CAPE LOOKOUT NATIONAL SEASHORE

2000 SEA TURTLE MONITORING PROGRAM

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INTRODUCTION

The field rangers of 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 continued to monitor turtle activity, document strandings, protect nest sites, relocate endangered nests (1987 being the exception) and protect hatchlings. Cape Lookout continues to be a significant northern nesting beach and supports among the highest number of loggerhead turtle nests in North Carolina. Each year data has been collected, analyzed and presented to management in hopes of better protecting our declining marine turtle population. The 2000 Sea Turtle Report will summarize the 2000 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) and the U.S. Fish and Wildlife Service (USFWS), concerning the protection of sea turtles. The North Carolina Sea Turtle Project Coordinator receives all original stranding reports and annual nesting activity reports. NCWRC also issues to Cape Lookout National Seashore a Threatened and Endangered Species permit for possession and disposition of 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. In September of 1999 Old Drum Inlet reopened creating a 3-mile long island of land formerly connected to NCB. 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 forth 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

The Seashore is divided into three study areas; each area corresponds to one of the four islands comprising the Seashore. Student Conservation Association Volunteers (SCAs), interns 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, individual data sheets were completed for each nest and dig. Locations of each activity were noted by linear mile markers (See Appendix I, Attachment 2). For detailed information on procedures used in the 2000 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. These nests 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 towards the sound 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 on SCB. Wire cages were used on some nests between the lighthouse and Power Squadron Spit, the area with the most problems from raccoons in the past. Nests on NCB and SB were screened when they neared 50 days of incubation. Nests were

monitored for hatching activity through November. Nests were excavated for follow-up data.

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 2000 was on May 19 and the last on August 22, for a 95 day nesting season. A total of 338 activities were documented of which there were 190 nests, 13 digs, and 135 crawls, (Table 1; see Appendix I for activity definitions).

Table 1. 2000 ACTIVITIES BY STUDY AREA

	North Core Banks	South Core Banks	Shackleford Banks	CALO Total
NESTS	81	93	16	190
DIGS	5	8	0	13
CRAWLS	69	66	0	135

Figure 1. Cape Lookout Turtle Activities 1990-2000

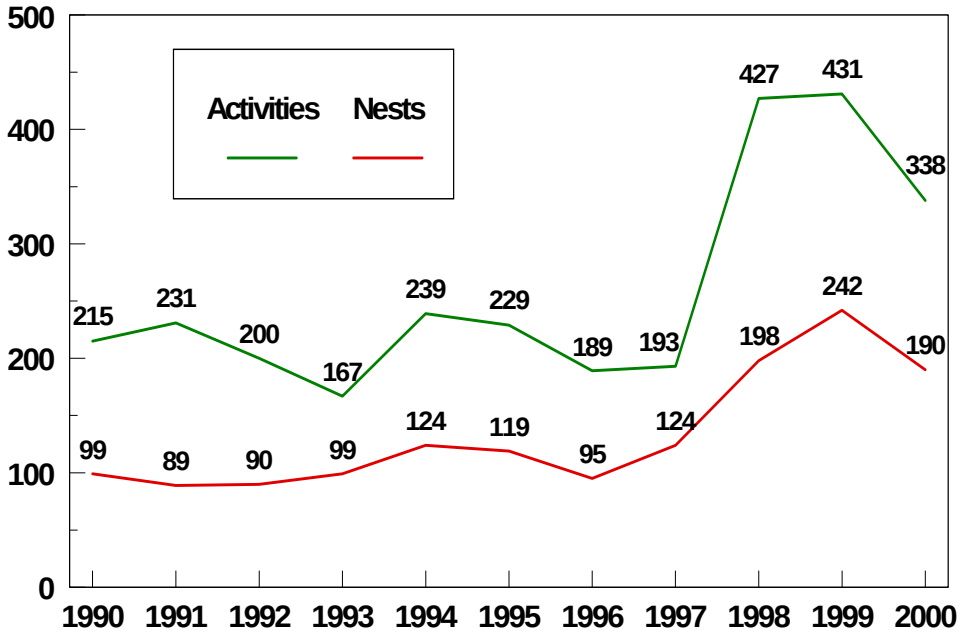
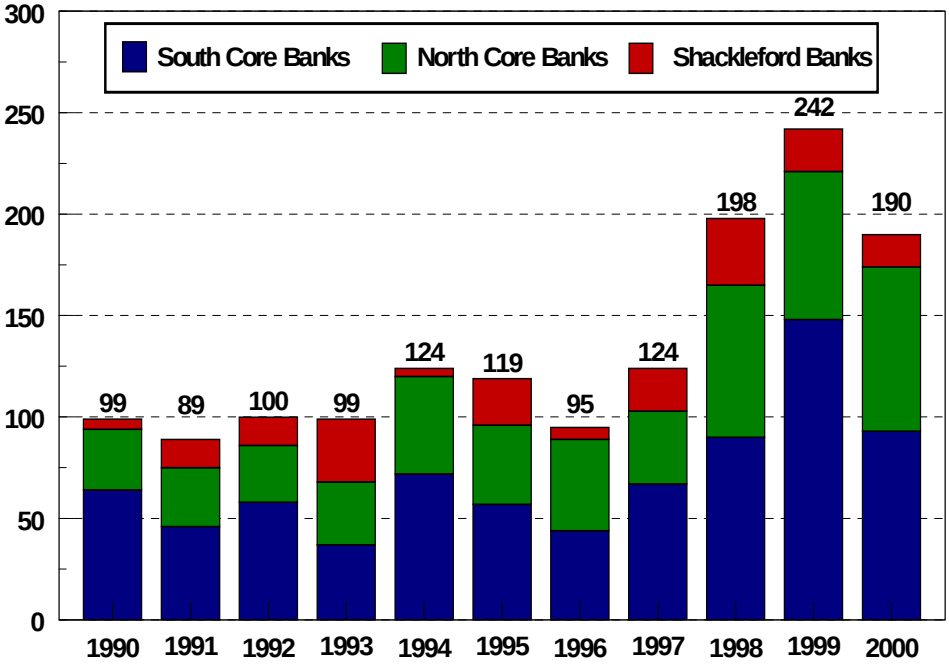


Figure 2. Turtle Nests 1990-2000



Nest totals for CALO in 2000 were the third highest ever recorded for the park (Fig. 2). NCB had a record numbers of nests. As in previous years, the greatest concentration of nests was in the area south of the lighthouse on SCB. The five-mile area between mile markers 42-47 accounted for 42% of the nests on the island. Nesting on NCB and Shackleford Banks was fairly evenly distributed (Fig. 3). The first leatherback turtle nest in the park since 1966 was found on NCB. One green turtle nest was found on SCB. The remaining nests were loggerhead turtle nests.

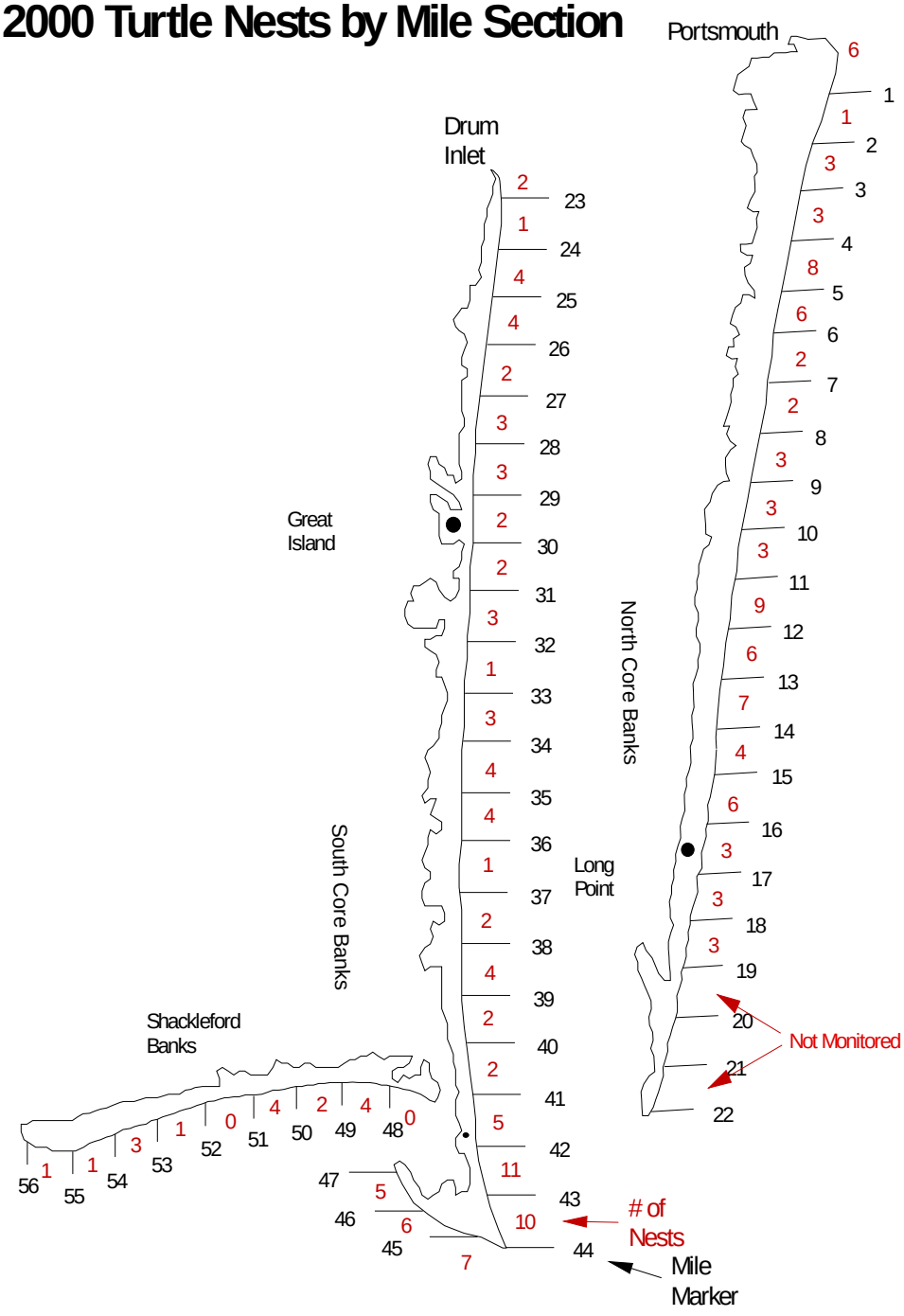
HATCHING RESULTS

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.

Follow-up studies were completed on 93% of the nests. One nests was washed away with the numbers of eggs unknown. Raccoons dug up 12 nests and the numbers of eggs were unknown. The last nest was excavated on November 17. The average clutch size was 111 eggs. It took an average of 67 days for nests to incubate. 69% of the eggs produced hatchlings that made it out of the nest (emergence success), the highest for any one nest being 100% and lowest 0%. A total of 19,527 eggs were counted in those nests either excavated or relocated. The number of eggs was unknown in 14 nests. 13,471 of these eggs hatched and hatchlings emerged or were released from the nest (Table 2).

Figure 3.

2000 Turtle Nests by Mile Section



Hurricanes or major storms did not affect the 2000-nesting season. Although 34 nests were overwashed only one nest was washed away and one nest failed to hatch due to flooding.

Calculating a true emergence success for the year always proves to be difficult. Raccoons may dig into a nest at hatching or after 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 2).

Table 2. SEA TURTLE HATCH SUMMARY 1990-2000

Year	Nests	Relocated	Excavated	Avg. Clutch	Flooded	Avg. Incu	Eggs	Emerged	EMR %
1990	99	68	89	115	1	57	10376	7369	71%
1991	89	56	74	115	6	62	8393	5197	62%
1992	90	39	84	114	4	63	9419	6791	73%
1993	99	54	89	115	9	59	10365	7544	74%
1994	124	98	119	120	3	62	14459	11296	79%
1995	119	66	103	115	38	57	12357	6157	51%
1996	95	69	85	115	16	65	10091	5602	57%
1997	124	92	120	122	3	63	14824	10740	73%
1998	198	117	169	114	39	62	19672	13315	69%
1999	242	123	191	116	90	62	23224	11751	53% *
2000	190	120	176	111	2	67	19527	13471	69%

*does not include 37 nests washed away with unknown egg totals

To provide a more accurate emergence success rate we have calculated an estimated emergence success of 65% in 2000. This figure includes 12 nests that were dug up by raccoons, but the number of eggs laid was unknown. The average clutch size for the year was given to those nests as the number of eggs laid, allowing them to be calculated into the estimated emergence success.

Table 3 provides a hatch summary by study area. SCB had an emergence success of 73%, well above the average hatch rate for the island in the last ten years. NCB and SH at 66% and <48% respectively both had lower rates than average.

Table 3. 2000 ACTIVITY SUMMARY BY STUDY AREA

	NCB	SCB	SH	TOTALS
NESTS	81	93	16	190
RELOCATED	54 (67%)	64 (69%)	2 (12%)	120
EXCAVATED	80	88	8	176
AVERAGE CLUTCH	111 eggs	111 eggs	116 eggs	111 eggs
EMERGE SUCCESS	66%	73%	<48%	69%
AVERAGE INCUBATION	69 days	65 days	61 days	67 days
# FLOODED	0	2	0	2
# DEPREDATED	9	11	10	30

In 2000 63% of the nests were relocated. Many nests that were relocated would have been lost to flooding had they not been moved. Non-relocated nests, in most cases, were laid on the primary dunes and met the park's criteria for a safe distance above the high tide line.

The emergence rate for relocated nests was less than the rate for untreated nests in 2000 (Table 4).

However, this does not include 12 non-relocated nests that failed to hatch but the number of eggs was

unknown.

Table 4. EMERGENCE SUCCESS OF RELOCATED VS. NON-RELOCATED NESTS BY STUDY AREA IN 2000

RELOCATED	NCB	SCB	SH	CALO Total
Nests	54	64	2	120
Eggs	5,853	7,272	251	13,376
Hatchlings	3,537	5,339	12	8,888
Emergence Rate	60%	73%	5%	66%
NON-RELOCATED				
Nests	27	29	14	70
Eggs	2,998	2,473	680	6,151
Hatchlings	2,344	1,807	432	4,583
Emergence Rate	78%	73%	63%	74%

Since 1990 emergence success has been similar for relocated and non-relocated nests (Table 5). The presence of good relocation areas has been the key factor in the success of relocated nests. This is dictated by the effects of storms on the beach and dune profiles.

In 2000, two nests were predated by ghost crabs. Ghost crab predation was recorded when eggshells were found on the surface. Raccoon predation was recorded for 28 nests. On SCB, raccoons dug into 12 nests, despite wire screens. The raccoons reached through the screen to get at the eggs on the top of the nest. Most raccoon predation occurred to relocated nests. Wire cages were successful in preventing egg losses to raccoons.

Table 5. 1990-2000 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	77	94
1991	63	57	76	97
1992	43	71	76	97
1993	54	74	73	90
1994	79	80	73	96
1995	55	61	38	86
1996	73	56	64	89
1997	74	69	86	95
1998	59	77	55	85
1999	51	49	59	79
2000	63	66	74	93
AVERAGES	61	66	66	88

Root invasion destroyed eggs or trapped hatchlings in seven nests. Two nests may have been affected by artificial light. Hatchling tracks and dead hatchlings were found near the backroad. Hatchlings may have been attracted to mainland lights or confused by topography rather than lights. Cold temperatures stopped development in five of nests by early November.

Off-road vehicles that disregarded beach closures threatened the successful survival of hatchlings. 70 violations of turtle closures were documented. Vehicles drove between posts and the ocean at low tide; drove through posts and rope or pulled up posts and drove through the closures.

DISCUSSION

An objective of the recovery plan for the loggerhead sea 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 and was effective in achieving a hatch rate greater than 60 percent in 2000.

Nests and hatchlings are protected from vehicles and park visitors through education and beach closures. Egg losses to raccoons can be limited through the use of screens and cages, although “smart predators” are providing new challenges. The management procedures used at CALO have been successful at increasing hatching success with minimal manipulation of natural sea turtle nesting.

STRANDINGS

Collecting information from stranded turtles is also an important phase of the CALO Sea Turtle Monitoring Program. Research has indicated that Loggerhead 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 the later stages, particularly large juveniles. Some potential nesting turtles are fatally wounded by boat propellers or ensnared in nets and line, in and around the shores of Cape Lookout.

96 dead strandings and 6 live strandings occurred at CALO in 2000. All strandings were reported to the Sea Turtle Project Coordinator for North Carolina. Species found were 46 loggerheads, 40 green turtles, 11 Kemp's Ridleys and 4 leatherbacks. The month of December had the greatest number of reported strandings (Table 6).

Carcass anomalies that may have contributed to the death of the turtle were recorded on each stranding report. 11 turtles were missing part or all of a flipper, five were missing heads (three had been cut off), eight had carapace damage, one had skull damage, one had a fish hook in the mouth, one had fishing net around the neck, four were found with prop scars and one turtle was cut in half with a knife. The remaining turtles showed no apparent cause of death. Turtles were scanned for Passive Integrated Transponder (PIT) tags. PIT tags were found in four loggerhead turtles. Metal tags were found in five loggerhead turtles (Table 7). 16 turtles were salvaged whole for the NC State Coordinator. Parts of 5 other turtles were salvaged for NMFS researchers.

Table 6. 2000 SEA TURTLE STRANDINGS AT CAPE LOOKOUT NATIONAL SEASHORE

	NCB	SCB	SH	OTHER	TOTAL
January	0	1	8		9
February	0	1	0		1
March	1	0	0	1	2
April	1	0	0		1
May	2	1	4	1	8
June	3	3	1		7
July	2	2	2		6
August	1	3	2		6
September	4	2	3		9
October	7	0	3		10
November	3	14	0		17
December	4	21	1		26
Total for 2000	28	48	24	2	102

The peak in strandings occurred in December when 25 dead turtles were found; most in the Cape Lookout Bight. The number of strandings in 2000 was the highest total ever recorded at CALO (Table 8). The average yearly total for 1990-1998 was 56 turtle strandings. 61 of the strandings occurred on the soundside of the islands, the remainder on the ocean beach. More leatherback turtles stranded at CALO in 2000 than in any previous year (Table 9).

Table 7. TAGGED LOGGERHEAD TURTLES FOUND AT CALO IN 2000

Stranding #	Date Found	Island	Metal Tag #	PIT tag #
00-16	17 May	NCB	SSR558, SSR559	None
00-39	23 August	NCB	QQT533, QQT554	None
00-68	23 November	SCB	XXE045, XXE046	500E0D477F
00-80	6 December	SCB	XXN001, XXN002	410B33287C
00-87	11 December	SCB		502E77310C
00-94	13 December	NCB	XXE178, XXE179	414409171D

Table 8. CALO SEA TURTLE STRANDINGS 1990 – 2000

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

Table 9. CALO TURTLE STRANDINGS BY SPECIES 1990-2000

YEAR	LOGGERHEAD	GREEN	KEMP'S RIDLEY	LEATHERBACK	UNKNOWN
1990	33	7	1	2	0
1991	16	2	1	0	1
1992	30	13	1	1	0
1993	29	6	5	2	1
1994	30	24	5	2	1
1995	27	7	6	1	2
1996	63	21	4	3	0
1997	49	1	7	0	0
1998	43	8	12	0	0
1999	36	41	15	2	0
2000	46	40	11	4	1

MANAGEMENT RECOMMENDATIONS

1. CALO should continue to use the US Fish and Wildlife's standards for conducting turtle patrols and continue the current relocation standards and procedures, these appear to be very successful.

2. Screens should be used throughout the park to prevent raccoon predation. Nests in the area south of the lighthouse should be protected with wire cages.

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

4. 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.

5. Vehicle closures should be better enforced to ensure that hatchling mortality is not caused by park
visitors.

APPENDIX I

2000 SEA TURTLE PROGRAM PROCEDURES

2000 SEA TURTLE PROGRAM PROCEDURES

The basic procedures for the 2000 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 assure 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. 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 in areas likely to be flooded will be relocated. Nests not in areas subject to flooding should not 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.

For all nests on SCB place a 3' by 3' (2"x 4" mesh) screen over the 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.

After 50 days have passed, all nests on NCB and Shackleford will be protected with screens following the above procedures. The turtle monitoring staff will now 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.

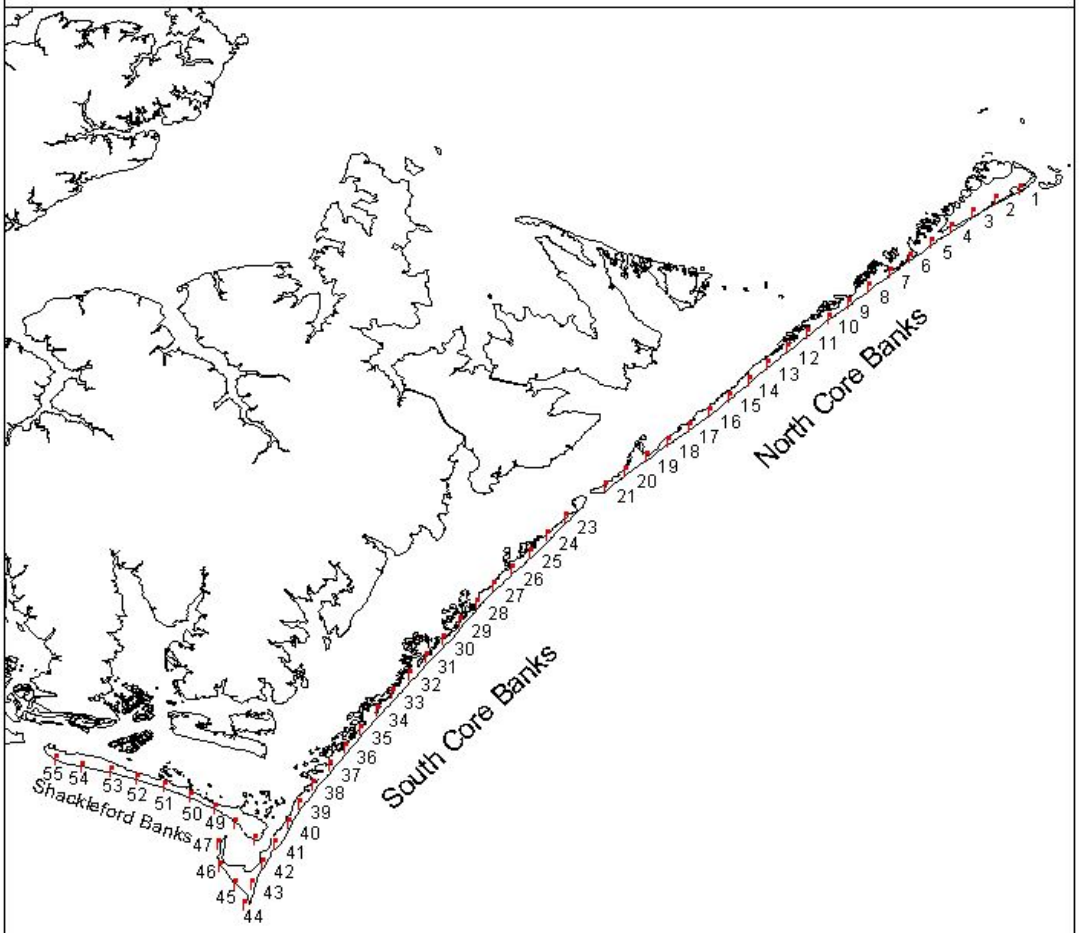
ATTACHMENT 1

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.

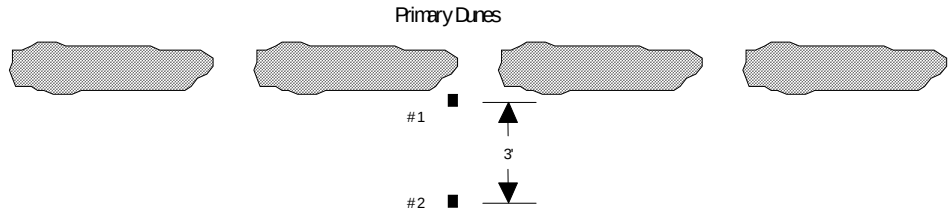
Latitude/ Longitude- If the nest is relocated, record the latitude and longitude of the new nest location using the GPS unit.

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:

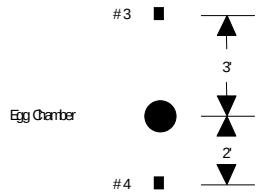
1) Nest stakes are PVC, range stakes may be wooden or PVC

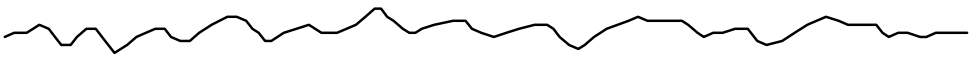
2) Stakes 1 through 4 must be on a straight line.

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

Legend

■ - Stake





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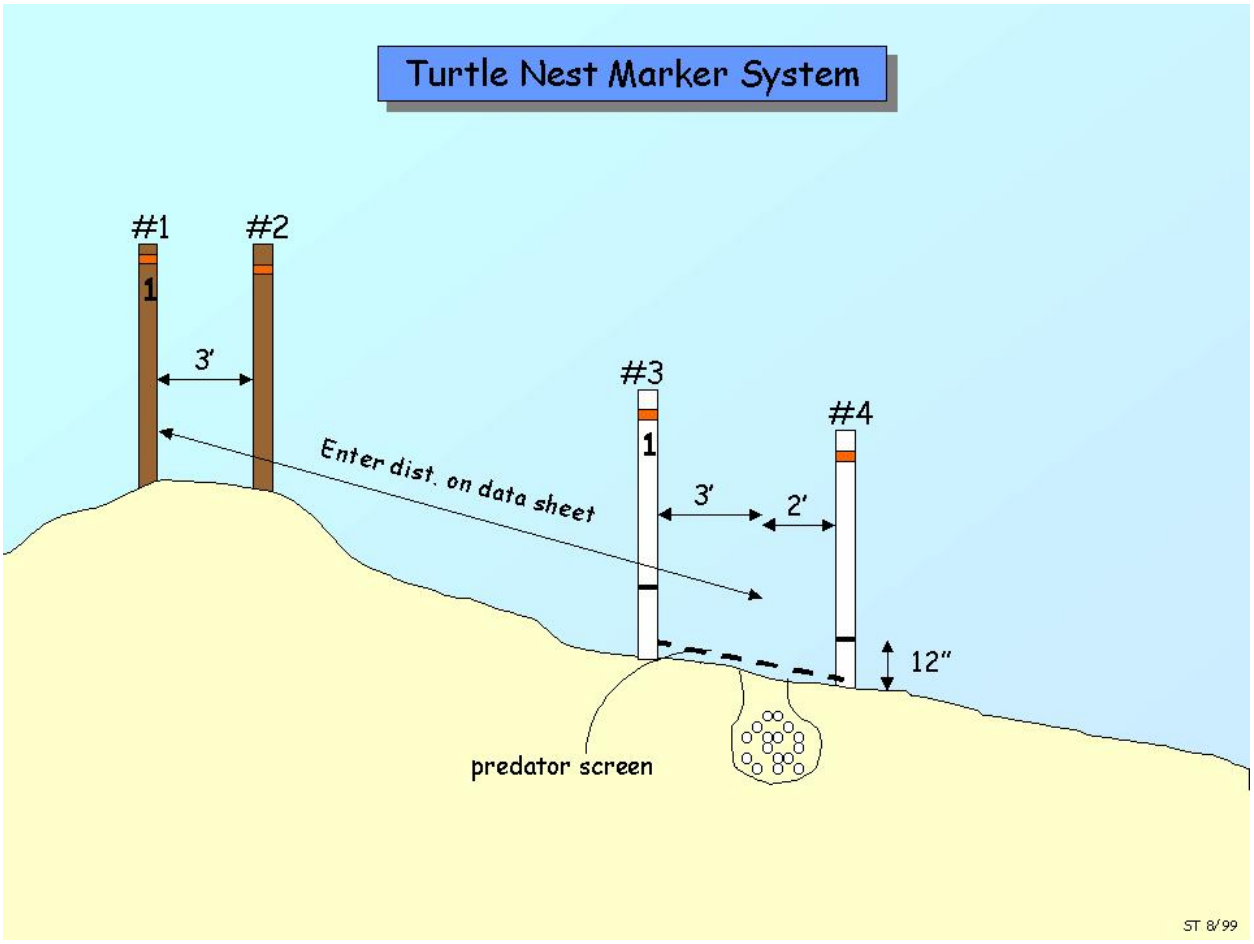
ATTACHMENT 4A

TURTLE NEST MARKER SYSTEM



ATTACHMENT 5- MASTER LOG OF SEA TURTLE NESTING ACTIVITIES 2000

_____*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.

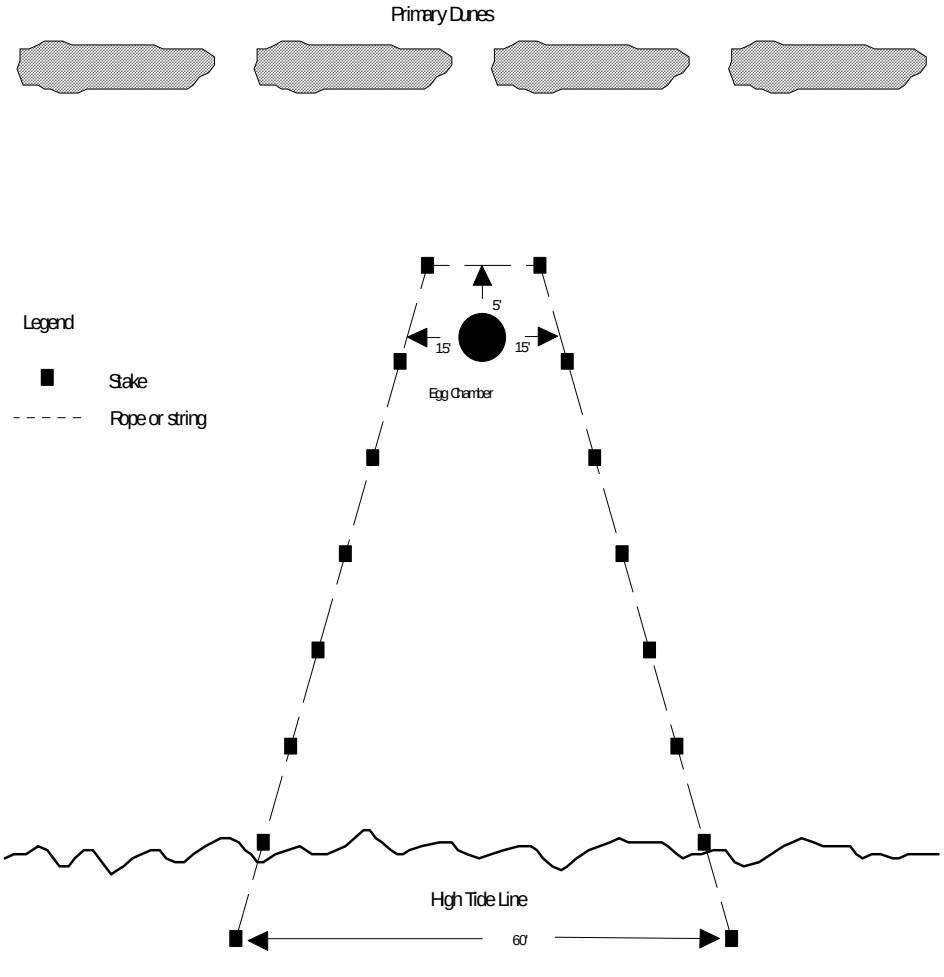
Depression Date. This date is taken by direct observation.

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.

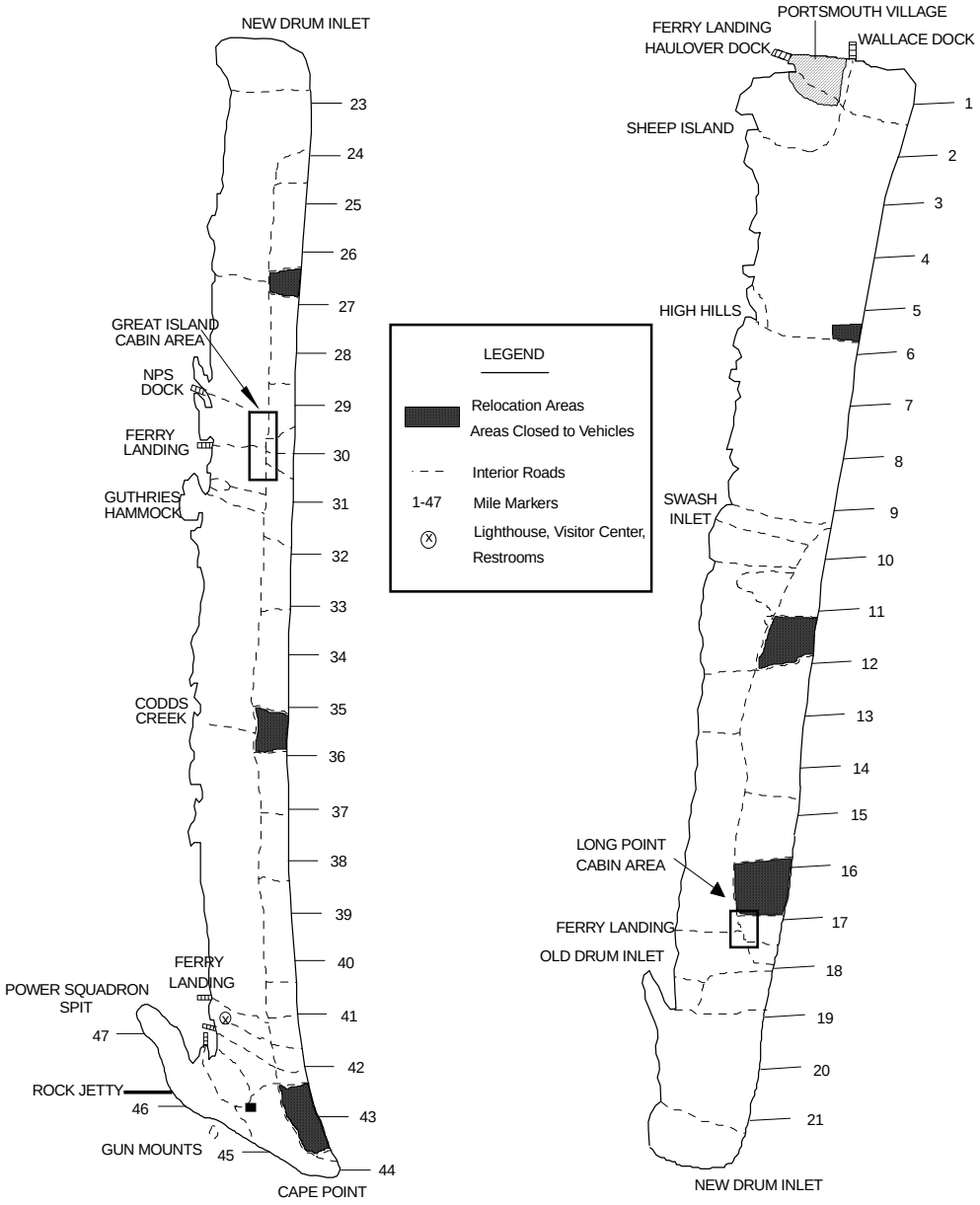
6. **Crawl Identification:** Surveyors will identify and record all "new" crawls by species and as nests or false crawls. False crawls will only be counted if the extend above the most recent high tide line. Crawl data will be reported by beach sector. The preferred length of beach sector is 1 km or 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. Index Beach Nesting Reports will be submitted on a weekly basis to: NC Sea Turtle Coordinator, P.O. Box 178, Marshallberg, NC 28553.

Attachment 8

Relocation Areas for Sea Turtle Nests



APPENDIX II

2000 NEST DATA