

CAPE LOOKOUT NATIONAL SEASHORE

2008 SEA TURTLE MONITORING AND MANAGEMENT REPORT



*A green sea turtle nest crawl on Shackleford Banks.*

NPS Photo 2008

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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 (*Dermochelyes coriacea*) and green (*Chelonia mydas*) sea turtles. Each year data have been collected, analyzed, and presented to management in hopes of better protecting our marine turtle population. This report will summarize the 2008 project, consolidate many years of data and make recommendations for management of these federally protected species. 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 park is currently divided into five barrier islands. The northernmost island, North Core Banks (NCB) is approximately 19 miles long, extending from Ocracoke Inlet to Old Drum Inlet. From Old Drum Inlet to New Drum Inlet is a 3-mile long island of land formerly connected to NCB known unofficially as Middle Core Banks (MCB). In 2005 an inlet formed during Hurricane Ophelia creating a  $\frac{3}{4}$  mile long island south of New Drum Inlet known as Ophelia Island. South Core Banks (SCB) extends southward from Ophelia Inlet almost 25 miles to Barden Inlet. The Core Banks have a northeast to southwest orientation and exhibit a low profile landscape. The fifth island, Shackleford Banks (SH) 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**

Three of the five islands comprising the Seashore were regularly monitored for turtle nesting activity. The area between Old Drum Inlet and Ophelia Inlet was not accessible by vehicle and was only monitored irregularly from May-August. Student Conservation Association interns and NPS staff patrolled NCB and SCB daily beginning May 1 to September 15 for nesting activity. Each patrol began early in the morning so that the island was checked for turtle activity by 12:00 PM. Shackleford Banks was monitored twice a week. For detailed information on procedures used in the 2008 Sea Turtle Program refer to Appendix III.

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. In 2008, nests laid in locations likely to repeated flooding were relocated to a higher elevation on the primary dune. Relocated nests were moved into 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. Camping and campfires were not permitted in the closures to prevent disturbance of hatchlings by artificial lights.

Nests relocated onto the primary dunes and into beach closures may introduce factors that increase egg and hatchling mortality. Sea oats (*Uniola paniculata*) are dominant on the primary dunes and their roots invade the nest. Hatchlings that emerge from nests located high on the primary dunes may be exposed to mainland lights and may travel toward the lights away from the ocean. Records were therefore kept of hatchlings entangled in roots and eggs destroyed by roots in the egg chamber. Hatchling tracks that were observed to go away from the ocean were also noted. Finally, relocating nests into a single beach closure increases the risk of a large loss due to storms, pathogens, or predation. Any sign of predation was 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 nests between the lighthouse and Power Squadron Spit, the area with the most problems from raccoons in the past. Nests and digs were monitored for hatching activity through November. Nests were excavated after hatching to

determine nest success. Digs were treated as nests through the nesting and hatching time frame. If the dig hatched it was added to the nest category and if it failed to show hatching activity after 75 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 (See Appendix I, Attachment 7).

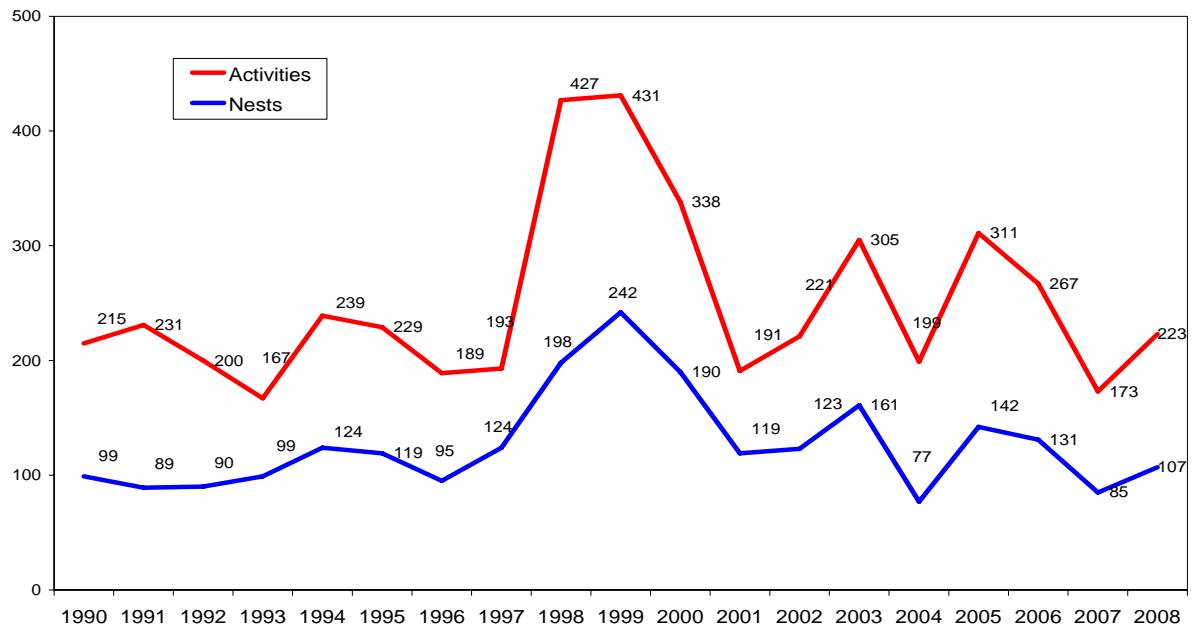
### *NESTING RESULTS*

The first recorded nesting activity in 2008 was on May 26 and the last on August 22, for an 88 day nesting season. A total of 223 activities were documented of which there were 107 nests and 116 crawls, (Table 1; see Appendix III for activity definitions). Two sea turtle species nested in the park with a total of 100 loggerhead turtle nests and 7 green turtle nests.

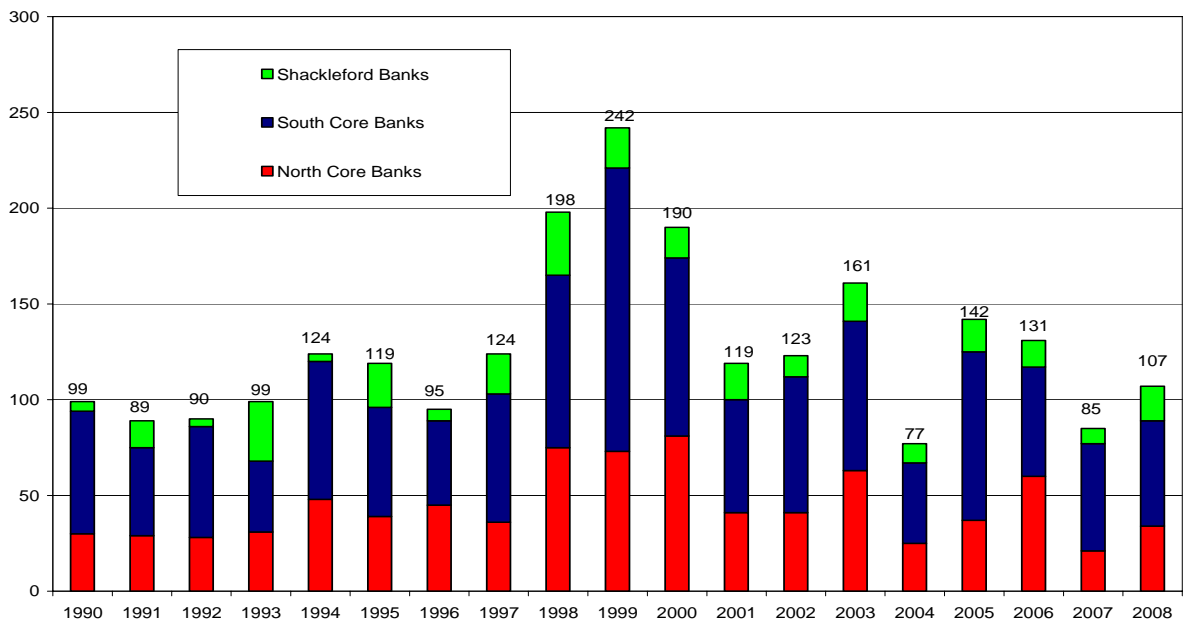
Table 1. 2008 ACTIVITIES BY STUDY AREA

	North Core Banks	South Core Banks	Shackleford Banks	CALO Total
NESTS	34	55	18	107
CRAWLS	59	48	9	116

**Figure 1. Cape Lookout Turtle Activities 1990-2008**



**Figure 2. Turtle Nests 1990-2008**



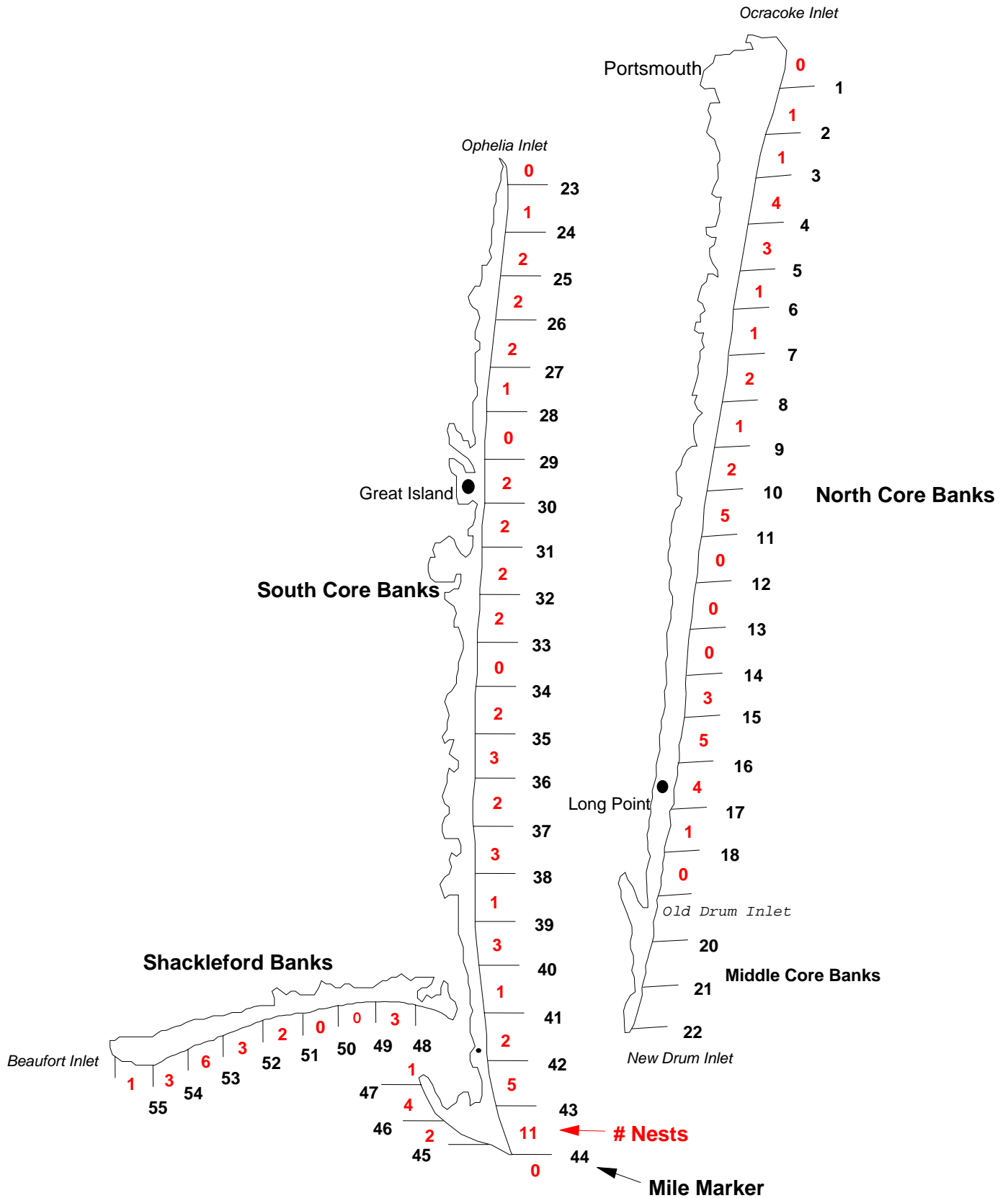


The number of nests found in 2008 (107 nests) was below the annual average for CALO (127 nests) (Fig. 1 and 2). South Core Banks continued to have more nests than the other islands in 2008. Though nesting on SCB was spread out there was a higher occurrence of nests south of the lighthouse between mile 41 and 44, 18 nests (Fig. 3). The green turtle nesting locations and intervals suggest two nesting females (Table 2).

Table 2. Green Turtle Nesting Intervals

Date	Activity Type	Island
June 22	Nest	SB
July 5	Nest	SB
July 18	Nest	SCB
July 26	Nest	SB
August 6	Nest	SB
August 18	Nest	SB
August 22	Nest	SCB

# Figure 3. 2008 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, often it can be determined if predators, human disturbance or environmental occurrences have adversely affected a nest. Individual nest data are in Appendix II.

The hatching results are first reported here as a combination of all species. The results by species are presented later in the report. Nest hatching began on August 2<sup>nd</sup> and ended on November 2<sup>nd</sup>, for a 92 day nest hatching period. The last nests were excavated on November 6<sup>th</sup>. A known total of 11,063 eggs, 7257 hatchlings, and 389 hatched dead were counted. The total hatch success, number of total eggs divided by number of total hatchlings, was 66%. The total emergence success of 62% (6868 emerged) was calculated by subtracting the total hatched dead from the total hatchlings and dividing by the total of eggs (Table 3). This is the same calculation for each individual nest emergence success (Appendix III, Attachment 3). The emergence success range was from 0% to 99%. The average clutch size was 111 eggs. It took an average of 60 days for nests to incubate. Eight nests were washed away with the numbers of eggs unknown. One nest on SCB was destroyed by raccoon predation with the number of eggs unknown and eight other nests suffered minor raccoon predation. On NCB one nest suffered some raccoon predation. A total of 60 nests were over-washed by the ocean, 41 nest from one to three days and 19 nests four times or more. Forty three of these 60 nests hatched. The emergence success for these 60 flooded nests was 44%.

Table 3. SEA TURTLE HATCH SUMMARY 1990-2008

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%

\*emergence success for nests with known egg and hatch totals

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

Calculating a true emergence success for the year always proves to be difficult. Raccoons may dig into a nest at hatching making it impossible to know how many turtles escaped from the nest.

A nest may be washed away that wasn't relocated, thus an emergence success of zero is known but the original number of eggs laid is not known. The emergence success reported is for those nests in which the number of eggs laid and the number of emerged turtles is known.

In order to account for the nine nests lost with unknown egg counts we have calculated an estimated

emergence success of 57% in 2008 (Table 3). This figure includes eight nests with unknown egg numbers that were lost to erosion before hatching and 1 nest that was lost to predation. The average clutch size for each island was given to those nests as the number of eggs, allowing them to be calculated into the estimated emergence success. The seashore total of nine lost nests at an average clutch of 111 equals 999 eggs with 0% emerge success (Table 4).

Table 4. 2008 ACTIVITY SUMMARY BY STUDY AREA

	NCB	SCB	SH	TOTALS
NESTS	34	55	18	107
# KNOWN EGGS	3585	5785	1693	11063
AVERAGE CLUTCH	109 eggs	113 eggs	113 eggs	111 eggs
EMERGE SUCCESS	64%	58%	72%	62%
ESTIMATED TOTAL EMERGENCE SUCCESS (including nests with unknown /averaged {888} egg totals)	62%	52%	60%	57%
AVERAGE INCUBATION	61 days	60 days	59 days	60 days
# LOST TO FLOODING	1	4	3	8
# LOST TO PREDATORS	0	1	0	1

In 2008, 30% of the nests were relocated. The emergence rate for relocated nests was 57% and the emergence rate for non-relocated nests was 64% (Table 5). The estimated emergence success for non-relocated nests was 57% which accounts for the nine nests lost to erosion and predation.

Table 5. EMERGENCE SUCCESS OF RELOCATED VS. NON-RELOCATED NESTS BY STUDY AREA IN 2008

<i>RELOCATED</i>	NCB	SCB	SH	CALO Total
Nests	13	19	0	32 (30%)
Eggs	1329	2259	n/a	3588
Hatchlings	516	1659	n/a	2175
# Hatch Dead	23	92	n/a	115
Emergence Rate	37%	69%	n/a	57%
<i>NON-RELOCATED</i>				
Nests	21	36	18	75 (70%)
Eggs	2256	3526	1693	7475
Hatchlings	1852	1918	1312	5082
# Hatch Dead	34	141	99	274
Emergence Rate	80%	50%	72%	64%
Estimated Total Emergence Rate	77%	43%	60%	57%

Since 1990 the average emergence success has been slightly better for non-relocated nests by one percentage point (Table 6). However the estimated emergence rate of non-relocated nests, which accounts for erosion lost nests, is lower on average than relocated nest by eight percentage points.

#### *Predation*

In 2008, one nest was completely lost to predators. This nest was dug into by raccoons either before hatch or during hatching. This predation incident was a total loss and no reliable data could be gathered. This incident occurred on SCB south of the lighthouse at mile 43.41. Eight other nests on SCB and one nest on NCB suffered some raccoon predation. Twelve nests suffered minor ghost crab predation in the seashore.

Table 6. 1990-2008 EMERGENCE SUCCESS FOR RELOCATED  
vs. NON-RELOCATED NESTS

YEAR	PERCENT OF NESTS RELOCATED	EMERGENCE RATE-RELOCATED	EMERGENCE RATE-NON RELOCATED*	% 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
<i>AVERAGES</i>	52	66%	67% (58%)	96

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

Two nests had roots in the egg chamber that destroyed eggs or trapped hatchlings. Sand deposition partially buried one nest and along with flooding may have prevented hatching. Hatchlings from one nest on SCB south of the lighthouse appeared disorientated and crawled north parallel to the shore for 0.41 mile. Some tracks eventually did turn to the ocean. Hatchlings from nest activity 13 at mile 24.01 appeared disoriented from lights from the mainland as the majority of hatchling tracks went toward the soundside. The nest was on a low dune surrounded by washover passes with little to block the glow from the towns across the Core Sound.

### *Hatch Results by Species*

The 100 loggerhead and seven green turtle emergence success was 61% and 74%, respectively (Table 7.). Green turtle nests accounted for 6 % of total sea turtle nests. Two green nests were on South Core Banks and five were on Shackleford Banks. Five of the seven green nests hatched. Two were lost to erosion/ storm flooding. The green turtle incubation range was from 55 to 66 days with an average of 62 days.

Table 7. Loggerhead and Green Sea Turtle Hatch Summary, 2008.

	Loggerhead	Green
NESTS	100	7
# EGGS	10243	669
# HATCHLINGS	6535	573
# HATCH DEAD	315	74
EMERGENCE SUCCESS	61%	74%
AVERAGE CLUTCH	109 eggs	133 eggs
AVERAGE INCUBATION	60 days	62 days

### *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. Fifteen violations of vehicle closures for turtle nests were documented by park staff for the seashore. These vehicles drove between posts and the ocean at low tides or drove through posts and rope.



## DISCUSSION

An objective of the *Recovery Plan for U.S. Population of Loggerhead Turtle* is to implement nest protection measures "to ensure (a) greater than 60 percent hatch rate." This should be done using the "least manipulative method ... to avoid interfering with known or unknown biological processes."

Tidal flooding continues to be a threat to nesting success at CALO due to a low beach profile.

Nest relocation is the primary management tool used to enhance hatching success in the park. In 2008, park staff relocated 32 nests that were threatened with repeated flooding or erosion. The remaining 75 nests were laid high on the beach or on the dunes. The nesting and hatching season spanned from May 26<sup>th</sup> to November 2<sup>nd</sup>, 160 days. While the nesting and hatching season was free of major storm impacts, there were 8 nests were lost to tropical systems. These included Hurricane Bertha, Hurricane Kyle, and Hurricane Hanna that produced swell and high tides along the banks. Despite these nests losses the seashore provided for a 64% hatch rate and a 61% emergence rate for loggerheads to achieve this recovery plan objective. Interestingly non-relocated nests had a higher emergence rate (64%) than relocated nests (57%) in 2008. In addition the long term trend shows a slightly higher emergence rate for non-relocated nests (67%) than relocated nests (66%).

Research in other parts of the loggerhead turtle's nesting range has found benefits from some tidal inundation of nests. Cooler temperatures may produce more male hatchlings and the hatchlings may be more likely to survive. In order to study these findings in North Carolina and CALO we began a study in 2007 in cooperation with NCWRC to measure sand temperature, nest temperatures and sex ratios of hatchlings. In 2008 ten HOBO temperature data loggers were placed on Shackleford, South

Core Banks, and North Core Banks in May to record sand temperatures throughout the nesting season. Thirty seven nests received HOBO temperature data loggers. Both relocated and non-relocated nests on NCB, SCB, and SB received one data logger in the nest and one in the sand three feet away. We plan to repeat this in the 2009 sea turtle nesting season and then to report on the results.

### **US Fish and Wildlife Service Biological Opinion**

The USFWS provided CALO a biological opinion that included two performance measures on sea turtles for the Interim Protected Species Management Plan. We met the sea turtle false crawl to nest ratio is less than or equal to 1:1 (annually) requirement. In 2008 there were 116 false crawls and 107 nests for a ratio of 1.08:1. 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 649 nests for the previous five years in North Carolina. In 2008 CALO had 16% of the state's total sea turtle nests for the last five years.

### **STRANDINGS**

Collecting information from stranded turtles is also an important phase of the CALO Sea Turtle Monitoring Program. Research has indicated that sea turtle population stability is much more sensitive to change in the large juvenile stage (subadult) than in earlier stages. The key to improving the outlook for this population lies in reducing mortality in large juveniles. 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.

One Hundred forty nine strandings occurred at CALO in 2008. All strandings were reported to the NCWRC and were documented with a “Sea Turtle Stranding and Salvage Network” stranding report. Juvenile green turtles accounted for the majority of the strandings (116). There were also 29 loggerhead turtles, two Kemp's Ridleys, and three unknown. Two cold stun events in the Cape Lookout Bight accounted for over half of the strandings. One Cold stun event from 1/7/08 to 1/15/08 accounted for 48 strandings. The second event from 11/19/08 to 11/28/08 produced 28 strandings. One hundred fourteen (76%) of the strandings were found on the soundside of the islands, the remaining 35 (24%) on the ocean beach.

Thirty eight live sea turtle strandings occurred in the park in 2008. They all appeared cold stunned. They were both greens and loggerheads and were transported out of the park and sent to the Topsail Turtle Hospital or the Pine Knolls Shore NC Aquarium.

Turtles were scanned for Passive Integrated Transponder (PIT) tags. PIT tags or metal tags were found in one green turtle and one loggerhead (Table 8). All or parts of some turtles were salvaged for NOAA Fisheries researchers. Tables 9 and 10 provide stranding data by island and species from 1990 to 2007.

Table 8. TAGGED SEA TURTLES FOUND AT CALO IN 2008

Stranding #	Species	Date Found	Island	Metal Tags #	PIT tag #
08-07	Green	1-07-08	SCB	TTX 684	4850497906
08-19	Loggerhead	1-07-08	SCB	TTX 719, TTX 718	48574F311D
08-72	Loggerhead	5-24-08	SCB	RRS 020	unknown
08-84	Loggerhead	6-20-08	SCB	RRS 844	4525712B64

Table 9. CALO SEA TURTLE STRANDINGS 1990 – 2008

YEAR	NCB	SCB	SHACK	OTHER	TOTAL
1990	11	18	14		43
1991	8	8	4		20
1992	18	16	10	1	45
1993	18	12	10	3	43
1994	22	27	12	1	62
1995	11	23	9		43
1996	29	33	29		91
1997	21	18	17	1	57
1998	20	21	20	2	63
1999	21	58	14	1	94
2000	28	47	24	2	102
2001	30	24	10		64
2002	13	38	19	1	71
2003	13	30	21		64
2004	20	39	18	1	78
2005	15	35	21		71
2006	14	26	20	1	61
2007	14	34	14	2	64
2008	22	110	16	2	149

Table 10. CALO TURTLE STRANDINGS BY SPECIES 1990-2008

YEAR	LOGGERHEAD	GREEN	KEMP'S RIDLEY	LEATHERBACK	HAWKSBILL	UNKNOWN
1990	33	7	1	2	0	0
1992	30	13	1	1	0	0
1993	29	6	5	2	0	1
1994	30	24	5	2	0	1
1995	27	7	6	1	0	2
1996	63	21	4	3	0	0
1997	49	1	7	0	0	0
1998	43	8	12	0	0	0
1999	36	41	15	2	0	0
2000	46	40	11	4	0	1
2001	38	15	9	2	0	0
2002	33	26	5	7	0	0
2003	44	9	7	2	1	1
2004	45	28	4	1	0	0
2005	37	21	6	0	2	5
2006	35	16	8	0	0	2
2007	19	38	1	0	0	6
2008	29	116	2	0	0	3

## **MANAGEMENT RECOMMENDATIONS**

1. CALO should continue to use the US Fish and Wildlife Service's Index Beach standards for conducting sea turtle monitoring to provide data comparable to previous nesting seasons.
2. The park should continue their relocation standards of moving nests that the monitoring staff believes are likely to be flooded repeatedly.
3. Evaluate established nest relocation areas before nesting season in April to determine suitability and nest relocation options.
4. All park staff and volunteers involved with turtle monitoring should be given complete training in current monitoring procedures.
5. Educational efforts should continue to be directed toward park visitors to prevent inadvertent disturbance to nesting females, eggs, and hatchlings. This should include posted signs, site bulletins, and interpretive programs to include nest excavations. The park should to continue to cooperate with the North Carolina Maritime Museum to educate visitors about sea turtles.
6. Continue sand and nest temperature study in cooperation with North Carolina Wildlife Resource Commission for the complete nesting seasons of 2009.

APPENDIX I  
2008 INDIVIDUAL NEST DATA

Table 11. North Core Banks Sea Turtle Nesting Data-2008

#	Date	Mile	Relocated Mile	Hatch Date	Incubation	# Eggs	# Hatchlings	# hatch dead	% Emerge	Comments
2	30-May	15.84		5-Aug	67	122	102	13	73	hobos collected and 3 hatchlings
7	6-Jun	10.48		12-Aug	67	122	115	0	94	ghost crab predation 8/6 & 8/12
8	14-Jun	14.54		19-Aug	66	121	110	0	91	flooded by tide 8/15 & 8/17
11	14-Jun	3.45		15-Aug	62	118	112	0	95	
14	16-Jun	7.09		15-Aug	60	143	128	0	90	flooded 7/13; Hatch on 8/15 - many went backwards to dunes
15	16-Jun	3.95		13-Aug	58	121	118	1	97	flooded 7/13 & 7/14
17	18-Jun	15.63		19-Aug	62	111	108	2	95	
27	21-Jun	14.03		23-Aug	63	85	61	0	72	flooded 7/13 & 7/14
30	22-Jun	15.55		19-Aug	58	116	108	0	93	
32	22-Jun	9.9		25-Aug	64	118	102	5	82	8/28 nest cavity discovered saturated upon excavation, sand on hatchlings & eggs very heavy
36	23-Jun	7.71		26-Aug	64	90	87	6	90	8/26 raccoon predation, eggshells & hatchling tracks all over beach, 1 dead hatchling on nest cavity
40	26-Jun	4.28	5.29	n/a		127	0	0	0	Nest flooded on 7/2,7/7,7/8, 7/11,7/13,7/14,7/15, 9/2; on 7/30 nest was relocated due to beach erosion in front of site - nest cavity was exposed.
41	28-Jun	16.04	15.79	31-Aug	64	90	87	0	97	flooded 9/2 - Hanna
44	2-Jul	4.92		31-Aug	60	136	121	1	88	
47	3-Jul	16.1		unk		94	91	0	97	
49	3-Jul	5.58		31-Aug	59	83	81	0	98	flooded 7/13, 9/1 & 9/2; many hatchlings went wrong way (raccoon tracks everywhere)
50	4-Jul	15.88	16.1	unk		120	44	1	36	
51	5-Jul	16.88		2-Sep	59	128	87	0	68	

#	Date	Mile	Relocated Mile	Hatch Date	Incubation	# Eggs	# Hatchlings	# hatch dead	% Emerge	Comments
52	5-Jul	3.85		unk		111	107	1	95	water pooled on nest 9/1 & 9/2 (Hanna)
53	7-Jul	16.95	15.67	31-Aug	55	108	107	4	95	9/2 ghost crab predation
55	8-Jul	9.27	11.35	8-Sep	62	107	96	0	93	
56	8-Jul	6.07	5.31	2-Sep	56	122	99	18	66	flooded 9/2 & 9/3 - Hanna
58	11-Jul	4.51	5.26	n/a		125	0	0	0	flooded 9/1,9/2&9/3 - Hanna
62	13-Jul	10.78		n/a		120	0	0	0	flooded 9/1&9/3 - Hanna, and 9/25
65	14-Jul	17.06		unk		135	126	4	90	
69	16-Jul	3.95	5.26			17	0	0	0	ghost crab predation on date nest laid - eggshells on top of body pit, nest cavity laid down in water table with only 17 eggs laid - 16 of which had been predated by ghost crabs. Flooded 9/1,9/2&9/3 - Hanna
71	19-Jul	14.22		15-Sep	58	107	18	1	16	roots penetrated nest
72	19-Jul	10.43		unk		unk				flooded 9/1&9/2, by 9/7 PVC posts & screen washed out as well as sand HOB0 - nest lost on 9/7 to storm
74	21-Jul	15.66		unk		75	70	0	93	
80	22-Jul	10.93	11.28	18-Sep	58	85	83	0	98	8-15 ghost crab predation
83	25-Jul	2.98	5.22	n/a		153	0	0	0	flooded 9/1,9/2&9/3 - Hanna
89	8-Aug	8.2	10.44	n/a		102	0	0	0	flooded 9/1&9/2 -Hanna, over washed on 9/25 & 9/29
91	11-Aug	1.15	5.04	n/a		75	0	0	0	flooded 9/1&9/2 -Hanna, over washed on 9/25 & 9/29
93	22-Aug	10.82	10.75	n/a		98	0	0	0	8/29 ORV ran over PVC but not directly over nest cavity; 9/1&9/2 flooded - Hanna, flooded 9/25 and 9/29



Table 12. South Core Banks Sea Turtle Nesting Data-2008

#	Date	Mile	Relocated Mile	Hatch Date	Incubation	# Eggs	# Hatchlings	# hatch dead	% Emerge	Comments
1	26-May	41.89	42.41	6-Aug	72	132	126	0	95	Hatchlings traveled north towards lighthouse some traveled outside enclosure. (North) 3 crawled north to mile 42, then turned to ocean
3	30-May	39.18		2-Aug	64	117	63	16	86	Ghost crab predation and raccoon on 8/2, 8/3, overwashed on 7/13, 7/19
4	31-May	23.36		2-Aug	63	138	106	0	77	
8	4-Jun	32.89	35.24	9-Aug	66	112	104	0	93	Some eggs shells have yolk stains; early ghost crab predation?
10	8-Jun	43.27	42.26	8-Aug	61	155	137	9	83	8/18 raccoon and seagulls tore open excavated nest photographed.
12	10-Jun	30.94	35.95	11-Aug	62	109	104	0	95	8/11 Raccoons dug into nest few eggs shells found. No turtle tracks found; 8/12 small depression; 8/14 number of hatched unknown due to rain.
13	11-Jun	24.02		6-Aug	56	123	115	0	93	Most hatchlings crawled towards sound. Some found dead dried out by the sun. Some predated by crabs in dunes. Approx 12-15 eventually crawled to ocean.
14	12-Jun	31.37		12-Aug	61	100	65	2	63	overwashed 7/11, 7/13, 7/15, 7/19, 8/4, 8/5, 8/15/12 major hatch,
16	12-Jun	42.51		14-Aug	63	122	115	0	94	No tracks ever exit nest: high tides and rain washed evidence away daily/nightly
#	Date	Mile	Relocated	Hatch	Incubation	#	#	# hatch	%	Comments

			Mile	Date		Eggs	Hatchlings	dead	Emerge	
17	13-Jun	35.16		13-Aug	61	121	51	0	42	High tides pooled over nest multiple times 7/13, 7/15, 7/19, 7/20, 8/15, 8/18; Ghost crab predation on 8/16, 8/18
18	13-Jun	35.33		14-Aug	62	131	94	0	72	Overwash-7/11, 7/13, 7/19, 7/20; GC predation-8/16, and raccoon predation 8/18
19	14-Jun	42.9	42.21	14-Aug	61	136	114	1	83	8/14 major depression, raccoon predation 8/16
20	15-Jun	35.74	35.74	16-Aug	62	106	96	0	91	Embryonic development of unhatched eggs=nothing; Tire tracks running over nest: no damage to eggs, GC predation 8/18
21	16-Jun	45.97	42.94	20-Aug	65	115	87	0	76	Overwashed; raccoon track at nest 8/20, 8/23, overwashed 7/13, 7/19, 8/15, 8/16, 8/17
24	17-Jun	26.26		14-Aug	58	124	118	0	95	Slight depression 8/8. One hatchling found dead near nest. No wounds. Evidence of raccoons digging around nest.
25	21-Jun	42.58	42.18	24-Aug	64	93	80	0	86	8/23 raccoon tracks around nest
26	22-Jun	34.35		22-Aug	61	53	10	0	19	Flooded 5 days, ghost crab predation 5 hatchlings. GC predation 8/20, 8/22, 8/23
27	23-Jun	45.27		18-Aug	56	141	21	0	15	P.E. moved over nesting site (3ft.off) 8/10-1 hatchling

#	Date	Mile	Relocated Mile	Hatch Date	Incubation	# Eggs	# Hatchlings	# hatch dead	% Emerge	Comments
28	23-Jun	29.13		24-Aug	62	95	17	2	16	overwashed daily 7/11-12, 7/19-21, 8/4
37	24-Jun	41.41		21-Aug	58	137	117	0	85	GC predation on 8/22
38	25-Jun	25.68		21-Aug	57	122	121	0	99	
39	27-Jun	43.24		23-Aug	57	137	4	2	1	Majority of eggs=No to little development loggerhead, overwash 7/11, 7/13, 7/19, 8/15-16, 8/22, 8/24-8/27
40	28-Jun	46.94		unk		138	18	0	13	No development in majority of unhatched eggs; overwash 7/12, 8/1-3, 8/16-17, 9/1
41	28-Jun	47.15		n/a		85	0	0	0	eggs underground in a pool of water no development, overwash 8/1-3, 8/16-17, 9/1
43	29-Jun	43.41		n/a		unk	0	0	0	Excavated eggs found less than 50% egg shells (10); Ghost crab and raccoons got to them.
45	30-Jun	43.08		unk		38	10	0	26	overwash 7/13, 7/19, 8/15-16, 8/22-24, 8/31, 9/1, 9/28/22 raccoon tracks around nest; 9/1 buried 1 ft under sand overwashed by extremely high tide,
47	1-Jul	31.83		unk		126	9	7	2	8/24 ATV tracks in closure and run behind nest, overwash-- 7/13, 7/19, 8/16
51	4-Jul	43.28	43.29	n/a		89	0	0	0	Raccoon destroyed 77 eggs, relocated 12 eggs left to clean sand on 7/4, 9/8 nest buried 1ft deep in sand. 7 unhatched eggs with no development. Ghost crab den directly on eggs. 1 piece of an egg found.
52	6-Jul	37.43		unk		99	20	7	13	overwash- 7/11, 7/13, 7/15, 7/19, 7/20, 8/15, 8/18, 9/1, 9/2

53	9-Jul	36.99		unk		80	69	70	0	one spacer egg, overwash 9/1
54	9-Jul	42.6		unk		102	98	1	95	8/23 raccoon tracks around nest; 9/13; 9/8 raccoon tracks around nest.
56	10-Jul	43.26		unk		145	139	0	96	9/10 eggs pulled out of nest by raccoon/ghost crab under cage in area. 9/9 raccoons dug under front of cage near
58	13-Jul	37.84		8-Sep	57	96	93	0	97	overwash on 9/1, 9/2. 9/9 1 hatchling found in sand pile that raccoons made after digging into the nest. Released! Unhatched eggs:2=no development and 1=dead fetus,
61	13-Jul	40.56		unk		123	1	1	0	overwash- 9/1-2, 9/7, 9/7 buried from Hurricane Hannah (1ft Approx)
64	14-Jul	46.59		n/a		unk	0	0	0	overwash-- 8/1-4, 8/16-18, 8/22-9/2 lost to storm erosion ;8/28 ghost crab hole in fenced in turtle nest
69	15-Jul	24.66		8-Sep	55	111	109	11	88	overwash- 9/7-9, 9/8 3 hatchlings found in 3ft sand covering nest; 9/9 covered with sand again; 9/10 crab hole in caged area
70	17-Jul	39.49		unk		unk	0	0	0	overwash- 7/19, 8/15, 9/1-2, 9/7. found 8 eggs under packed shell hash layer. Did top of nest get washed away?
72	18-Jul	27.63		11-Sep	55	88	72	0	82	confirmed green
73	18-Jul	43.69	43.44	13-Sep	57	130	127	0	98	overwash- 9/7, 9/12 ghost crab hole directly in nest. No new turtle tracks.
76	20-Jul	43.86		unk		116	3	0	2	overwash-9/1-2, 9/18
77	23-Jul	36.86	36.48	unk		149	146	0	98	GC predation-7/23

78	24-Jul	43.25		unk		125	18	0	14	overwash 8/15, 8/24, 9/1-9/7, 9/7 buried in 2 ft sand from Hannah; 9/22 nest uncovered, 18 hatchlings released
79	25-Jul	34.6	35.18	18-Sep	55	122	111	0	91	overwash 9/1-9/2, 9/7 high tide line up to nest
80	27-Jul	30.11	35.2	unk		114	4	0	4	overwash 9/1-2, 9/18
83	28-Jul	25.59		unk		119	118	1	98	overwash 9/18
84	29-Jul	39.82		n/a		unk			0	lost to erosion on 9/18, overwash 9/1-2, 9/7
86	30-Jul	43.84	42.24	unk		138	122	64	43	overwash 9/1, 8/23 raccoon tracks around cage, GC hole in cage on 10/1
89	1-Aug	46.02	42.11	unk		85	82	9	86	overwash on 9/18 and GC hole on 10/1
92	4-Aug	26.27	26.97	1-Oct	58	111	96	0	86	overwash on 9/18 and GC predation on 8/4
94	7-Aug	43.51	42.16	unk		138	28	9	14	overwash 9/1-2, 9/18 (sand deposition)
99	9-Aug	32.26	35.28	1-Oct	53	110	94	0	85	overwash 9/7, 9/18, GC predation 10/1, raccoon predation 10/2
100	9-Aug	29.04		unk		127	4	0	3	overwash 9/18
101	14-Aug	37.84	36.39	unk		115	1	0	1	overwash 9/18, 10/26, 10/27
102	22-Aug	46.47		n/a		unk			0	9/7 beach eroded (+/-) 50ft hurricane Hanna; shear cliff developed; everything completely gone
103	22-Aug	38.93		unk		147	120	21	67	CM,overwash on 9/18

Table 13. Shackleford Banks Sea Turtle Nesting Data-2008

#	Date	Mile	Relocated Mile	Hatch Date	Incubation	# Eggs	# Hatchlings	# hatch dead	% Emerge	Comments
3	12-Jun	54.54		7-Aug	56	45	40	0	89	Raccoon tracks at nest; flooded 6/30
5	12-Jun	48.06		n/a		119	0	0	0	flooded by tide 8/1
6	15-Jun	54.52		unk		unk	2	0	unk	flooded on 6/30, 7/1, 7/3 erosion exposed nest & eggs-recovered with sand ; 8/21 2 hatched eggs found, other eggs missing - presumed lost to erosion
8	19-Jun	55.04		14-Aug	56	140	110	2	77	
9	22-Jun	53.21		27-Aug	66	141	137	1	96	CM
10	1-Jul	54.06		28-Aug	58	92	87	0	95	
11	2-Jul	53.15		unk	unk	91	60	0	66	flooded by tide 9/1 & 9/2; 1' sand deposition 9/2
12	2-Jul	51.73		28-Aug	57	127	125	4	95	
13	5-Jul	53.27		unk	unk	139	110	52	42	CM; flooded by tide 9/1 & 9/2
14	16-Jul	48.36		1-Sep	47	106	83	0	78	roots and ants in nest
15	14-Jul	51.32		unk		100	66	39	27	flooded on 9/26
16	17-Jul	53.31		unk		151	149	0	99	flooded on 9/26, CM, body pit, crawl, and nest depth
18	1-Aug	48.38		1-Oct	61	95	93	0	98	
19	26-Jul	52.95		n/a						CM; flooded by tide 9/2, lost to storm erosion on 9/26
22	6-Aug	53.25		n/a						CM; flooded by tide 9/2, lost to erosion on 9/26
25	7-Aug	52.69		1-Oct	55	94	89	0	95	flooded by tide 9/2, 9/26
26	18-Aug	53.86		21-Oct	64	154	134	0	87	CM
27	21-Aug	52.28		2-Nov	73	99	27	1	27	flooded by tide 9/1, 9/2, 9/26

APPENDIX II  
2008 GIS SEA TURTLE ACTIVITY MAPS

Figure 4. 2008 North Core Banks Sea Turtle Activities.

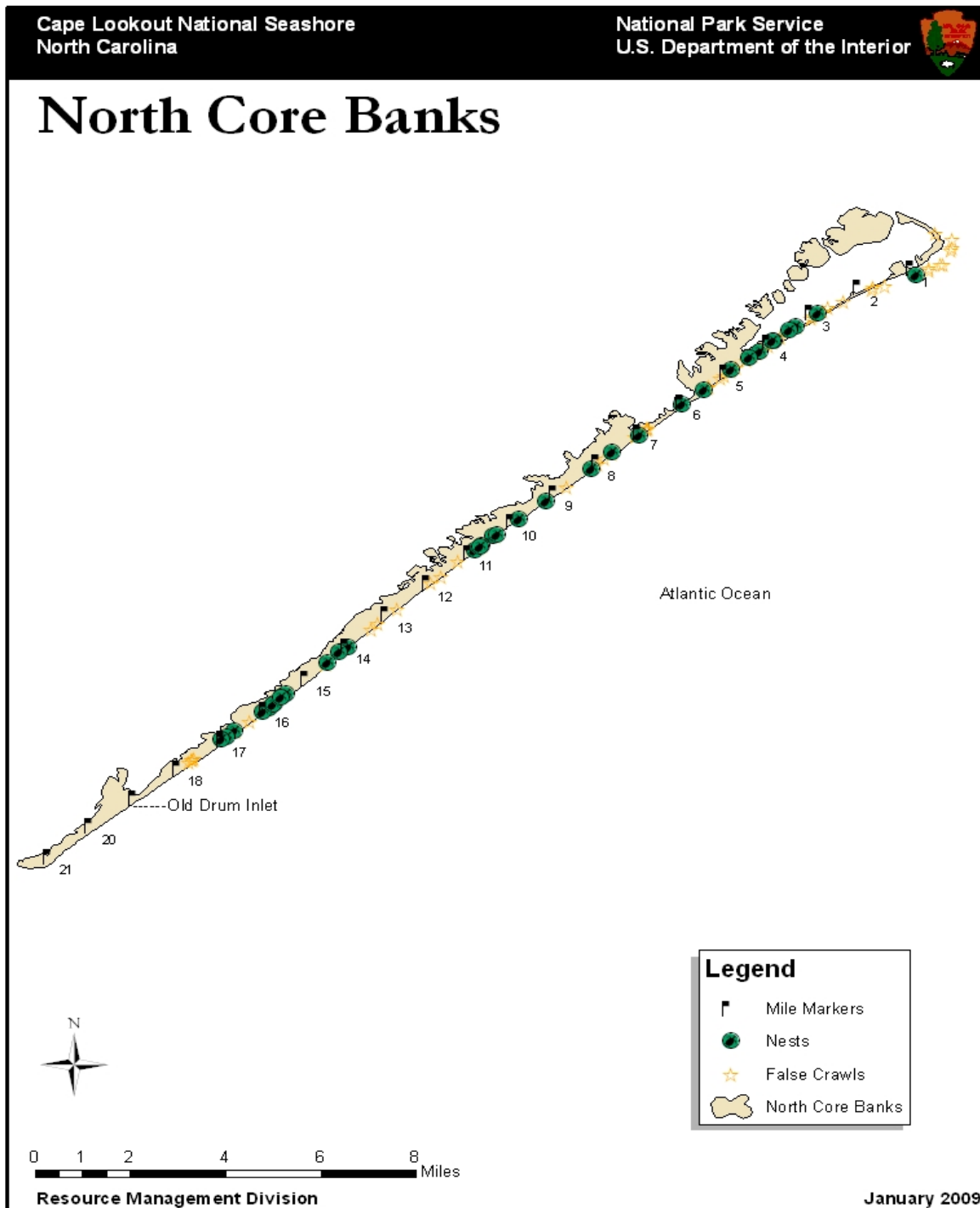
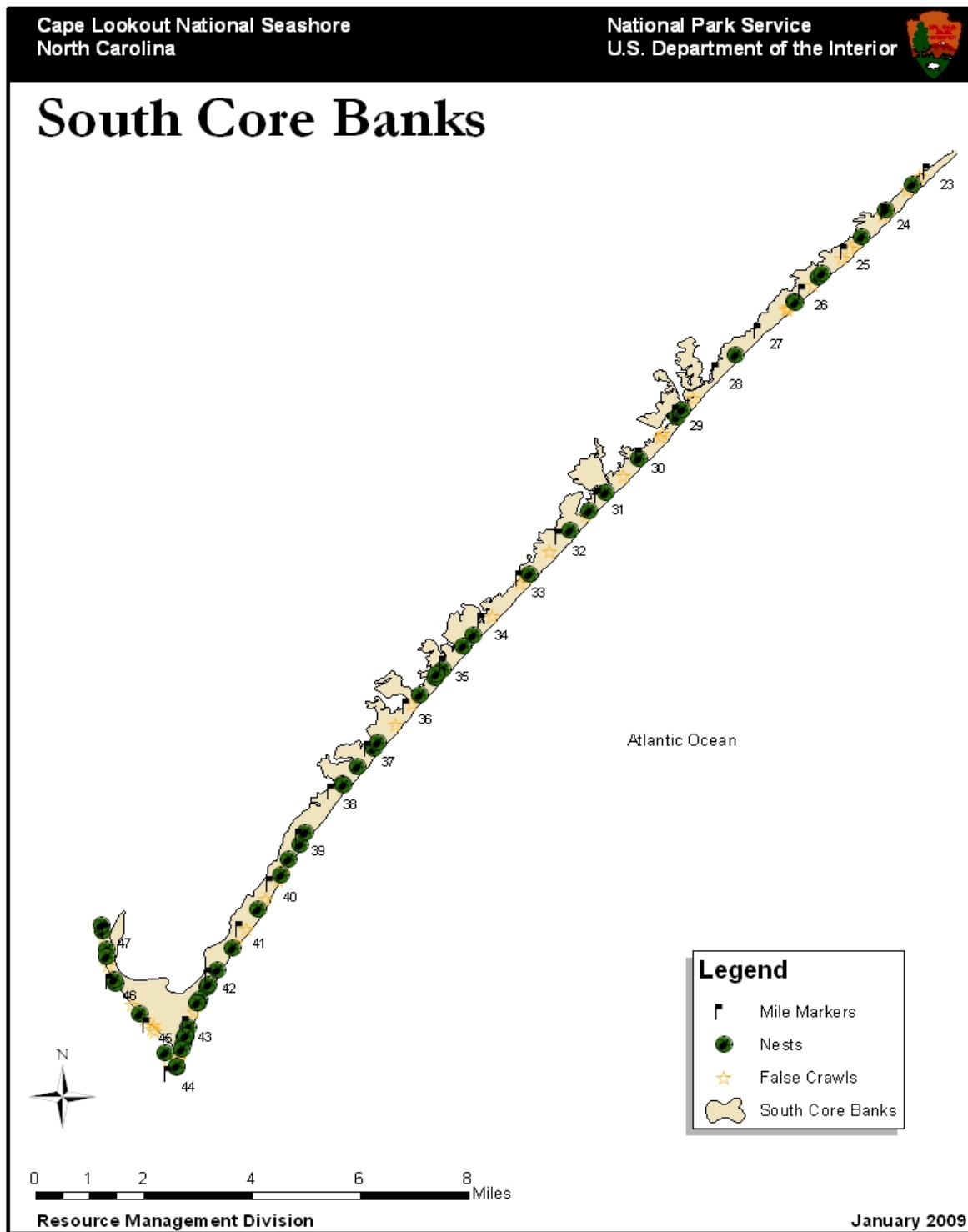




Figure 5. 2008 South Core Banks Sea Turtle Activities.





Appendix III

2008 SEA TURTLE PROGRAM PROCEDURES

## **2008 SEA TURTLE PROGRAM PROCEDURES**

The basic procedures for the 2008 sea turtle program are outlined below. The monitoring program encompasses both turtle nesting activity and turtle strandings. The primary goal of the program is to ensure continued survival of sea turtles. This is done by:

- collecting data that can be used by the NPS and other organizations in developing sea turtle conservation programs
- protecting sea turtle nests and hatchlings

These procedures outline the basic organization of monitoring staff, describe field identification of nesting activities, and provide instructions on the monitoring system. In order to standardize data collection methodology and provide year to year consistency of data collection Cape Lookout will adopt the U.S. Fish and Wildlife's "Index Nesting Beach Survey Protocol". This protocol is given in Attachment 7.

### **ORGANIZATION OF MONITORING PROGRAM STAFF**

The organization of the sea turtle monitoring staff is as follows:

#### Resource Management Specialist (RMS)

- Oversees the total program and assures all permits are current
- Acts a liaison with other agencies
- Represents CALO at public hearings regarding sea turtles
- Reviews and routes turtle related reports to appropriate authorities

#### Field Coordinator

- Reviews turtle activity reports
- Checks nest sites for proper marking
- Provides field guidance on locating nests, relocations, marking and follow-up
- Assures turtle monitoring staff are carrying out the program as described in the procedures
- Purchases related supplies and equipment
- Schedules staffing requirements
- Ensures follow-up checks are conducted on all nests and digs
- Completes the annual turtle program summary report

## **TYPES OF NESTING ACTIVITIES AND FIELD IDENTIFICATION TECHNIQUES**

Nesting activity is defined as any terrestrial activity by sea turtles possibly related to nesting. These techniques were developed for loggerhead sea turtles, the majority of activities. See additional notes for other species. There are three types of nesting activities. Determining the type of nest activity is the initial step in field observations. The types of nesting activities and field techniques for identifying them are:

Nest: Nesting occurs when eggs have actually been laid. Usually, there is a body pit associated with a nest. A body pit is a large shallow depression or disturbance made in the beach from the turtle's initial digging activities; loggerhead body pits are about 2.5' in diameter and 6" deep. There are tracks associated with nesting activity. Loggerhead tracks are approximately 2' wide.

Choose the most likely spot(s) in the body pit and carefully dig down 10 to 15 inches by hand to locate the nest. You may determine the most likely spot by determining the direction of the turtle crawl and digging on the trailing edge of the body pit. The actual nest may be anywhere in or at the edge of the body pit. A methodical approach may be the easiest and most effective way of locating nests. Place surveyor flags in a circle around the area in which the nest is most likely to be found. Such a circle should encompass an area larger than the typical body pit. Divide the circle into quarters and excavate one quarter at a time. Do not refill any portion of the circle until either the nest is found or the entire circle has been checked. Nests are often difficult to find; you may have to dig several times to locate the nest. If eggs are found, do not disturb them unless the nest is to be relocated, refill the nesting area with sand. Pack the sand tightly; this is important for proper incubation.

Dig: A dig occurs when the turtle excavates a body pit or disturbs a large amount of sand but an egg chamber is unconfirmed. A nest is occasionally misidentified as a dig because an egg chamber is difficult to find, often because the body pit is indistinct or obscured by the turtle's activities. For this reason, every "dig" will be accurately marked, recorded, and monitored just as if it is a confirmed nest, except that the screening will not be installed.

Crawl: Crawls are defined as turtle tracks that are not associated with any type of digging activity by the turtle. Crawls will only be counted if they extend above the most recent high tide line.

## **TURTLE NESTING ACTIVITY MONITORING SYSTEM**

A uniform system to locate, mark, and record turtle nesting activity is necessary for coordinating staff efforts in collecting related data. This will enhance the long-term value of the data collected by making it easier to analyze and retrieve data. Equipment and materials needed for the monitoring program are listed in attachment 1.

Mile Markers: Mile markers are the primary means of recording locations of sea turtle nesting

activity. It facilitates determining concentrations of nesting activity and relocating nests for follow-up. Beach areas are marked at one-mile intervals. Attachment 2 shows the "mile marker locations." More information on using the markers is contained in the instructions for completing the "Turtle Nest Data Sheets" (Attachment 3A).

Marking Nesting Activity Sites: Techniques for marking each activity are given below.

Nest Marking: Each nest is marked with four stakes. Stake #4 is placed two feet from the seaward side of the egg chamber. Stake #3 is placed three feet from the dune side of the egg chamber. Stake #1 is placed at the primary dune line and perpendicular to the shoreline (See attachments 4 and 4A). Stake #2 is placed three feet from the seaward side of stake #1 and in line with stakes #1, 3 and 4.

If the nest is laid behind the dune line, also place an extra stake at least 25' seaward of stake #4 so that it may be seen from the beach but not be below the high tide line.

The nest number will be written in waterproof ink on stakes number 1 and 3. This will facilitate identifying nests at a later time. This number is assigned from the "Activity No." column of the "Master Log of Sea Turtle Nesting Activity" (Attachment 5 and 5A). When marking a nest or dig measure 12" up from the surface of the sand at stakes #3 and 4 and mark the stakes at this height with a line completely around the stake using a permanent marker. Observe the mark daily for drastic sand deposition or erosion. Around the time of hatch, level sand over the nest to the original 12" mark.

Dig Marking: Digs will be marked the same as nests. Since the location/existence of any associated nest is in doubt, use the center of the body pit for the nest as a reference in setting stakes. This will require that you carefully excavate the stake locations by hand to check for presence of eggs prior to setting stakes.

Crawl Marking: Simply flag the highest point of the crawl. The flag should be removed when the tracks are no longer visible.

Recording Nesting Activity: Records of sea turtle nesting activity are kept on "Turtle Nest Data Sheets" (Attachment 3) and the "Master Log of Sea Turtle Nesting Activities" (Attachment 5 and 5A). Individual data sheets are used for each nest and dig. The log is used to summarize and keep track of turtle activities. Attachment 3A provides instructions on completing data sheets.

GPS Locations: The latitude and longitude of all activities will be recorded using a Garmin GPS unit. To mark a position press "mark" and "enter." The waypoint number should be the same as the activity number on the Master Log.

Relocating Nests: Nests laid at or below the high tide line or in areas where they are likely to be washed away will be relocated. Three areas on each island will be designated as closed to vehicles and nests will be relocated into the closed area closest to the original nest site. Attachment 8

indicates which areas will be closed to vehicles for relocation purposes. Nests on Shackleford Banks will be relocated to the nearest suitable area.

Nests should be relocated within 12 hours after the eggs were laid. The following procedures should be followed for relocating nests.

1. When relocating a nest, be careful not to rotate the eggs.
2. Gently move the eggs from the nest into the pail.
3. Measure the dimensions of the nest chamber, depth to top of eggs, width of chamber, and depth to bottom of nest chamber. Use these dimensions to recreate the new nest chamber.
5. Fill in the original excavation and mark with a surveyor flag. After wind, rain, or tide has erased the tracks, remove the surveyor flag.
6. Transport the eggs preferably by foot to the new nest site. If the eggs must be moved by vehicle to the nearest relocation area, do so slowly and try to minimize jarring.
7. The eggs should be placed in the new nest site in the same layered fashion as the original nest.
8. Cover the eggs with sand.

This process should be completed quickly so that the temperature of the eggs will not change drastically.

## **PROTECTING NESTS**

Nest protection will start as soon as the nest is discovered. "Digs" will be treated as "nests." Each nest will be staked/marked as described in attachments 4 and 4A. The main purpose of the stakes is to warn ORV Drivers away from nests and facilitate relocating nests later.

Place a 3' by 3' (2"x 4" mesh) screen over each nest. The 4" side of the wire opening should be parallel with the waterline. Anchor the four sides down with steel rebar and cover with 1" to 2" of sand. The screen is designed to protect the nest from raccoon predation. Some nests on SCB will be covered with a 3'x3'x2' wire cage to prevent raccoons from digging through the screen. Bury the edges of the cage about 6" and anchor it with rebar. Digs do not receive screening since rebar anchors could puncture unlocated eggs.

After 50 days have passed the turtle monitoring staff will erect a funnel-shaped barricade around those nests/digs not in protected areas (i.e. single nest) from the nest to a point at least 15 feet below the high tide line and smooth any ORV tracks in the enclosure. (The barricade should extend down to a point where the sand is usually hard enough to prevent formation of tire ruts). Attachment 6 diagrams the closure. This action provides a natural beach surface for the hatchlings to crawl to the ocean, protecting them from becoming trapped in ORV tracks. This barricade is removed after the nest is excavated. Barricade stakes will also be wrapped in orange or red reflector tape.

## **FOLLOW-UP ON NESTS AND DIGS**

Follow-up of nesting activity involves excavating nests, looking for signs of turtle hatching, retrieving temperature HOBOS, and recording related data.

Follow-up of nesting activity begins fifty days after the nest was laid. Smooth the sand over and around the nest to a height equal to the original sand level indicated by the 12" line on stakes #3 and 4. This facilitates observing the small (2" to 4" inch) depression usually formed in the sand above the nests when hatching begins. Smoothing the sand also facilitates observing hatchling tracks. Excavate the nest on the fifth day after a major hatch (indicated by distinctive hatchling tracks), 10 days after the depression forms, or excavate the nest 75 days after the date laid if there has been no sign of hatching. Digs will be excavated after 75 days to determine if the activity was a nests or a crawl. If many live hatchlings are found in the nest, simply refill the nest with sand and continue to check until hatching occurs. Check the condition of the hatchlings prior to placing them back in the nest. If the egg yoke sack has not been fully absorbed by the hatchlings, then place them back in the nest, cover lightly with sand and allow them to complete this process. If the hatchlings are weak and or dehydrated (plastrons concave) they should be released as soon as possible. If there are hatchlings with fully absorbed egg yokes found in the nest after the main hatch, release them in the evening hours, preferably after dark. Such hatchlings should be allowed to crawl at least a short distance of beach and enter the ocean under their own power. Create/maintain a clear path to the ocean for the hatchlings; visitors should be kept back from the hatchlings to avoid stressing them. *It is a violation of our permit to dig into nests prior to hatch.*

When motionless hatchlings (apparently drowned) are located in a recently flooded nest, the following resuscitation efforts should be attempted.

1. Remove the hatchling from the water.
2. Invert hatchlings (head lower than tail).
3. Stimulate hatchlings by slight compressions of the plastron.
4. Raise the head to provide an open airway.
5. Continue stimulating for approximately 15 minutes.

If the hatchlings regain consciousness, monitor their progress and assist them in reaching the surf.

During late fall excavations, if sluggish turtles are located well after the 75-day normal incubation period, these measures may be taken.

1. Remove the turtles from the nests.
2. Allow them to warm on the sand or in a warm tidal pool until they become more active.
3. Assist the turtles to hard packed sand near the surf. If the turtles do not respond, the N.C.



Aquarium may be telephoned for possible long-term care.

Digs are monitored daily beginning 10 days prior to estimated hatch date and ending at hatch or 75 days from date of lay, whichever occurs first. Look for signs of a depression or hatchling tracks within a 15-foot radius of the nest stakes.

Complete the "Hatching Data" section of the Turtle Nest Data Sheet. Remove the turtle nest stakes.

### **NOTES ON GREEN AND LEATHERBACK SEA TURTLES**

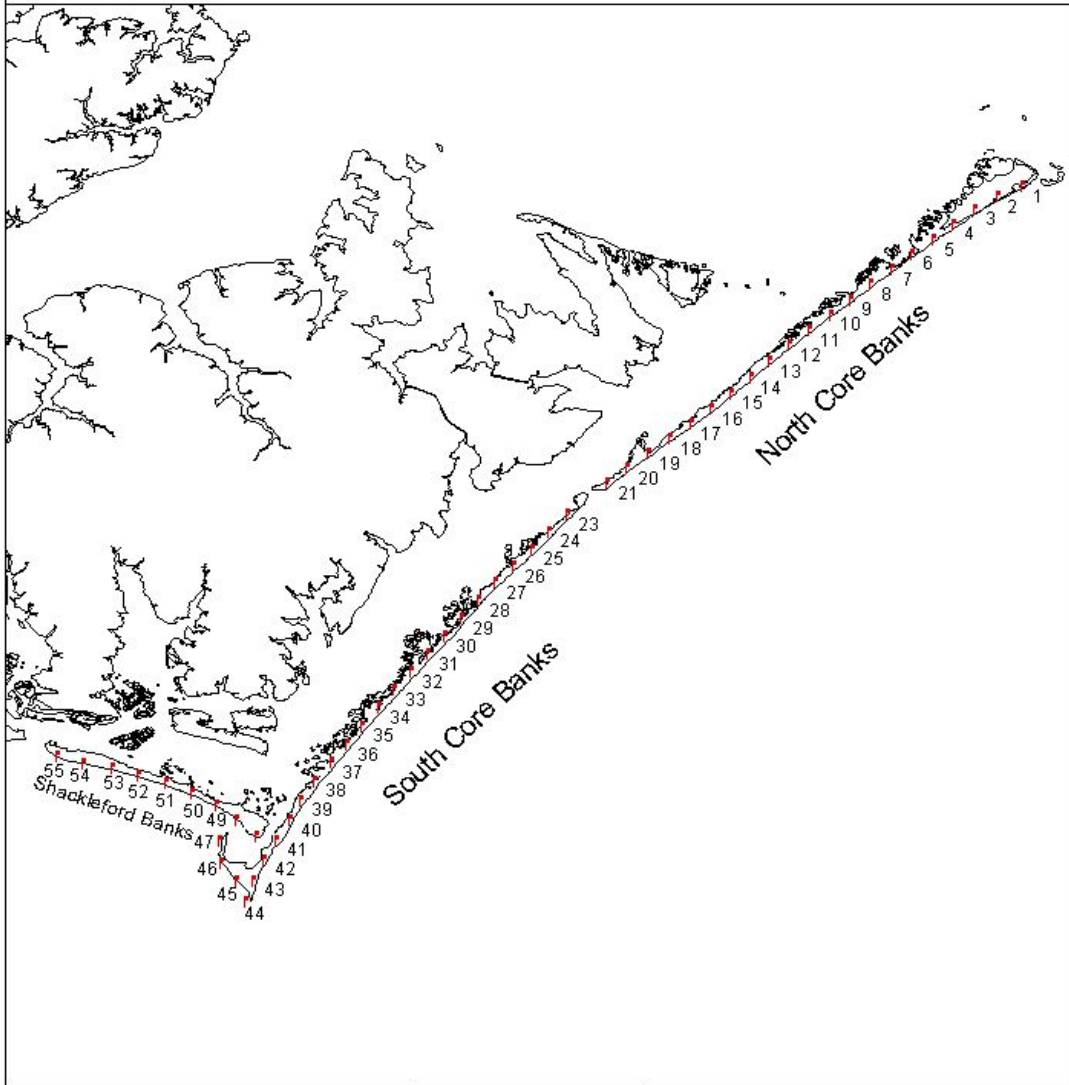
While 99% of the sea turtle nests at Cape Lookout are loggerhead nests, we do provide nesting habitat for green and leatherback sea turtles. We may have green turtle nests every year in low numbers and can occur throughout the summer. Leatherback nests occur less frequently, about every other year and typically occur in late spring and early summer. In 2007 there was a leatherback activity on April 30. In general these turtles are treated the same as the loggerheads except for some important differences. Both the green and leatherback nest are laid deeper in the sand, leatherback eggs can be up to a meter deep. The green eggs are slightly bigger than loggerheads and the leatherback eggs are at least double the size of loggerheads. Leatherback eggs often go unconfirmed due to their depth and the body pit size. Incubation for leatherback eggs is longer from 60 to 110 days. Incubation for green nests is also longer from 64 to 69 days.

**ATTACHMENT 1**

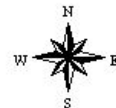
**EQUIPMENT AND MATERIALS  
FOR  
SEA TURTLE NEST MONITORING PROGRAM**

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>QUANTITY</u>
Marker stakes	PVC 1 1/4" x 5' post and Wood 2"x2"x5' post	2 per nest  2 per nest
Post hole diggers		
Turtle monitoring kit	in pack, with contents as described below	1 for each island
Orange reflective tape	2" wide	
Tape measure	100'	
Marker	waterproof (permanent ink or paint)	
Pens		
Clip board	standard size	
Binder	for data sheets	

## Attachment 2- Mile Marker System Cape Lookout National Seashore



National Park Service  
Cape Lookout National Seashore  
Resource Management



Plot date: December 1, 2000 c:\my documents\gisbase\maps.apr

ATTACHMENT 3

TURTLE NEST DATA SHEET

CAPE LOOKOUT NATIONAL SEASHORE

NAME \_\_\_\_\_

\_\_\_\_\_ North Core Banks \_\_\_\_\_ South Core Banks \_\_\_\_\_ Shackleford Banks

Activity \_\_\_\_\_ (check one)  
Number \_\_\_\_\_ Date \_\_\_\_\_ Nest \_\_\_\_\_ Dig \_\_\_\_\_ Turtle Observed? Y/N Species \_\_\_\_\_

Original Nest

Location (tenths of mile): \_\_\_\_\_  
Site Desc. \_\_\_\_\_  
Dist. above high tide \_\_\_\_\_  
Distance below high tide \_\_\_\_\_  
Dist. dune stake to nest \_\_\_\_\_

Relocated Nest

Location (tenths of mile): \_\_\_\_\_  
Site Desc. \_\_\_\_\_  
Dist. above high tide \_\_\_\_\_  
Date and Time Relocated \_\_\_\_\_  
Dist. dune stake to nest \_\_\_\_\_  
# of Eggs Relocated \_\_\_\_\_  
Latitude \_\_\_\_\_ N  
Longitude \_\_\_\_\_ W

**Nest Damage/Predation (prior to hatchling emergence)**

Date eroded/washed away \_\_\_\_\_  
Date(s) flooded by tide \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.  
Human disturbances (circle one): ORV, Dug-up, Other \_\_\_\_\_  
Ghost crab predation (date)? \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.  
Raccoon predation (date)? \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.

**HATCHING DATA**

Dates nest hatched: \_\_\_\_\_ (circle major hatch date)  
Excavated by \_\_\_\_\_ Date nest excavated \_\_\_\_\_

Hatched eggs, from which hatchlings escaped from egg ..... H = \_\_\_\_\_

Hatched dead,  
hatched from egg but dead in nest ..... HD = \_\_\_\_\_

Unhatched eggs, includes turtles pipped dead..... UH = \_\_\_\_\_

Total eggs in Clutch (H+UH) ..... TC = \_\_\_\_\_

Emergence success (H-HD/TC) ..... ES = \_\_\_\_\_ %

Live Hatchlings released from nest LH = \_\_\_\_\_

## ATTACHMENT 3A

### INSTRUCTIONS FOR COMPLETING "TURTLE NEST DATA SHEET"

Activity Number - This number is assigned on the chronological order that the nesting activity (nest, dig, crawl) occurred in the area being monitored (South Core Banks, North Core Banks, or Shackleford Banks). For example, the number one would be entered for the first nest laid on North Core Banks (NCB); a three would be entered if it was the third nest laid on NCB.

Mileage - Mile Markers are the primary tools used in determining location. Mileage is obtained by using the mile markers and the ATV's odometer. For example, mileage of a nest that is .2 mile south of mile marker 40 on SCB is entered as 40.2. Refer to Attachment 2 for a diagram of the marker system.

Site Desc. - Descriptions such as "nested in grass", "nested among dunes", or "nest relocated to front of primary dune", etc. may be entered here.

Dist. above/below high tide - Give the distance in feet from the estimated high tide line.

Dist. dune stake to nest - This is the distance from the base of the stake farthest from the nest (stake #1), to the center of the egg chamber. This distance is measured following the natural grade between the stake and nest.

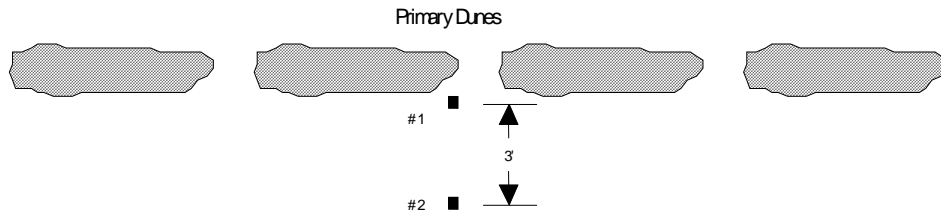
Latitude/ Longitude- If the nest is relocated, record the latitude and longitude of the new nest location using the GPS unit.

Predation- Record ghost crab predation if eggshells are found on the surface.

Emergence success - Percent of the eggs that hatched and produced turtles that emerged or were released from the nest.

# ATTACHMENT 4

## TURTLE NEST MARKER SYSTEM

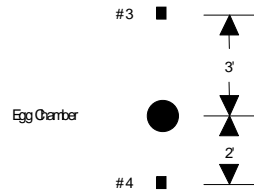


### NOTES

- 1) Nest stakes are PVC; range stakes may be wooden or PVC
- 2) Stakes 1 through 4 must be on a straight line.
- 3) Stakes 3 and 4 should have orange reflector tape on top.

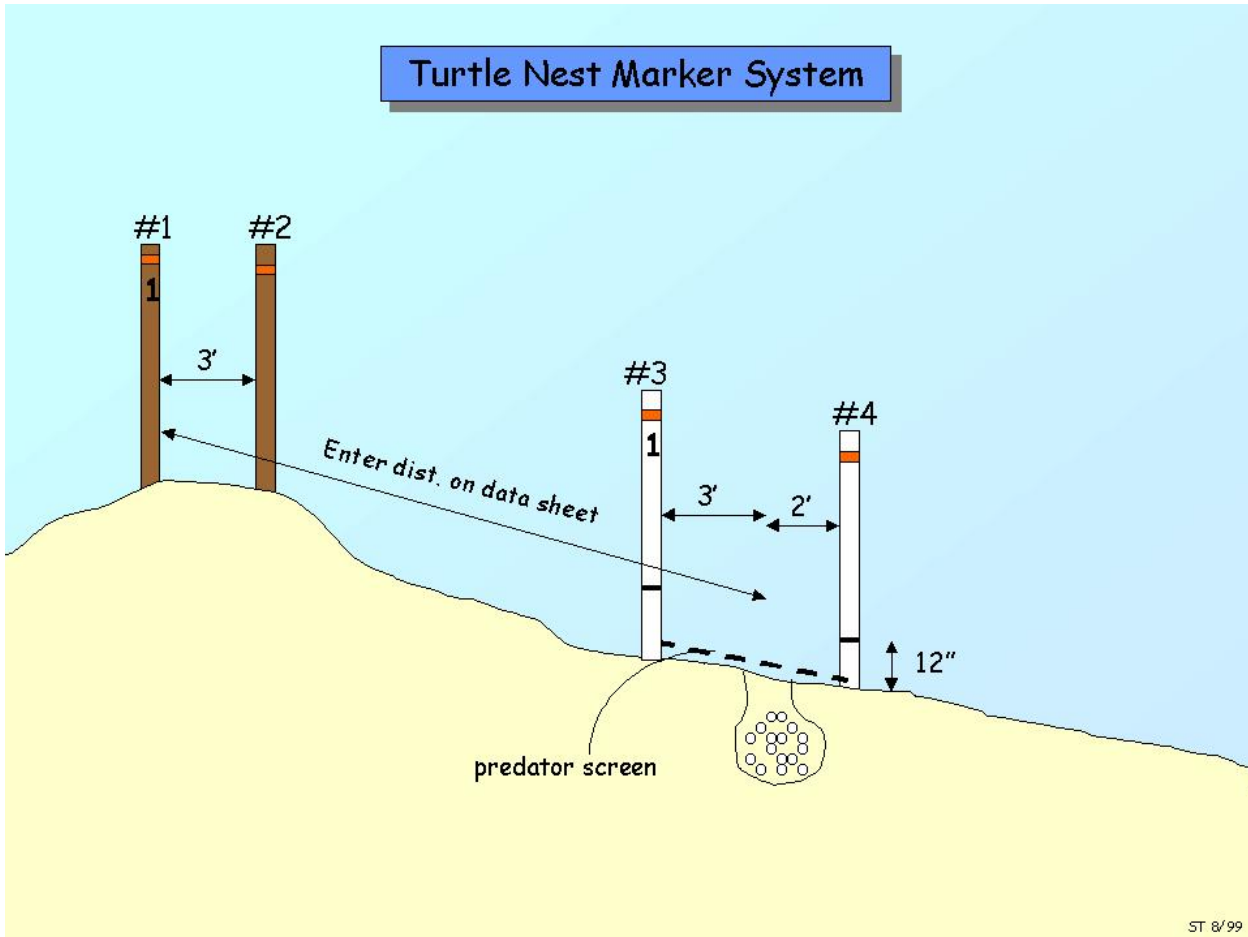
### Legend

■ - Stake



ATTACHMENT 4A

TURTLE NEST MARKER SYSTEM







## ATTACHMENT 5A

### Instructions for Master Log of Sea Turtle Nesting Activities

Activity Number. This number is assigned sequentially and entered as the "Activity Number" on the turtle nest data sheet completed for each nest, dig, or crawl (N, D, or C) observed.

Location. Enter "mile" to the nearest tenth as entered on "Turtle Nest Data Sheet" in the "location" block for the original nest site and the relocated nest site.

Latitude and Longitude. Use a GPS unit to obtain the location. Record the location in DD.MMMMM format. Mark and save activity sequentially in GPS unit.

Date Occur. This is the date the activity is discovered.

Barricade Date. Add 50 days to the "Date Occurred" date to get this date. Smooth/level the sand over the egg chamber to facilitate observing formation of a "depression", an indication of hatching.

Estimated Hatch Date. This date is obtained by adding 60 days to the "Date Occurred." Start looking for a "nest depression" ten days before this date; continue watching the nest until either evidence of hatching occurs or 75 days have passed.

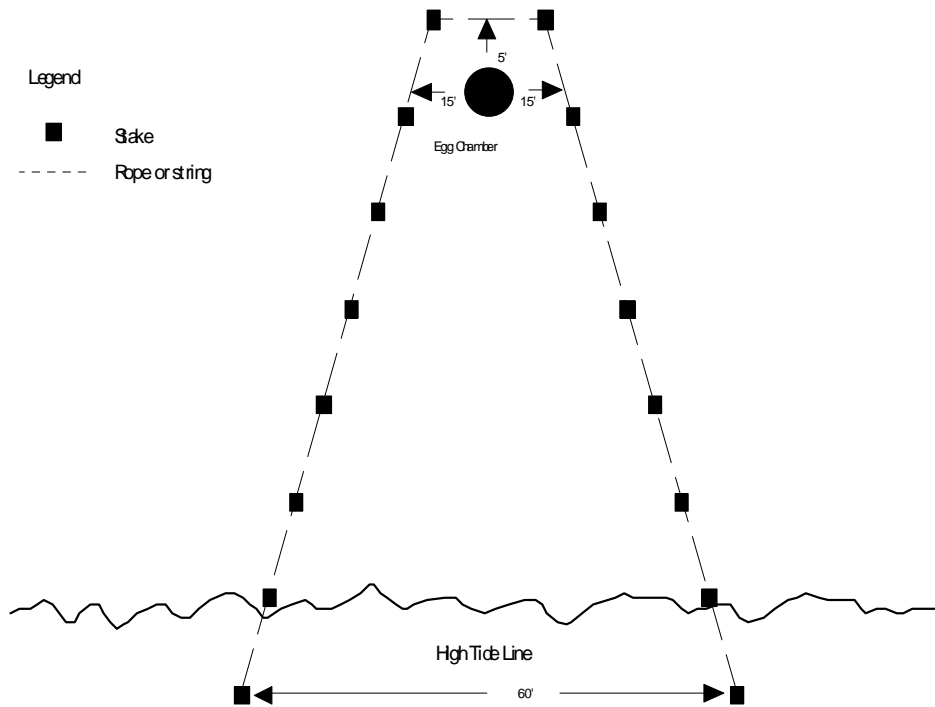
Depression Date. This date is taken by direct observation.

Actual Hatch Date. The day most hatchling tracks were observed or the day of the main emergence of hatchlings from the nest. If no sign of hatching was observed, excavate 75 days after the "Date Occurred".

Date Excavated. This is the date the nest was excavated by CALO personnel. Excavate five days after nest hatches.

# ATTACHMENT 6 NEST BARRICADE

Primary Dunes



## NOTES

- Approx 15' between posts
- Nest markers not shown

## ATTACHMENT 7

### U.S. FISH AND WILDLIFE SERVICE INDEX NESTING BEACH PROTOCOL

1. **Survey Consistency:** Standardization of data collection methodology and year to year consistency of data collection efforts are crucial to the long term success of the project. Adherence to the protocol outlined herein is necessary to eliminate survey bias. Deviations from this protocol must be relayed to project leaders in order to accurately interpret the data base.
2. **Survey Period:** All index beaches (east and west coast) south of and including Cape Canaveral National Seashore will be surveyed 15 May - 31 August of each year. All index beaches north of Canaveral National Seashore will be surveyed 1 June - 15 August of each year. Additional requirements for Cape Lookout National Seashore include monitoring from 1 May- September 15.
3. **Survey Time:** Surveys should be conducted in the early morning hours, preferably beginning at dawn.
4. **Survey Frequency:** There are several options, but one option must be selected and adhered to. Options are:
  - a. Seven (7) days per week. All crawls are marked daily to avoid duplicate counts on subsequent survey days. This is Cape Lookout National Seashore's option.
  - b. Six (6) days per week with randomized non-survey day and no "marking" of crawls on the non-survey day. Randomized non-survey days have been generated and will be provided by USFWS. Data is not reported from the non-survey day or from the survey immediately following the non-survey day. In other words, six (6) survey days without "marking" on the non-survey day result in 5 daily reported counts per week.
  - c. Six (6) days per week with randomized non-survey day and "marking" of crawls on the non-survey day. Randomized non-survey days have been generated and will be provided by USFWS. All crawls present on the non-survey day are "marked" prior to sundown. Data is reported from the survey day immediately following the non-survey day. Six (6) survey days with "marking" on the non-survey day result in 6 daily reported counts per week.
5. **Unplanned Missed Survey Days:** For projects surveying six days per week, an unplanned missed survey day may be substituted for a scheduled random non-survey day within the same week, provided the non-survey day has not already occurred. For all other situations follow

the procedures above in 4(b) and 4(c) as appropriate. Explain in remarks section of data report form for the affected week.

6. **Crawl Identification:** Surveyors will identify and record all "new" crawls by species and as nests or false crawls. False crawls will only be counted if they extend above the most recent high tide line. Crawl data will be reported by beach sector. The preferred length of beach sector is 1 km or 1/2 mile. Sectors must be identified with a unique numbering or lettering system.
7. **Crawl Verification:** Nest and false crawl determinations should be based on observable crawl characteristics. Digging for verification should not be routinely carried out. Probing for verification purposes is strongly discouraged.
8. **Data Reporting:** Data will be recorded on CALO Turtle Nest Data Sheets. Annual Sea Turtle Nesting Reports will be submitted to: NC Sea Turtle Program Coordinator

## Attachment 8 Relocation Areas for Sea Turtle Nests

