CAPE LOOKOUT NATIONAL SEASHORE

2005 SEA TURTLE MONITORING PROGRAM

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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 turtle nests in North Carolina. 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 2005 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 central coastal area of North Carolina between Beaufort and Ocracoke Inlets. The park is currently divided into four 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. South Core Banks (SCB) extends southward from New Drum Inlet 25 miles to the Cape Lookout bight area. Both NCB and SCB have a northeast to southwest orientation and exhibit a low profile landscape. The fourth 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 four islands comprising the Seashore were monitored for turtle nesting activity. The three-mile long area between Old Drum Inlet and New Drum Inlet was not accessible by vehicle and was not monitored regularly. Student Conservation Association resource assistants, volunteers and NPS staff patrolled NCB and SCB from June 1 to August 15. Patrols were conducted seven days a week and each patrol began early enough so that the island was checked for turtle activity by 12:00 PM. Patrols of Shackleford Banks were conducted two or three times a week. Once a turtle activity was located, data were collected and the activity was marked. For detailed information on procedures used in the 2005 Sea Turtle Program refer to Appendix I.

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 2005, only nests laid near or below the high tide line were relocated to a higher elevation on the primary dune. The park closed six beach areas, up to one mile in length, to vehicles. Relocated nests were moved into these closures and vehicles were detoured around the backside of the primary dunes. Beach closures eliminated the need to construct and maintain numerous individual barricades. However, individual barricades were erected around those nests that were not relocated and were outside the beach closures. Beach vehicle closures provide a rut-free corridor from the nest site to the ocean thus preventing hatchlings from 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 are 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 predation, wire screens anchored by rebar were placed over all nests. Wire cages were used on most nests between the lighthouse and Power

Squadron Spit, the area with the most problems from raccoons in the past. Nests were monitored for hatching activity through November. Nests were excavated after hatching to determine nest success.

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 2005 was on May 16 and the last on August 20, for a 96 day nesting season. A total of 311 activities were documented of which there were 142 nests, 21 digs, and 148 crawls, (Table 1; see Appendix I for activity definitions). Three sea turtle species nested in the park with a total of 136 loggerhead turtle nests, 5 leatherback turtle nests (+ 1 dig and 2 crawls) and 1 green turtle nest. One loggerhead female was tagged by Keith Rittmaster after a false crawl on July 24. The same female with tags PPZ507 and PPZ501 nested successfully five days later.

Table 1. 2005 ACTIVITIES BY STUDY AREA

	North Core Banks	South Core Banks	Shackleford Banks	CALO Total
NESTS	37	88	17	142
DIGS	4	13	4	21
CRAWLS	32	112	3	148

Figure 1. Cape Lookout Turtle Activities 1990-2005

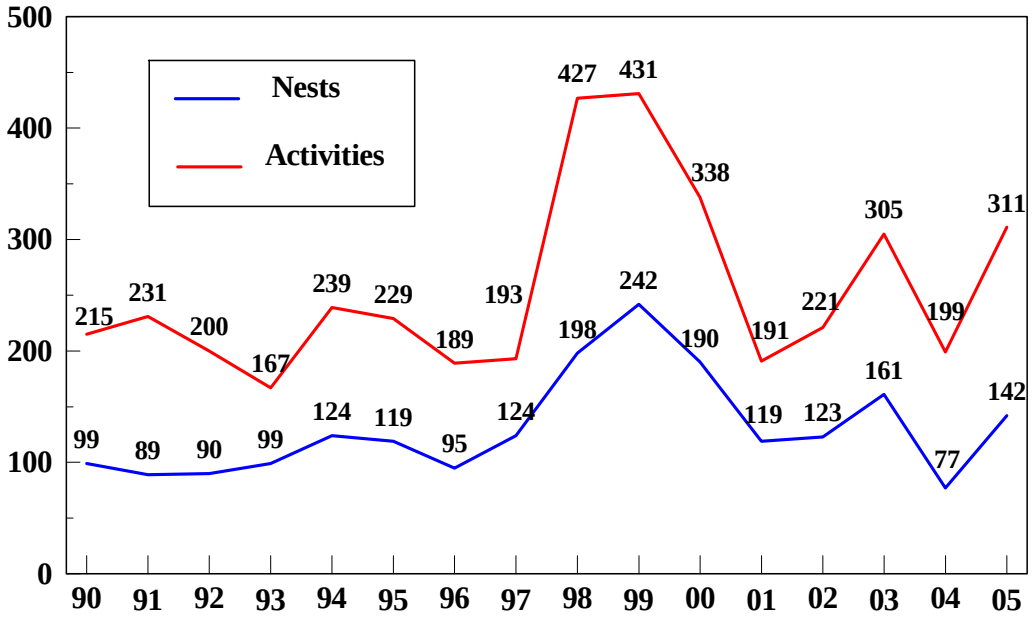
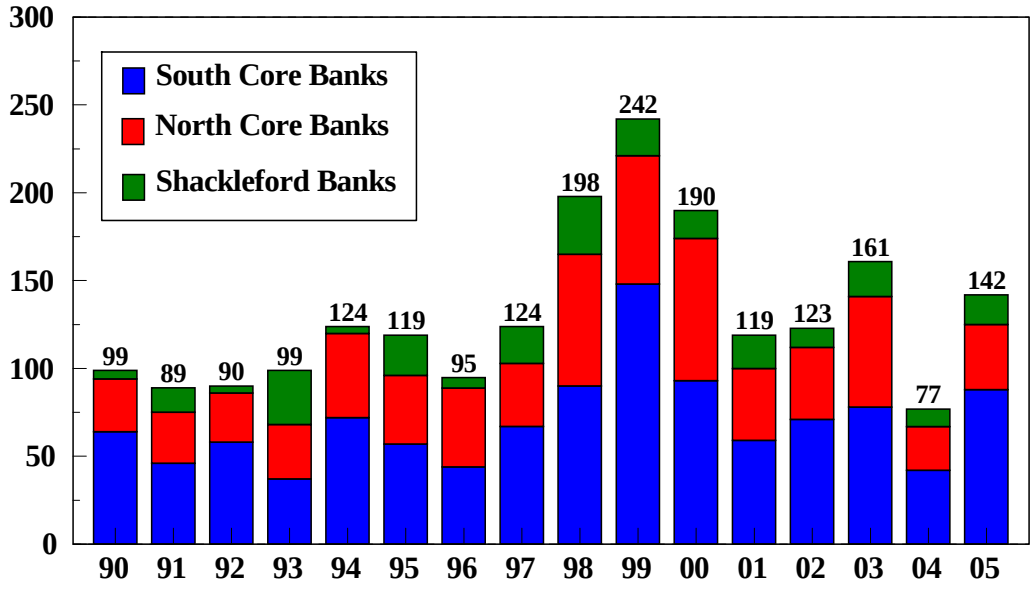


Figure 2. Turtle Nests 1990-2005



The number of nests found in the park in 2005 was slightly above the annual average of 131 nests (Fig. 2). The greatest concentration of nests in the park occurred between Mile 42 and 45 on SCB (Fig. 3). Over one-third of all the nests on the island were in this three mile area south of the lighthouse. The leatherback nests on SCB were found at nine day intervals and were probably from a single female (Table 2). The leatherback nesting on SB was likely a different female.

Table 2. Leatherback Nesting Intervals

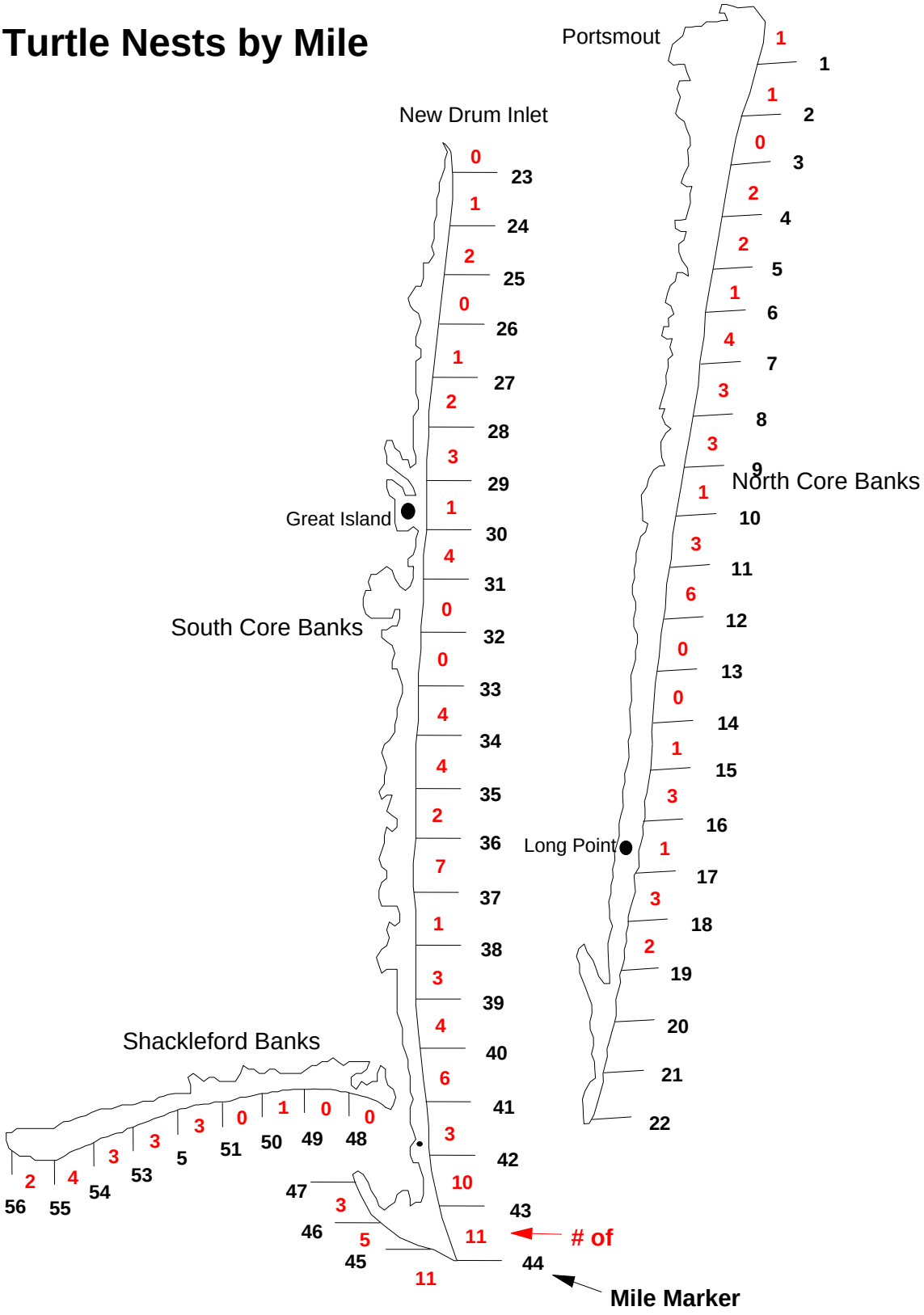
Date	Activity Type	Island
June 7	dig	SCB
June 25	nest	SCB
July 4	nest	SCB
July 13	nest	SCB
July 16	nest	SB
July 22	crawl	NCB
July 23	crawl	SCB
July 24	nest	SCB

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 for SCB, NCB and SH are given in Appendix II.

Figure 3.

2005 Turtle Nests by Mile



The last nest was excavated on November 1. The average clutch size was 111 eggs. It took an average of 60 days for nests to incubate. 53% of the counted eggs produced hatchlings that made it out of the nest (emergence success), the highest for any one nest being 99% and lowest 0%. A total of 12,423 eggs were counted. Thirty nests were washed away or dug up by raccoons with the numbers of eggs unknown. 6,569 of these eggs hatched and produced hatchlings that emerged or were released from the nest (Table 3). Flooding during Hurricane Ophelia and several other storms had a great impact on the 2005 nesting season. A total of 81 nests were flooded by the ocean. Fifty four nests were washed away or failed to hatch due to flooding.

Table 3. SEA TURTLE HATCH SUMMARY 1990-2005

Year	Nests	Relocated	Excavated	Avg. Clutch	Flooded	Avg. Incu	Eggs	Emerged	EMR %*	Est.Total EMR%**
1990	99	68	89	115	1	57	10,376	7,369	71%	69%
1991	89	56	74	115	6	62	8,393	5,197	62%	61%
1992	90	39	84	114	4	63	9,419	6,791	73%	71%
1993	99	54	89	115	9	59	10,365	7,544	74%	74%
1994	124	98	119	120	3	62	14,459	11,296	79%	79%
1995	119	66	103	115	38	57	12,357	6,157	51%	47%
1996	95	69	85	115	16	65	10,091	5,602	57%	53%
1997	124	92	120	122	3	63	14,824	10,740	73%	73%
1998	198	117	169	114	39	62	19,672	13,315	69%	61%
1999	242	123	191	116	90	62	23,224	11,751	53%	44%
2000	190	120	176	111	2	67	19,527	13,471	69%	65%
2001	119	60	106	113	5	65	12,358	9,555	79%	75%
2002	123	56	115	119	7	61	13,657	10,758	79%	75%
2003	161	66	138	119	45	65	16,440	10,067	61%	53%
2004	77	34	75	104	36	64	7,309	3,139	43%	40%
2005	142	49	112	111	54	60	12,423	6,569	53%	42%

*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. The number of nests excavated for the year provides a basis for knowing how many nests the emergence success is based upon (Table 3).

To provide a more accurate emergence success rate we have calculated an estimated emergence success of 42% in 2005. This figure includes 25 nests with unknown egg numbers that were washed away before hatching and three nests dug up by raccoons. 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.

Table 4. 2005 ACTIVITY SUMMARY BY STUDY AREA

	NCB	SCB	SH	TOTALS
NESTS	37	88	17	142
RELOCATED	28(76%)	21(24%)	0	49(34%)
AVERAGE CLUTCH	106 eggs	112 eggs	117 eggs	111 eggs
EMERGE SUCCESS	56%	46%	81%	53%
ESTIMATED TOTAL EMERGENCE SUCCESS (including nests with unknown egg totals)	55%	35%	53%	42%
AVERAGE INCUBATION	60 days	59 days	61 days	60 days
# LOST TO FLOODING	12	36	6	54
# LOST TO PREDATORS	0	5	0	5

In 2005, 34% of the nests were relocated, the lowest percentage since 1988. At the request of the N.C. Wildlife Resources Commission, only nests we were certain would be lost to flooding were moved. The emergence rate for relocated nests was the same as the estimated rate for untreated nests (Table 5). However, 92% of the nests relocated were moved in July and August and were subject to flooding from Hurricane Ophelia and other storms. For nests laid after July 1, the emergence success for relocated nests was 38%, but only 19% for nests not moved. Nests found within 30 feet of the ocean, which would have been relocated in previous years, had a success rate of only 29%. Half of the nests in this category failed completely.

Table 5. EMERGENCE SUCCESS OF RELOCATED VS. NON-RELOCATED NESTS BY STUDY AREA IN 2005

RELOCATED	NCB	SCB	SH	CALO Total
Nests	28	21	0	49
Eggs	2,995	2,506	0	5,501
Hatchlings	1,486	852	n/a	2,338
Emergence Rate	50%	34%	n/a	42%
NON-RELOCATED				
Nests	9	67	17	93
Eggs	835	4,795	1,292	6,922
Hatchlings	668	2,512	1,051	4,231
Emergence Rate	80%	52%	81%	61%
Estimated Total Emergence Rate	71%	35%	53%	42%

Since 1990 emergence success has been similar for relocated and non-relocated nests (Table 6). The presence of elevated relocation areas and the impacts of major storms have been the key factors in the success of relocated nests.

Table 6. 1990-2005 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
AVERAGES	*56*	*65*	*67(53)*	*88*

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

In 2005, two nests lost eggs to ghost crabs. Ghost crab predation was recorded when eggshells were found on the surface. Raccoon predation occurred on nine nests, all on SCB. Three nests were lost before they could be protected. Five nests lost eggs when raccoons dug through their protective screens and one unprotected nest was dug up after it hatched.

Three nests had roots in the egg chamber destroy eggs or trap hatchlings. Artificial lights attracting hatchlings was not known to be a problem. A light barricade was used successfully on a nest directly in front of the Long Point cabin area.

Off-road vehicles disregarding beach closures threaten the survival of hatchlings. Forty five violations of vehicle closures for turtle nests were documented by resource management staff. These vehicles drove between posts and the ocean at low tides.

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 the principal threat to nesting success at CALO. Nest relocation is the primary management tool used to enhance hatching success in the park. Unfortunately, because of the change in relocation procedures and flooding from Hurricane Ophelia, the park did not meet the goal of a greater than 60 percent hatch rate.

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. However, the beach profile at CALO makes nests laid in the back swale area of the beach likely to be flooded for long lengths of time during high tides and storms. Rather than just reducing hatching success of these nests, in the majority of cases nests in these areas that are repeatedly flooded are likely to fail completely. The best management decisions can only be made by evaluating the local conditions and their potential effect on nesting success.

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.

Seventy one strandings occurred at CALO in 2005. All strandings were reported to the NCWRC and were documented with a "Sea Turtle Stranding and Salvage Network" stranding report. Loggerhead turtles accounted for the majority of the strandings (37). There were also 21 green turtles, six Kemp's Ridleys, two hawksbills and five unknown. The month of June had the greatest number of strandings (Table 7). Thirty three (46%) of the strandings were found on the soundside of the islands, the remainder on the ocean beach.

One live stranding occurred in the park in 2005. A live loggerhead found stranded on Shackleford Banks was sent to the Topsail Turtle Hospital.

Table 7. 2005 SEA TURTLE STRANDINGS AT CAPE LOOKOUT NATIONAL SEASHORE

	NCB	SCB	SH	TOTAL
January	2	9	2	13
February	0	0	0	0
March	1	0	1	2
April	1	1	1	3
May	3	5	1	9
June	6	5	8	19
July	1	2	3	6
August	1	3	1	5
September	0	1	1	2
October	0	0	0	0
November	0	3	2	5
December	0	6	1	7
Total for 2005	15	35	21	71

Injuries or abnormalities were recorded on each stranding report. Three turtles were missing part or all of a flipper, one was missing its head, nine had carapace damage, one was found with prop scars, and one was found entangled in net. The remaining turtles showed no apparent cause of death.

Turtles were scanned for Passive Integrated Transponder (PIT) tags. PIT tags or metal tags were found in one loggerhead turtles and one Kemp's Ridley (Table 8). All or parts of 13 turtles were salvaged for NOAA Fisheries researchers.

Table 8. TAGGED SEA TURTLES FOUND AT CALO IN 2005

Stranding #	Date Found	Island	Metal Tags #	PIT tag #
05-12	27 January	SCB	RRS769 & RRS770	43344F7065
05-22	18 May	NCB		4337520265

Table 9. CALO SEA TURTLE STRANDINGS 1990 – 2005

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

Table 10. CALO TURTLE STRANDINGS BY SPECIES 1990-2005

YEAR	LOGGERHEAD	GREEN	KEMP'S RIDLEY	LEATHERBACK	HAWKSBILL	UNKNOWN
1990	33	7	1	2	0	0
1991	16	2	1	0	0	1
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

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. The park should return to its traditional relocation standard of moving nests that the monitoring staff believes are likely to be flooded. Those relocation standards were successful in meeting the loggerhead turtle recovery plan goal of a greater than 60 percent hatch rate.

2. All park staff and volunteers involved with turtle monitoring should be given complete training in current monitoring procedures.

3. 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. The park should to continue to work in cooperation with the North Carolina Maritime Museum and Cape Lookout Environmental Education Center to educate visitors about sea turtles.

APPENDIX I

2005 SEA TURTLE PROGRAM PROCEDURES

2005 SEA TURTLE PROGRAM PROCEDURES

The basic procedures for the 2005 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:

<u>Resource Management Specialist (RMS)</u>
- 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

<u>Field Coordinator</u>
- 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. 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 3.5' to 4' 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 does not lay eggs. 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.

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 near or below the high tide line 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 or wait until 14 days after the date the nest was laid. The following procedures should be followed for relocating nests.

1. Dig a nest cavity, approximately 18" deep and 12" wide in a suitable location.
2. Place approximately 6" of cool sand (from the nest cavity) in the bottom of a bucket.
3. When relocating a nest, be careful not to rotate the eggs.
4. Gently move the eggs from the nest into the pail.
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, 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.

After 50 days have passed the turtle monitoring staff will erect a funnel-shaped barricade around those nests/digs not in protected areas 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 hatch. 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, 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. 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.

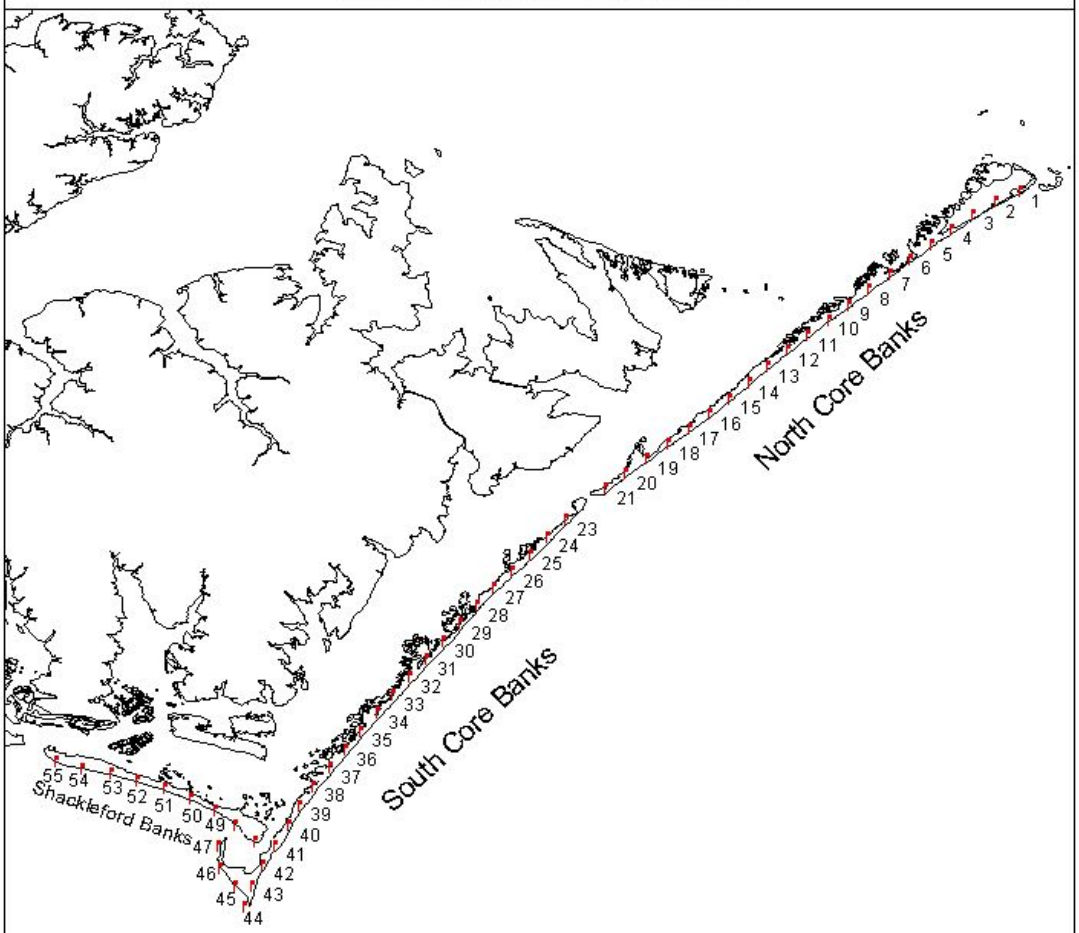
ATTACHMENT 1

EQUIPMENT AND MATERIALS
FOR
SEA TURTLE NEST MONITORING PROGRAM

ITEM	DESCRIPTION	QUANTITY
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

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Plot date: December 1, 2000 c:\my documents\gis\base 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.

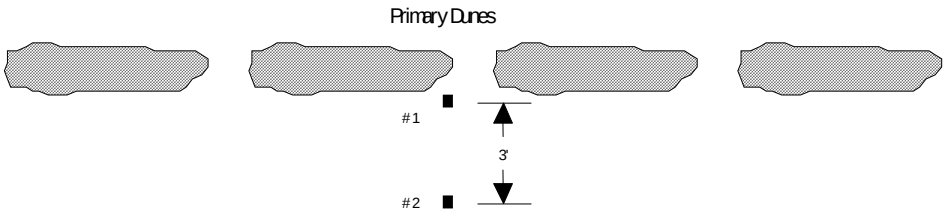
Latitude/ Longitude- If the nest is relocated, record the latitude and longitude of the new nest location using the GPS unit.

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

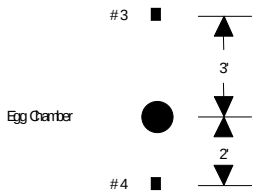
1) Nest stakes are PVC, range stakes may be wooden or PVC

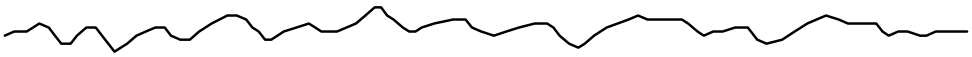
2) Stakes 1 through 4 must be on a straight line.

3) Stakes 3 and 4 should have orange reflector tape on top.

Legend

■ - Stake





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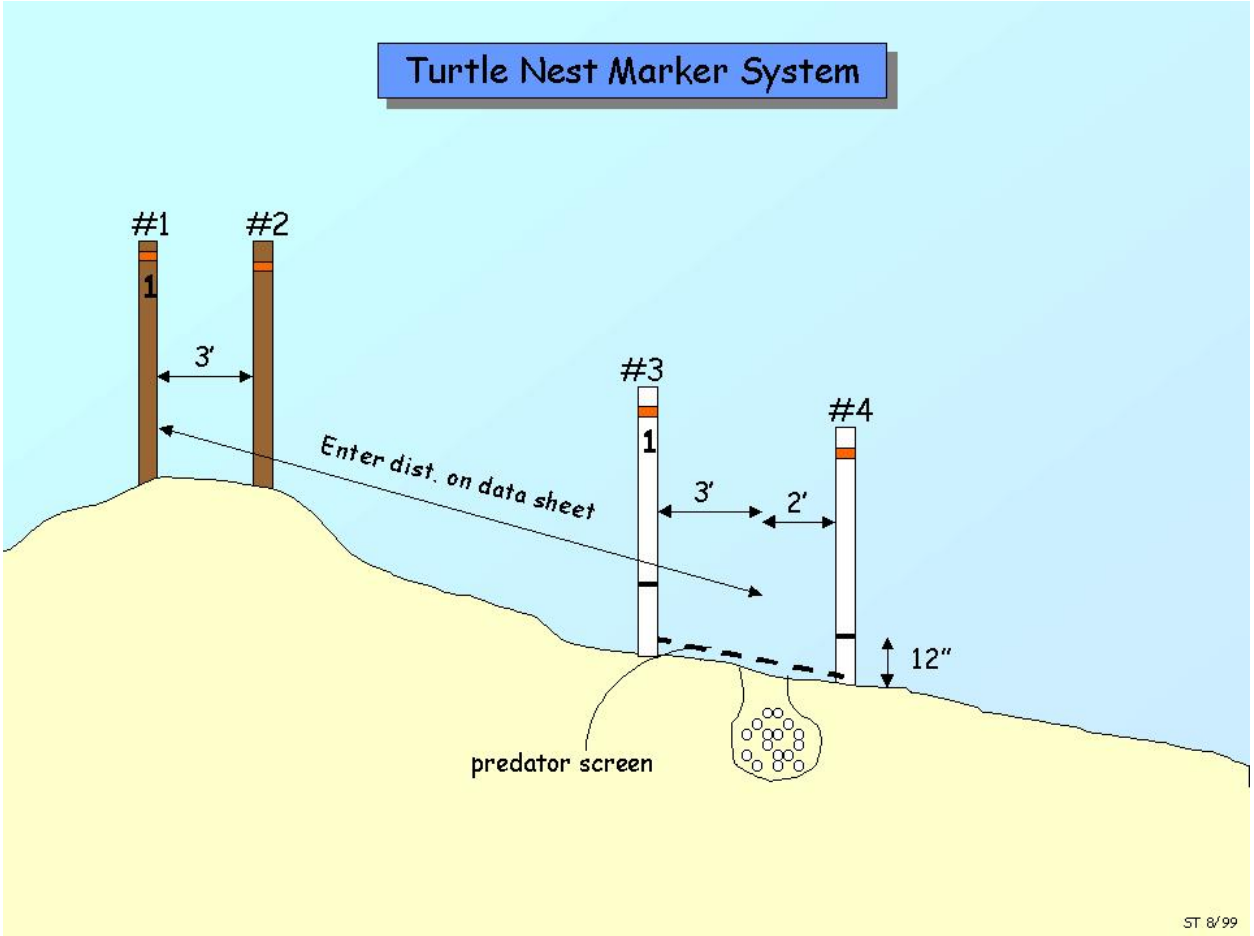
ATTACHMENT 4A

TURTLE NEST MARKER SYSTEM



ATTACHMENT 5- MASTER LOG OF SEA TURTLE NESTING ACTIVITIES 2005

_____*North Core Banks* _____*South Core Banks* _____*Shackleford Banks*

Activity Number	N	D	C	Location Original	Location Relocated	Latitude	Longitude	Date Occurred	Barricade Date	Estimated Hatch Date	Depress Date	Actual Hatch Date	Date Excavated

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 MM.MMM format.

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.

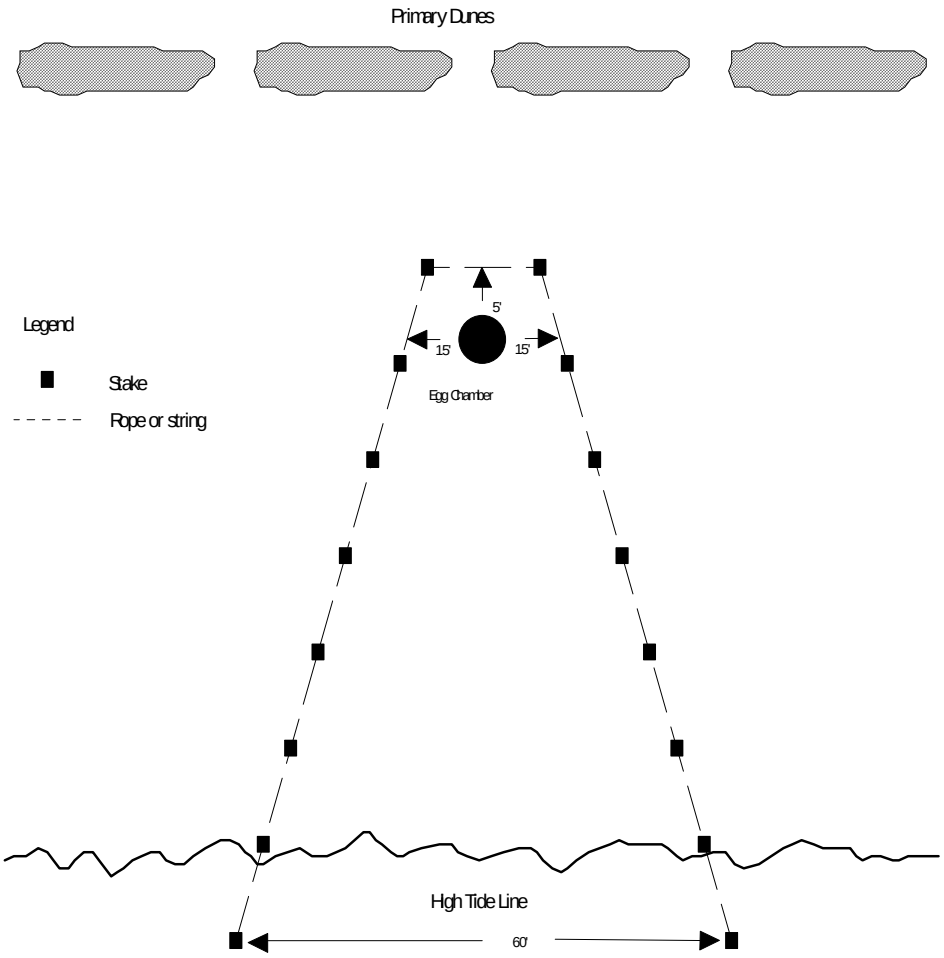
Depression Date. This date is taken by direct observation.

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



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.

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.

   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.

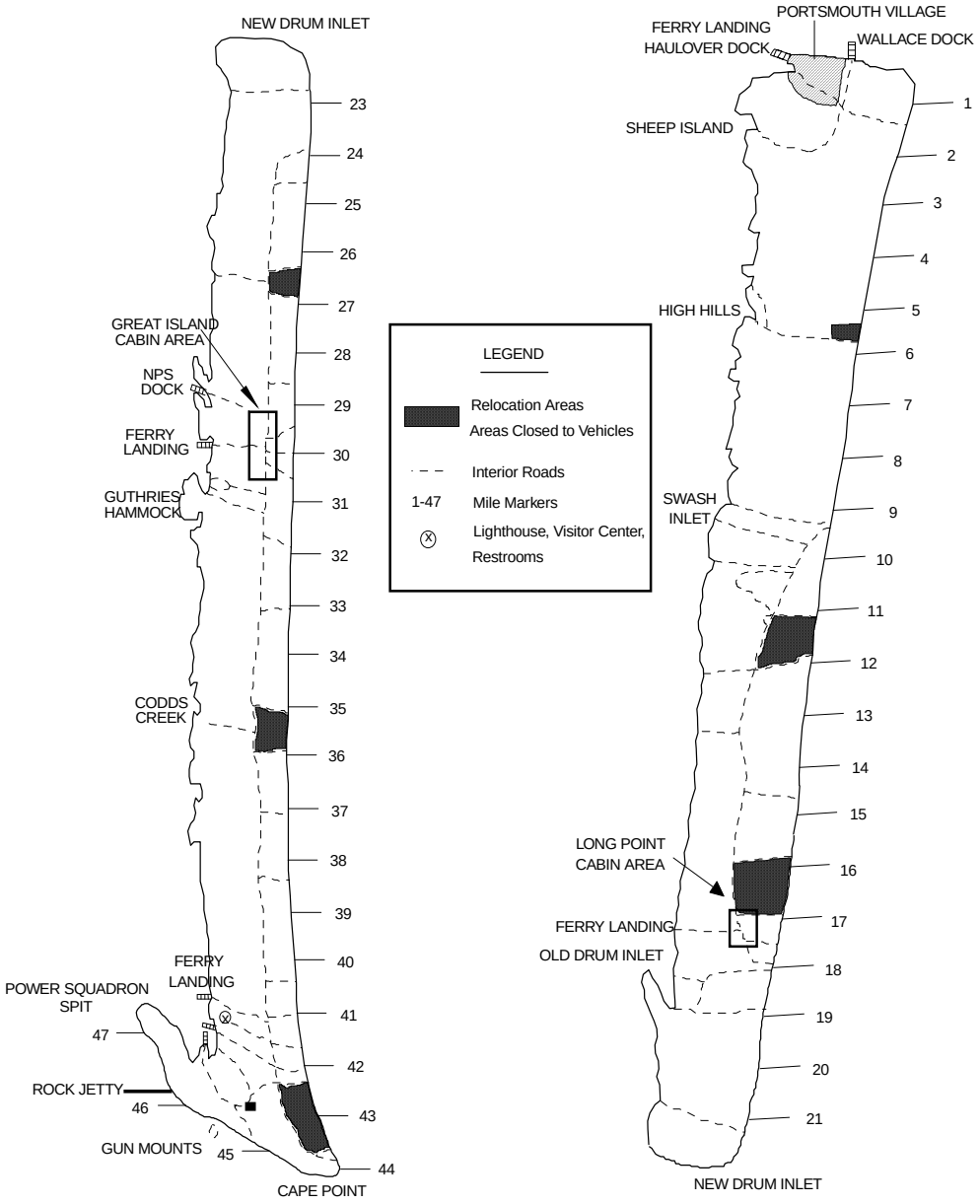
6. **Crawl Identification:** Surveyors will identify and record all "new" crawls by species and as nests or false crawls. False crawls will only be counted if the extend above the most recent high tide line. Crawl data will be reported by beach sector. The preferred length of beach sector is 1 km or 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



APPENDIX II

2005 INDIVIDUAL NEST DATA

Table 11. North Core Banks Sea Turtle Nesting Data-2005

#	Date	Mile	Relocated Mile	Hatch Date	Incubation	# EGGS	#Emerge	%Emerge	Comments
1	9-Jun	16.1		20-Aug	72	100	61	61	
5	13-Jun	8.4	11.4	15-Aug	63	135	124	92	
7	15-Jun	17.2	16.8	20-Aug	66	108	98	91	
8	16-Jun	17.2		20-Aug	65	113	80	71	
11	19-Jun	11.8	11.4	20-Aug	62	144	114	79	
12	19-Jun	18.2		22-Aug	64	109	75	69	
17	25-Jun	11.4		24-Aug	60	91	81	89	
18	26-Jun	11.7				110	106	96	ROOTS IN NEST
19	26-Jun	10.1				86	78	91	
20	27-Jun	18.4		20-Aug	54	112	102	91	
21	3-Jul	15.8	11.8	24-Aug	52	80	77	96	
23	5-Jul	6.3	5.3	3-Sep	60	104	99	95	
25	6-Jul	15.6		3-Sep	59	114	85	74	
26	6-Jul	11.9	11.9	2-Sep	58	144	135	94	
31	12-Jul	8.6	5.3			106	76	72	
32	13-Jul	5.7	5.4			85	75	88	
34	14-Jul	0.3	5.2			96	0	0	WASHED AWAY 9/15
37	15-Jul	7.1					0	0	WASHED AWAY 9/15
38	16-Jul	3.4	5.2			81	79	97	
40	17-Jul	7.7	5.2	8-Sep	53	110	105	95	
41	17-Jul	6.3	5.2			100	0	0	FLOODED
42	17-Jul	14.9	15.6			86	72	84	
45	18-Jul	3.8	5.2			99	92	93	
46	18-Jul	11.0	11.6			133	121	91	
47	18-Jul	15.1	15.6	8-Sep	52	145	123	85	
49	19-Jul	4.9	5.3			93	84	90	
53	23-Jul	9.8	11.6			120	6	5	FLOODED AND BURIED, 58 DEAD HATCHLINGS

	Date	Mile	Relocated Mile	Hatch Date	Incubation	# EGGS	#Emerge	%Emerge	Comments
56	25-Jul	17.2	15.6			167	6	4	FLOODED AND BURIED, 131DEAD HATCHLINGS
62	27-Jul	10.6	11.5			144	0	0	FLOODED IN HURRICANE OPHELIA
63	28-Jul	8.1	11.4			87	0	0	FLOODED IN HURRICANE OPHELIA
64	30-Jul	11.9	11.6			90	0	0	FLOODED IN HURRICANE OPHELIA
66	1-Aug	1.9	5.3			112	0	0	FLOODED AND BURIED
67	2-Aug	6.3	5.4			90	0	0	FLOODED AND BURIED
69	7-Aug	7.1	5.4			89	0	0	FLOODED AND BURIED
71	11-Aug	4.5	5.2			86	0	0	FLOODED AND BURIED
72	12-Aug	6.8	5.3			62	0	0	FLOODED AND BURIED
73	14-Aug	10.6	11.5			99	0	0	FLOODED AND BURIED

Table 12. South Core Banks Sea Turtle Nesting Data-2005

#	Date	Mile	Relocated Mile	Hatch Date	Incubation	# Eggs	# Emerge	%Emerge	Comments
5	2-Jun	40.9		5-Aug	64	96	88	92	
6	3-Jun	43.7		6-Aug	64	137	98	71	
8	9-Jun	45.2		13-Aug	65	147	126	86	
9	9-Jun	27.1		20-Aug	72	117	116	99	GREEN TURTLE
10	10-Jun	43.7		14-Aug	65	85	21	25	FLOODED
12	12-Jun	33.3		15-Aug	64	82	62	76	
13	12-Jun	39.6		15-Aug	64	111	103	93	
14	12-Jun	43		14-Aug	63	105	58	55	RACCOON PREDATION 6/12
16	13-Jun	46.9		13-Aug	61	127	94	74	
17	13-Jun	41.7		14-Aug	62	124	105	85	GHOST CRAB PREDATION
18	16-Jun	39.1				105	0	0	FLOODED
22	18-Jun	39.6		20-Aug	63	94	80	85	
23	18-Jun	42.9		25-Aug	68	98	17	17	FLOODED AND RACCOON PREDATION
25	19-Jun	28.2		19-Aug	61	81	48	59	
28	19-Jun	44.5	43.0	20-Aug	62	130	124	95	
29	19-Jun	44.1				145	0	0	FLOODED
31	19-Jun	43.6					0	0	WASHED AWAY 6/27
32	19-Jun	42.1				113	3	3	FLOODED
33	19-Jun	35.4				91	9	10	FLOODED
35	22-Jun	40.9		23-Aug	62	86	77	89	
36	22-Jun	44.0				148	0	0	FLOODED
37	23-Jun	28.7		20-Aug	58	93	71	76	
38	24-Jun	24				114	112	98	
39	25-Jun	36.2				89	0	0	LEATHERBACK, FLOODED
40	25-Jun	42.9		22-Aug	58	103	48	47	GHOST CRAB PREDATION
41	25-Jun	43.7				152	0	0	FLOODED
42	26-Jun	36.1		23-Aug	58	97	61	63	

#	Date	Mile	Relocated Mile	Hatch Date	Incubation	# Eggs	# Emerge	%Emerge	Comments
43	26-Jun	38.5		27-Aug	62	77	74	96	
44	26-Jun	42.7		21-Aug	56	118	115	97	
48	29-Jun	43.2				109	107	98	
51	30-Jun	30.3				102	87	85	
52	30-Jun	39.0		23-Aug	54	106	66	62	ROOTS IN NEST
54	1-Jul	41.9		23-Aug	53				DUG UP BY RACCOON AFTER HATCH
55	1-Jul	46.0		25-Aug	55	109	99	91	
57	2-Jul	36.9					0	0	FLOODED, WASHED AWAY 9/15
61	4-Jul	43					0	0	WASHED AWAY 9/15
62	4-Jul	44.1	43.3	3-Sep	61	76	63	83	LEATHERBACK
63	5-Jul	28	26.3	3-Sep	60	154	18	12	RACCOON PREDATION THROUGH SCREEN
65	5-Jul	23.9					0	0	WASHED AWAY 9/15
66	5-Jul	30.9					0	0	FLOODED, WASHED AWAY 9/9
67	5-Jul	40.7					0	0	FLOODED, WASHED AWAY 9/15
70	6-Jul	43					0	0	LOST TO RACCOON PREDATION
71	6-Jul	44	42.9	29-Aug	54	124	92	74	
72	6-Jul	44	42.9	29-Aug	54	129	96	74	
73	6-Jul	44.6					0	0	FLOODED, WASHED AWAY 9/15
74	4-Jul	36.9		27-Aug	54	102	98	96	
78	7-Jul	36.7					0	0	FLOODED, WASHED AWAY 9/15
79	8-Jul	45.3		31-Aug	54	118	107	91	
82	9-Jul	37.9					0	0	WASHED AWAY 9/15
84	9-Jul	42.7		3-Sep	56	101	82	81	
91	11-Jul	43.0		4-Sep	55				WASHED AWAY AFTER HATCH
92	11-Jul	40.2				93	0	0	FLOODED, 57 HATCHLINGS DROWNED
93	11-Jul	40.1	42.4	3-Sep	54	126	107	85	
94	11-Jul	40.1		3-Sep	54	106	101	95	
98	12-Jul	45.9	42.7			122	101	83	
99	13-Jul	34.5					0	0	LEATHERBACK, WASHED AWAY 9/15

#	Date	Mile	Relocated Mile	Hatch Date	Incubation	# Eggs	# Emerge	%Emerge	Comments
100	13-Jul	36.9					0	0	FLOODED, WASHED AWAY 9/15
109	14-Jul	44.6	42.7			105	99	94	
110	15-Jul	38.0		7-Sep	54	87	83	95	
113	17-Jul	24.8	26.3			121	0	0	LOST TO RACCOON PREDATION
119	18-Jul	36.3	35.3			150	0	0	FLOODED AND BURIED
120	18-Jul	34.2	35.2			109	0	0	FLOODED AND BURIED
124	18-Jul	26.3					0	0	WASHED AWAY 9/15
125	18-Jul	29.4					0	0	WASHED AWAY 9/9
126	18-Jul	45.9					0	0	WASHED AWAY 9/15
128	19-Jul	42.6	42.6			155	0	0	WASHED AWAY 9/15
132	20-Jul	44.1					0	0	LOST TO RACCOON PREDATION 7/20
134	20-Jul	44.9	42.6			115	0	0	WASHED AWAY 9/15
143	24-Jul	34	35.8			100	0	0	LEATHERBACK
147	25-Jul	46.0	42.6			145	0	0	WASHED AWAY 9/15
148	26-Jul	42.3				109	0	0	EGGS UNDEVELOPED
154	28-Jul	35.1				135	0	0	FLOODED AND BURIED
158	28-Jul	45.1	42.7			91	30	33	52 DEAD HATCHLINGS IN NEST
159	29-Jul	42.6				98	96	98	FEMALE TAG #PPZ507
160	30-Jul	30.5				109	0	0	FLOODED
164	31-Jul	30.3				131	0	0	FLOODED
168	31-Jul	43.4					0	0	WASHED AWAY 9/15
169	31-Jul	42.9					0	0	WASHED AWAY 9/15
173	1-Aug	33.6				144	0	0	FLOODED AND BURIED 9/15
178	2-Aug	33.2	35.3			120	0	0	FLOODED AND BURIED
179	2-Aug	38.9				101	0	0	FLOODED AND BURIED
186	4-Aug	34.4	35.2			87	0	0	WASHED AWAY 9/15
187	4-Aug	43.7					0	0	WASHED AWAY 9/15
188	5-Aug	33.9					0	0	WASHED AWAY 9/15
190	5-Aug	44					0	0	LOST TO PREDATION 8/5

#	Date	Mile	Relocated Mile	Hatch Date	Incubation	# Eggs	# Emerge	%Emerge	Comments
192	9-Aug	42.8	42.8			87	0	0	LOST TO PREDATION 8/21
195	10-Aug	42.6	42.6			138	103	75	
204	13-Aug	27.5	26.9			122	19	15	FLOODED AND BURIED

Table 13. Shackleford Banks Sea Turtle Nesting Data-2005

#	Date	Mile	Hatch Date	Incubation	# Eggs	# Emerge	%Emerge	Comments
1	7-Jun	53.2			93	89	96	
3	9-Jun	56.1			128	74	58	
4	?-Jun	53.8	3-Aug		134	103	77	NEST FOUND 6/9
6	16-Jun	49.3	30-Aug	75	110	60	54	LEATHERBACK
7	22-Jun	52.9	23-Aug	62	116	91	78	
8	23-Jun	51.5	23-Aug	61	141	117	83	
9	?-Jun	54.3	16-Aug		138	130	94	NEST FOUND 6/23
10	28-Jun	54.2	23-Aug	56	103	97	94	
11	28-Jun	51.4	23-Aug	56	113	102	90	
12	5-Jul	52.6			121	117	97	
13	4-Jul	55.3				0	0	WASHED AWAY
14	7-Jul	51.4	30-Aug	54	95	71	75	
17	14-Jul	54.6				0	0	WASHED AWAY 9/15
18	14-Jul	54.8				0	0	WASHED AWAY 9/15
20	19-Jul	52.9				0	0	WASHED AWAY 9/15
21	21-Jul	53.4				0	0	WASHED AWAY 9/15
23	28-Jul	55.0				0	0	WASHED AWAY 9/15