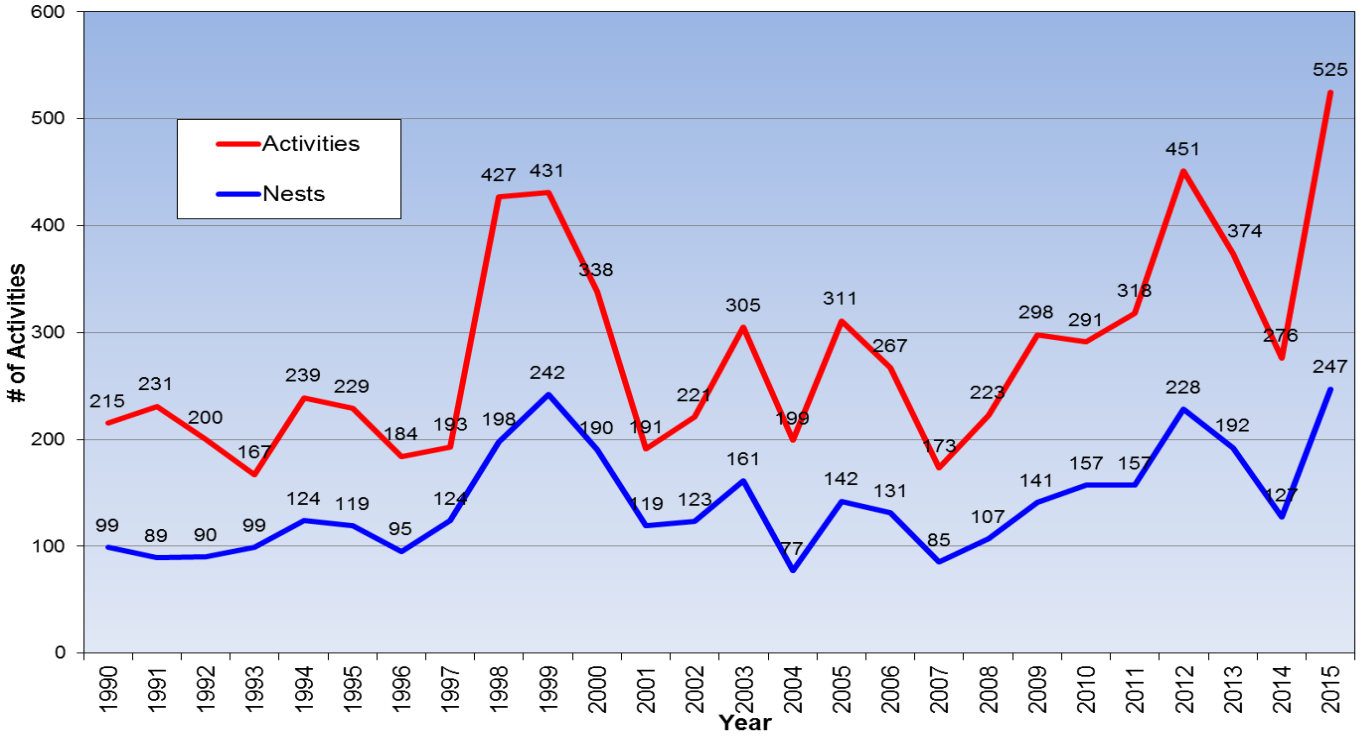


Figure 3. Cape Lookout Sea Turtle Nests 1990-2015

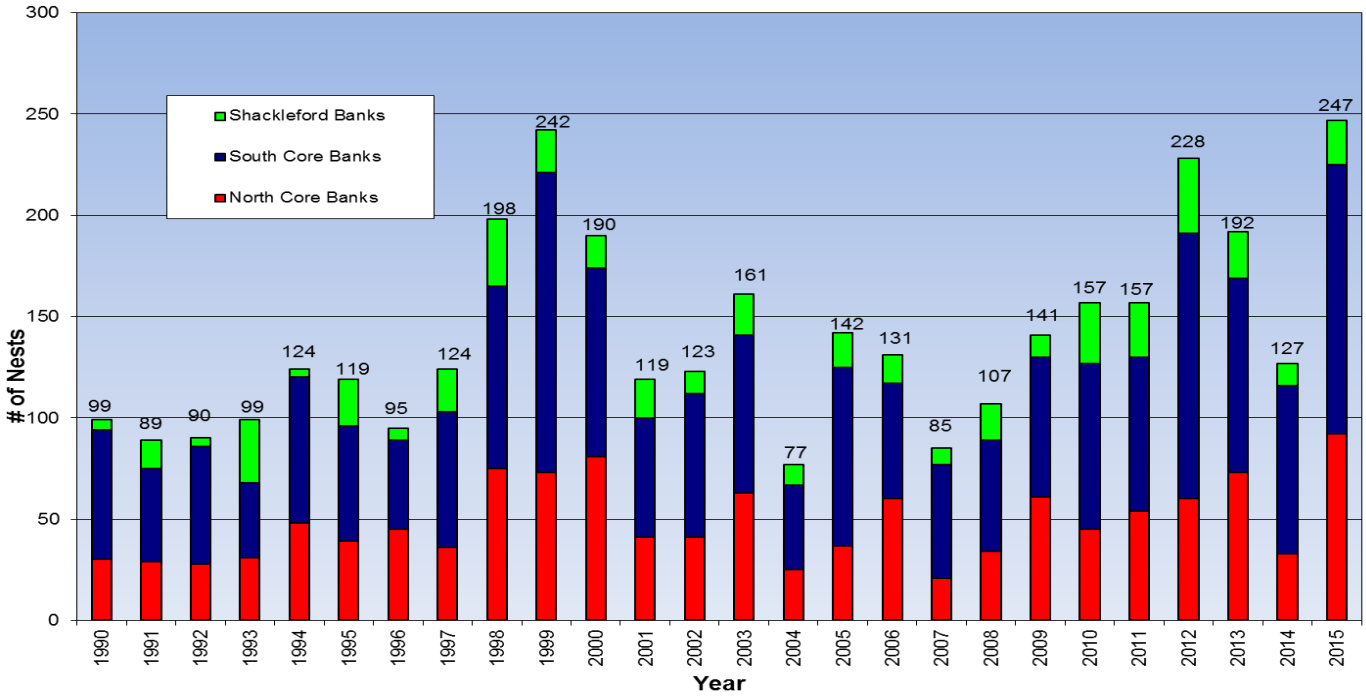
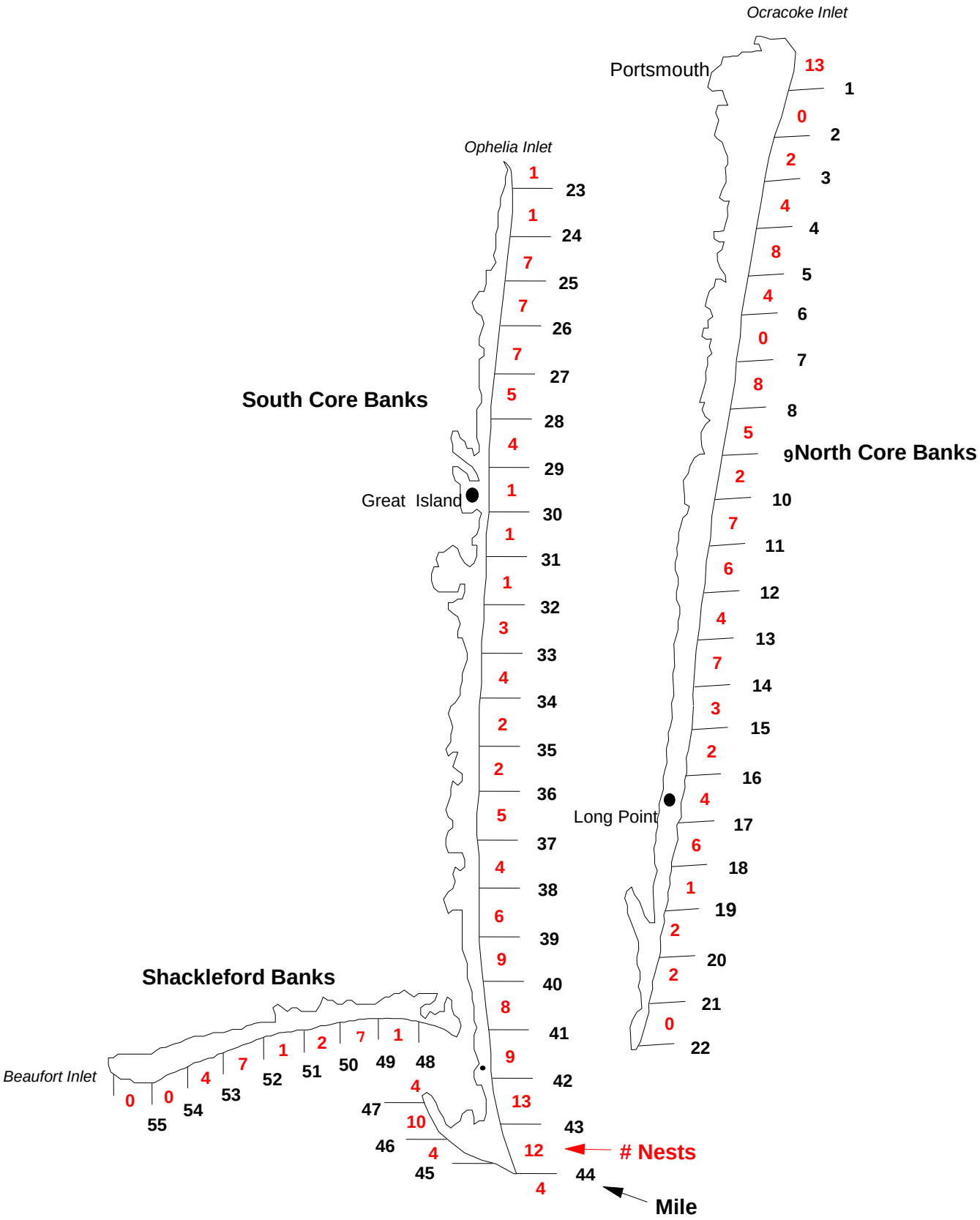


Figure 4. 2015 Turtle Nests by Mile Section



HATCHING RESULTS

Following nest monitoring activity involved observing nest and dig sites for signs of hatching, recording relevant data, and excavating the site. Hatch information is used to determine if predators, human disturbance or environmental occurrences have adversely affected a nest.

The nest hatching period for 2015 began July 9th and ended September 30th- a total of 84 days. The last nest was inventoried on November 20th at day 73 of incubation on South Core Banks. A known total of 26,160 eggs, 15,640 hatchlings, and 705 hatched dead were counted. The total hatch success, number of total hatched eggs divided by number of total eggs, was 60%. The total emergence success of 57% (14,935 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 54%, which subtracts live hatchlings that were still in the nest. CALO has not traditionally subtracted the live hatchlings in the nest which receive emergence assistance and to remain consistent with 26 years of data will report emergence success based on the traditional calculation. The emergence success range for individual nest was from 0% to 98%. The average clutch size was 112 eggs. It took an average of 59 days for nests to incubate to hatch. The range of incubation was from 48 days to 71 days. Thirteen nests were lost to erosion events with unknown clutch sizes. Two of these nests were lost after hatching and were sub sequentially not inventoried. A total of 121 nests were over-washed by the ocean at least once. Seventy eight of these 121 nests hatched. The emergence success for these 121 flooded nests was 37%.

In order to account for the 13 nests lost with unknown egg counts we have calculated an estimated emergence success of 54 % in 2015 (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 13 lost nests at an average clutch of 112 eggs equals 1,456 eggs with 0% emergence success.

Table 2. SEA TURTLE HATCH SUMMARY 1990-2015

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%
2015	247	112	121	59	26,160	14,935	57%	54%

*emergence success for nests with known egg and hatch totals

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

In 2015, a total of 40 (16%) nests were relocated. The emergence rate for relocated nests was 54% and the emergence rate for non-relocated nests was 58% (Table 3). Of the 247 nests, 234 were inventoried and 13 nests were washed away/predated with an unknown egg count and/or unknown success.

Table 3. 1990-2015 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%
2015	16%	54%	58% (53%)	94%
AVERAGES	*44%*	*65%*	*64% (56%)*	90%

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

Since 1990 the twenty six year average emergence success is 65% for relocated nests and 64% for non- relocated nests (Table 3).

Hatch Results by Species

The 232 loggerhead and 15 green turtle emergence successes were 58% and 42%, respectively (Table 4.). Seven of the confirmed green nests hatched. The green turtle incubation range was from 57 to 61 days with an average of 59 days.

Table 4. Loggerhead, and Green Sea Turtle Hatch Summary, 2015.

	Loggerhead	Green
NESTS	232	15
# EGGS	24346	1814
# HATCHLINGS	14864	776
# HATCH DEAD	693	12
EMERGENCE SUCCESS	58%	42%
AVERAGE CLUTCH	110 eggs	130 eggs
AVERAGE INCUBATION	59 days	59 days

Predation

In 2015, one nest suffered losses due to what appeared to be coyote (*Canis latrans*) predation on SCB. On NCB 41 hatchlings were predated by raccoons from five nests after hatching. These hatchlings were found near nests with their heads bitten off. Ghost crab predation took place throughout the seashore with 131 eggs lost from 27 nests.

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. In 2015, park law enforcement staff issued two 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 North Carolina Sea Turtle Project Coordinator and the National Marine Fisheries Service (NMFS) and assists in the transportation of live strandings to rehabilitation facilities.

In 2015, 124 strandings occurred at CALO. 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 (79). There were also 21 loggerheads, 23 Kemp's ridleys, and 1 leatherback. 59 turtles stranded on the inshore soundside and 65 turtles stranded on the offshore oceanside. There were only 4 live strandings. No major cold stun event occurred in 2015. The live stranded turtles were 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. Figure 5, Figure 6, and Table 5 provide stranding data by year, month, and species from 1990 to 2015.

Figure 5. Sea Turtle Stranding Totals at CALO (1990-2015) with a simply linear regression line.

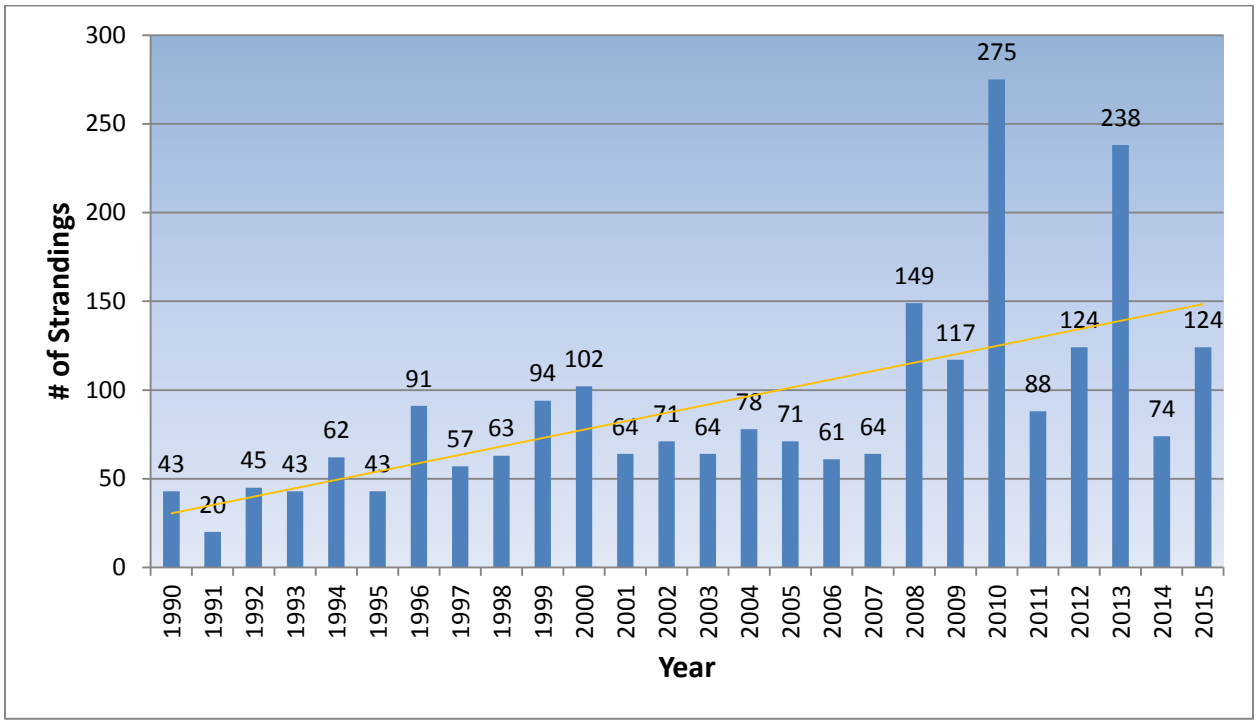


Figure 6. 2015 Sea Turtle Strandings at CALO by Month.

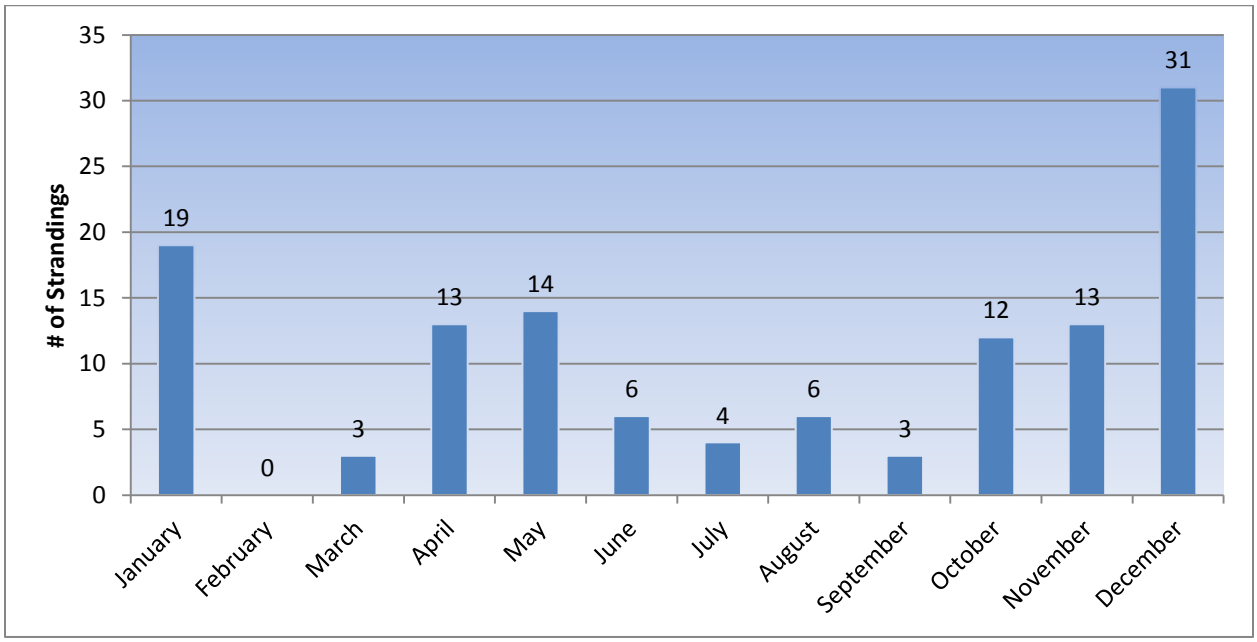


Table 5. CALO SEA TURTLE STRANDINGS 1990 – 2015

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
2015	124	23	78	21	1	0	1

DISCUSSION

The nesting and hatching season started on May 8 and ended on September 30, lasting +145 days. Though nests were monitored until November 20th they did not hatch after September 30th due to the heavy rainfall in early October from Hurricane Joaquin. Nests that are flooded from heavy rainfall are negatively impacted and can have lower hatch success (Kramer and Bell 1980). The average incubation rate of 59 days in 2015 was 3 days earlier than the 26 year average of 62 days. One nest hatched at day 48 and two hatched on day 50 of incubation. The management plan calls for closed areas around the nests at day 50 to allow for tire ruts to smooth out before hatching. However there needs to be some flexibility in barricade application to allow for higher summer temperatures that speed up incubation. Barricades should be erected at day 40-45 if nesting season air temperatures are above average and nests are showing signs of early hatching.

The coyote nest predation event on SCB is of major concern. This canine's ability to dig further and deeper than a raccoon under wire screens could make protection of nests difficult. Once this food source is discovered future nesting seasons could see significant predation.

The majority of nesting and hatching season was relatively free of tropical storm impacts and only eleven nests were washed away during Hurricane Joaquin's pass offshore. Ninety three percent of the nests were inventoried. There were a total of three undetected nest that were later discovered after the lay date. Two nests appeared to have been initially missed by turtle patrol on Shackleford banks, but the faint tracks were later discovered and the nests located. One undetected nest on SCB was discovered at hatching.

The past eight years has seen a higher number of stranded sea turtles. There is an increasing trend of more strandings (Figure 5). The majority of turtles have been stranded on inshore beaches and have been juveniles. There has also been a trend of more juvenile greens and Kemp's ridley than loggerheads in the past nine years at the seashore. November, December, and January continue to be the busiest months of the year for strandings.

The seashore continued to participate in the genetic mark-recapture study of the northern recover unit of sea turtles in 2015. Results can be viewed at www.seaturtle.org. The study has 90.3% of the DNA samples assigned with 99 individual nesting females documented in 2015. The mean nest per female was 2.57 nests with a maximum of 6 nests assigned to one female. The mean interesting period was 14 days.

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

The USFWS provided CALO a biological opinion 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 2015, there were 278 false crawls and 247 nests for a ratio of 1.12: 1. The second performance measure states we should have 20 percent or greater of the state's total sea turtle nests for the last five years. There was an average of 963 nests for the last five years in North Carolina. In 2015 CALO had 26% of the state's total sea turtle nests for the previous five years.

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APPENDIX I

2015 GIS SEA TURTLE ACTIVITY MAPS

Figure 7. 2015 North Core Banks Sea Turtle Activities

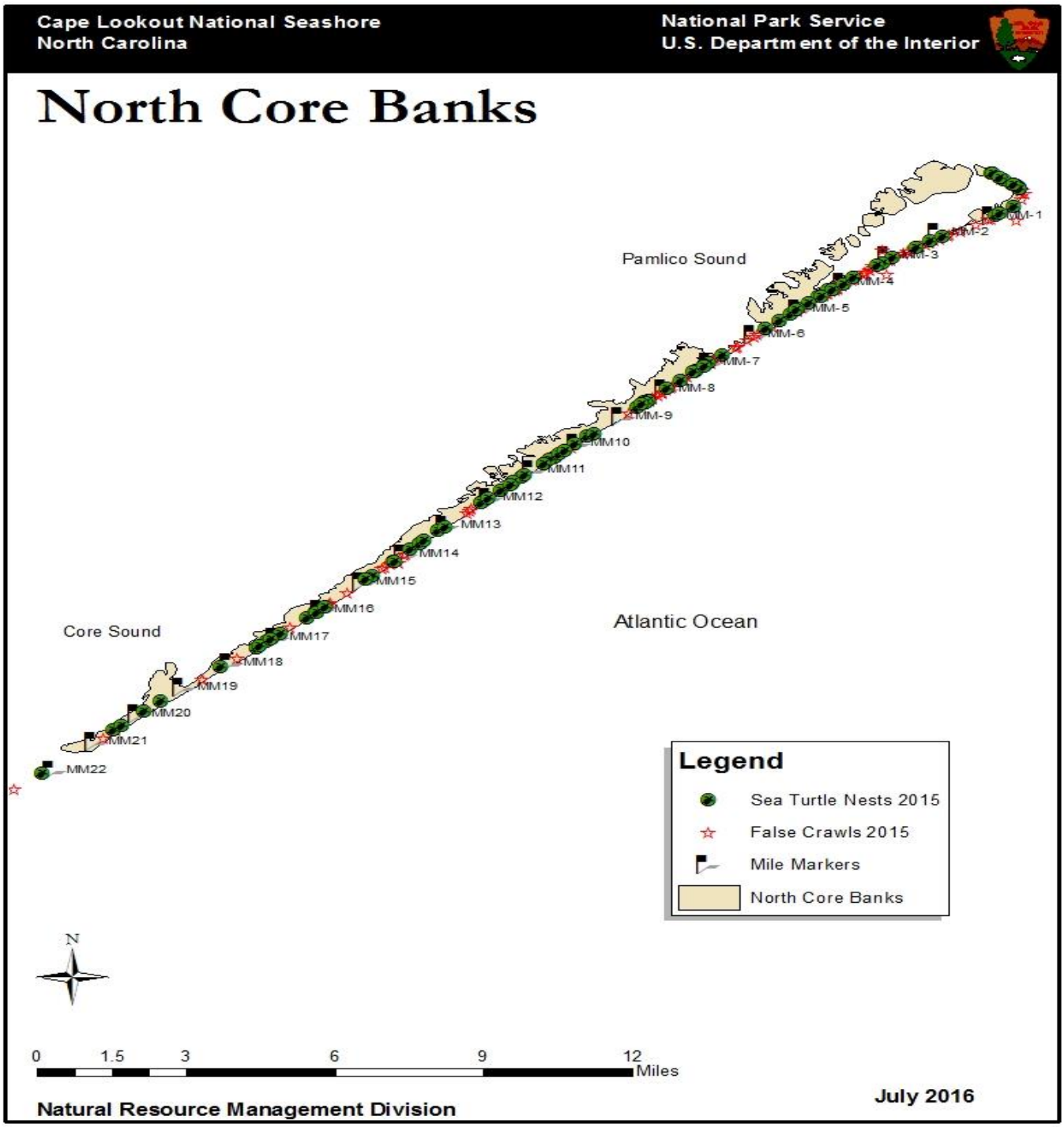

Figure 8. 2015 South Core Banks Sea Turtle Activities.

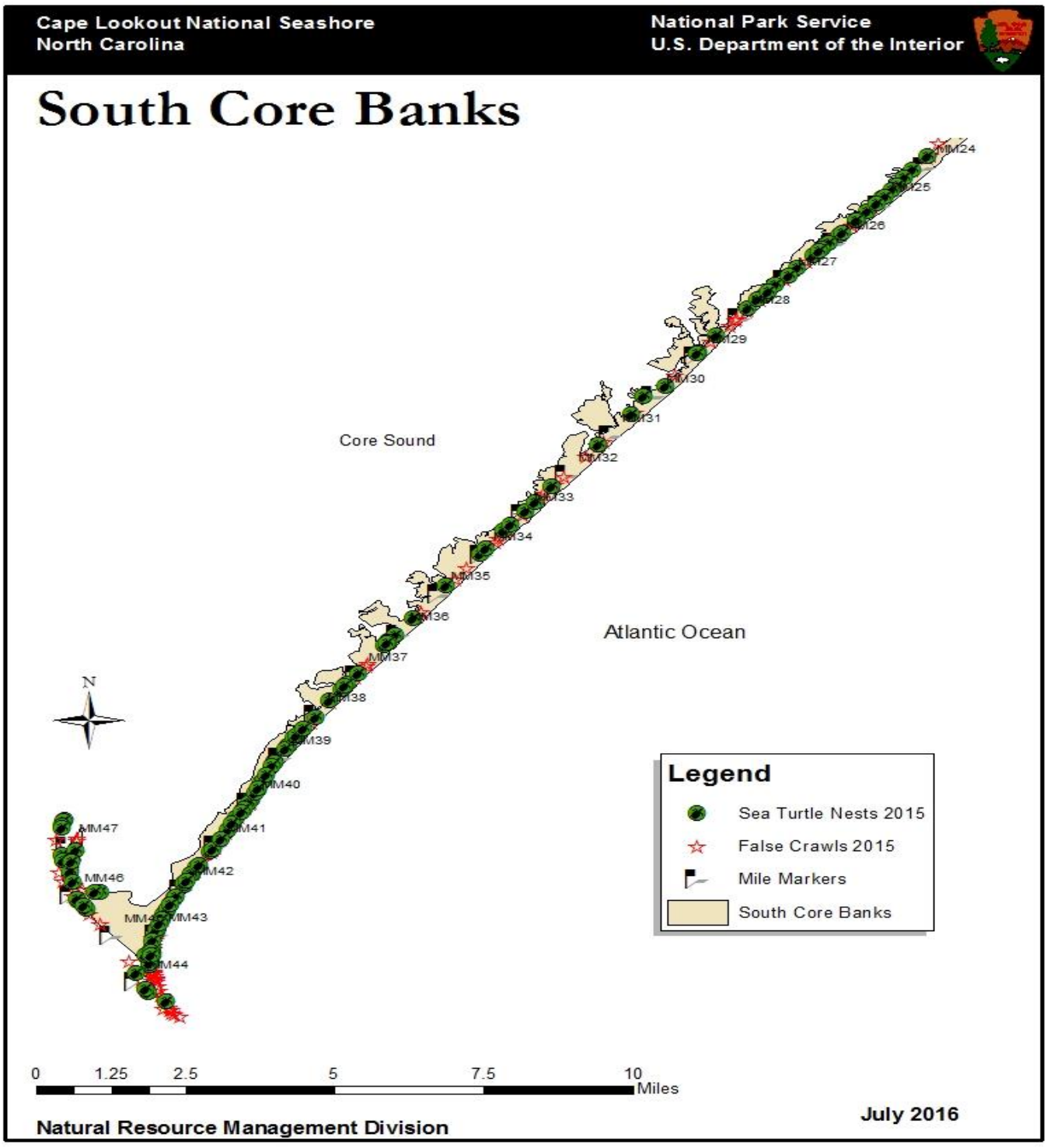

Figure 9. 2015 Shackleford Banks Sea Turtle Activities.