

Loggerhead Turtle Projects in South Carolina

Edited By
Sally Hopkins Murphy

ANNUAL REPORTS FOR 1983



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LOGGERHEAD TURTLE
PROJECTS IN SOUTH CAROLINA
Annual Reports for 1983



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TABLE OF CONTENTS

	Page
List of Tables	11
Introduction	1
Hilton Head Island Report	2
Pritchards Island Report	5
Prripp Island Report	10
Hunting Island Report	13
Edisto Island Report Part I	17
Edisto Island Report Part II	44
Seabrook Island Report	48
Kiawah Island Report Part I	51
Kiawah Island Report Part II	56
Cape Island Report	59
South Island Report	66

LIST OF TABLES

	Page
1. Loggerhead Sea turtle crawl activity on four Edisto Island Beaches, 1983	24
2. Success rate and causes of failure of verified loggerhead turtle nests and potentially true loggerhead turtle nests on four Edisto Island Beaches, 1983	26
3. Hatching success of loggerhead turtle nests on four Edisto Island Beaches, 1983	29
4. 1983 nesting season results, Kiawah Island, South Carolina	53
5. Yearly summary of hatchery data, Kiawah Island, South Carolina	55
6. Egg dissection results, Kiawah Island	58
7. Loggerhead turtle nesting and false crawl totals and density per km, 1975-1983, Cape Island, South Carolina	61
8. Hatching success and production of nests transferred to hatcheries	62
9. Data summary of control nests and unmonitored nest on beach, Cape Island	63

INTRODUCTION

The number of loggerhead turtle projects in 1983 increased to 9 with the addition of Seabrook Island. The cover photo was taken on Seabrook Island beach. It is an attractive reminder to the visitors and residents who share the beach with the turtles.

We hope this report will serve to inform those of us who work on the beaches of everyone's efforts. It should also be informative to sea turtle managers and researchers in other states. Any questions concerning the information in these reports should be directed to the individual authors.

SHM

LOGGERHEAD NESTING COUNT ON

HILTON HEAD, S. C.

by

Nanci Polk Weckhorst

OBJECTIVES

- (1) To count and record locations of loggerhead nests on Sea Pines Plantation, Hilton Head, S. C.
- (2) To count turtle strandings on Hilton Head Island.

INTRODUCTION

This was the second year for "Project Turtle Watch". This project involved six persons hired by the Sea Pines Beach Committee who walked the 5.2 miles of Sea Pines Beach. Volunteers checked the rest of the 11 miles of the island randomly and reported sightings of nests.

The hired persons were: Cindy Hykes, Allison Reed, Louanne LaRoche, Charles Wood, Kurt Huggins, Jeff Rupert

METHOD:

The beach was monitored from 15 May to 27 August. Each nest was located by its tracks and body pit to determine whether it was false or a true nest. The tracks were measured to determine the size of the nesting females. The nest was then marked to the dune side with 2" P.V.C. stakes acting as range markers. Measurements were taken of the distance from the stakes to the nest and from the stakes to a grid of base stakes. These main base stakes were 4" P.V.C. posts located every tenth of a mile in the primary dune along sea in the primary dune.

The nests were checked periodically for predation and also near hatching time. After signs of hatching the nest was dug up and the contents were recorded.

RESULTS

The nesting season started on May 26th and ended August 8th. There were 73 nests and 12 false crawls for the entire 16 mile island. From that total Sea Pines Beach recorded 48 nests and 10 false crawls. Of these 48 nests, 35 were south of the Monarch condos, 13 were north of the congested condo area. The majority of false crawls were directly in the congested areas.

The peak of the nesting season was the entire month of June but the greatest nesting was just prior to and just after the full moon.

Of the 48 nests recorded, 18 hatched for a 37.5% hatching rate. The average incubation time was 63 days.

Total nests hatched: 18

Average eggs/nest: 120.7

Of the 18 nest, total eggs: 2,173

Total eggs hatched unassisted: 1,840

Total undeveloped eggs: 191

Total live in nests, released: 123

Total of dead in nests: 24

Nest mortality was limited mostly to ghost crabs and water inundation from spring tides. There was also heavy loss of the nesting stakes due to beach traffic. The total stranding count was only 15 for the entire island.

RECOMMENDATION

As recommended in 1982 we would like to be able to relocate the nests layed in poor nest sites or to have a hatchery. This would allow a larger percentage of nests to hatch and provide more accurate information on hatchlings' success. Also beach renourishment would be unrestricted.

CONCLUSION

Thanks to the efficiency of the hired walkers, few nests were missed. Deep thanks goes to Mr. John Kennedy and several other helpful citizens who followed the project to the end, watching and reporting hatchings. Thanks also to citizens for reporting strandings to my office, and to Sea Pines Beach committee for funding this nest monitoring research.

LOGGERHEAD NEST TRANSLOCATION

PRITCHARDS ISLAND, BEAUFORT COUNTY, SOUTH CAROLINA

ANNUAL REPORT FOR 1983

by

David McCollum

INTRODUCTION

For the second consecutive season a loggerhead sea turtle conservation project has been completed on Pritchards Island. The use of this island as a nesting site by female loggerheads presents some particularly difficult problems for the turtles and those attempting to aid in the conservation of this threatened species.

The island, approximately two and one-half miles in length, is very erosional. The beach is heavily littered with stumps and logs of the eroded maritime forest. This condition discourages many female turtles when on shore and results in numerous false crawls. At high tide the waterline is virtually at the forest edge. The soil available to the turtle for nest deposition is sometimes thick with roots which hamper the turtle when she attempts to dig a nest. What dunes remain are small and have been consistently lost to erosional tides leaving a scarp that is difficult for the turtles to climb over. Though physical obstacles to nesting are many, the female turtles eventually find a site in which to deposit their eggs. In many instances these locations are within the spring tide range, and the nest would probably be drowned well before any hatchlings developed. Finally, Pritchards Island is inhabited by numerous raccoons that are quick to exploit any nest that is successfully deposited. Observers have noted that before the conservation project began, virtually every nest laid was destroyed either by high tides or raccoon predation.

METHODS

The situation on Pritchards Island requires the translocation of every nest that can be located. These nests are removed from their natural deposition site to a dune area where they are reburied in artificial nests and covered with wire. To accomplish this, it is necessary to have nightly beach patrols. This effort is employed between approximately May 20 through August 25 and

requires about 3,500 manhours of labor.

When nesting turtles are encountered, they are measured (carapace length and width) and checked for tags or any natural marks that might be useful for identification. This information is recorded along with time, nest location, and weather observations. Any crawl where an unobserved female has returned to the sea is checked for a possible nest. Body pits and likely nest locations are probed by hand to avoid damage to the eggs. It has been our experience to have females attempt to dig a nest cavity in several areas during the same crawl. It appears that the turtle digs down into roots or wet soil and attempts another nest cavity several feet away. Any crawl where no nest is located is classified as a false crawl. Locations of successful nests and false crawls are approximated on an island diagram.

This season the project was able to staff the island throughout the hatchery season in an attempt to enumerate and protect the hatchlings.

RESULTS AND DISCUSSION

Following is a data summary of the 1983 season on Pritchards Island:

Number of Nests Translocated: 91 (first nest, May 30; last nest, August 22)

Number of Eggs Translocated: 10,182

Mean Clutch Size: 112

Number of False Crawls: 309 (first crawl, May 25; last crawl, August 23)

Total Number of Crawls: 400

Number of Eggs Lost to Predators: 369+/- (estimated, before translocation)
82+/- (estimated, after translocation)

Number of Nests with Root Intrusion: 3

Number of Nests Inundated: 3 (Capers Island only)

Number of Strandings: 8

Number of Dead Hatchlings: 55

To avoid statistical error, the following data analysis does not include those nests inundated and those nests which could not be relocated due to loss

basket with a small kerosene lantern near the edge of the hatchery area. Emerging hatchlings would see this light before seeing the Fripp lights and move toward it. The light was placed so the hatchlings were trapped in the basket as they moved toward the light. This solution allowed the workers time to monitor both the beach and the hatcheries during that period of the season when both activities coincided.

The Final Report on the 1983 Fripp Island
Loggerhead Turtle Program

by

Norine Smoak

INTRODUCTION

Beach erosion continues to make the translocation of nests necessary. Our organizational meeting in April was attended by 22 volunteers, eager to start locating and verifying turtle nests.

METHODS AND MATERIALS

Beach sections were patrolled by volunteers early each morning. All nests laid below the rock revetment and in front of the Beach Club were relocated. Each body pit was probed for the nest to be verified. The nest number, date and location were recorded on our white stakes. File cards on each nest contained further information, description of nest site, whether the nest was in the high tide zone and moved, at which time eggs were counted and recorded.

RESULTS

The first female crawled up on the beach on May 27, approximately 2 weeks late from previous years. Once the ocean water temperature suited the loggerheads they continued to come aboard through August 25 to dig their nests and lay their eggs.

Fripp continues to be a safe nesting place for these marine turtles - the total number of verified nests is fairly stable - this year there were 124 verified nests and 106 false crawls. Many of these false crawls occurred near the north point where the pole light near the pro-shop shines all night. This season, for the first time, nests south of the villas through sub-division 3, section A, also had to be moved since high tides reached the base of the primary dune daily. Consequently 84 nests had to be relocated, and 10,639 eggs were moved to a safe area. The first nests hatched in approximately 60 days, due to cool weather in June. As the summer got hotter and dryer, eggs hatched in shorter times - incubations of 42 to 46 days common. This fast development produces small, premature hatchlings, many of them suffocating before they could dig out of the dry sand. These weak hatchlings were subject to tiny ants which seemed to sense when a nest was hatching - they attacked

the top hatchlings, destroying eyes, head and soft carapace. We had a sad count of 2266 dead hatchlings and approximately 3078 infertile and root-haired eggs - where minute roots searching for moisture invade the egg and literally consume its contents. On the other hand, with constant surveillance by volunteers 9,180 hatchlings made their way to the ocean. We had no severe storms during the nesting season. By marking the high tide peak in June and July, it was easier to judge if a nest would be in jeopardy. One nest in its 21st day of incubation had to be moved just before a flooding tide on September 1. In the nest 35 days, roots reached the new nest site and filled 21 eggs, 9 eggs failed to hatch, and 67 hatchlings crawled their way to the water.

The stranding network reported 9 washed up marine turtles on Fripp in 1983. These carcasses were measured and mutilations noted by Tom Holme and Norine Smoak. This is a program extending from the New England coastline to the gulf coast of Texas. The total count for the South Carolina coast was 169 this year, higher than last year but much lower than the 581 counted in 1980.

CONCLUSIONS

Relocation of nests is essential on Fripp until our beach becomes stabilized sufficiently to have a beach area between high tide and the primary dune. The survival battle between vegetation and turtle eggs is a problem of nature with no solution. Areas with a low peak of high tides support rapid vegetation growth - most welcome for beach erosion but root growth can be deadly to the turtle eggs.

Active volunteers who spent countless hours in the loggerhead project included Tom and Billy Holme, Betty Sobol, Mary Lauffer, Louise and Ed Schneider, Mary Oppenheimer, Olga Luster, Pres Edwards, Marge Dysart, Mary Frederick, Dorothy Dugdale, Lynn Knaus, Nellie and Bob Newman, Ether Farr, Bev Edwards, Jack Muhlhauser, Norine and Dick Smoak, Kay and Claude Cowan and Max Talaska. Nellie Newman, who has worked with the program several years, will be the director for the next season.

LOGGERHEAD NESTING ON
HUNTING ISLAND, SOUTH CAROLINA

by

Marjorie Reed

Louise Schneider

OBJECTIVE

- (1) To try to save and hatch as many loggerhead turtle eggs as possible and release hatchlings to the sea.

INTRODUCTION

This study was performed to determine the number of Atlantic loggerhead nests laid on Hunting Island and the success rate of the nests, and the number of hatchlings produced during the season.

Hunting Island has experienced severe erosion in the past; and there has been a continual loss of sand since the beach renourishment project in 1980. These erosion problems made it necessary to relocate nests that were laid in areas susceptible to inundation by tides, to more favorable sites.

Major management activities during the 1983 nesting season of the loggerhead included locating nests, transferring nests to higher dune locations, protecting nests with wire and snowfencing, and monitoring the emergence of the hatchlings.

METHODS

Two teams patrolled Hunting Island to locate and mark nest sites and record false crawls. The northern half of the island was patrolled each morning from 10 May to 15 August. The southern half of the island was patrolled from 15 May to 1 November. On the southern half of the island nests in danger of inundation by tides, or by predation were relocated on the foredune away from Uniola paniculata sea oats and away from the public beach and campground. On the northern half of the island, nests found (via probing) were moved to a safe dune area on Fripp Island with the exception of one verified nest (the 1st) which the turtle laid in a high sand dune on Hunting Island. All the other nests had been laid in a precarious location, in a beach area where the high dunes are far back from the high tide line. People traffic plus trash trucks which operate on the beach 2 - 3 times per week to empty beach trash containers jeopardize nests. Many nests were laid in the soft sand area below the high tide line. In a highly populated, transient area such as this, it was impossible to mark the nests except by paces from a fixed

point on the Island as even the loggerhead turtle nesting area signs were all removed.

All nests were covered with 3'x3' sections of chicken wire to help protect them from raccoon predation. The wire was placed on top of each nest, and the edges buried. This screening was removed when it was found not to be effective against raccoons. Half-inch mesh hardware cloth was then purchased and used to cover the nests. The hardware cloth was found to be an effective deterrent to predation.

The date all nests were laid, the number of eggs in each nest, other pertinent information (we had several eggs this year with two yolks - all hatched as single) was recorded on file cards.

The nests were monitored daily, and the screening removed just prior to hatching.

RESULTS

The 1983 loggerhead nesting season on Hunting Island lasted 89 days. During this time, there were 168 emergences; with 101 nests (60%), and 67 false crawls (40%). Of these 101 nests, 27 were destroyed by raccoons (27%), and 2 by ghost crabs (2%). There was a peak in both nesting and false crawls during the second week in June.

It was necessary to move all but two nests due to the severe erosion of the beach, resulting in steep vertical dune banks, which the female turtles could not crawl over.

A total of 6,528 hatchlings emerged from 72 nests, and were observed entering the water during the season.

In regard to the other 13 nests relocated on Fripp, there were 1,675 eggs laid and 1,231 hatchlings released (75%). We did have a problem with ants in the first two nests that we relocated in a renourished dune, but fortunately we found a safer natural area of sand dunes for the remaining nests. Fifty-one hatchlings were killed by ants and 282 eggs did not mature (roots, sea oat hair, etc.).

CONCLUSIONS

Half-inch hardware cloth was found to be more effective than chicken wire in protecting the nests from raccoon and ghost crab predation. Nests laid near the state cabins and public beach areas were more susceptible to predation than those laid on the private sector of the island.

RECOMMENDATIONS

Since the severe erosion of the island prevents the turtles from climbing the banks, they dig their nests on the berm; therefore it is recommended that the eggs be carefully moved to safer areas on the dunes, be protected from predators, and monitored through hatching.

Part I

Edisto Island Sea Turtle Project

1983

by

Deborah A. Mundell

OBJECTIVES

- (1) To determine distribution, frequency and success of nesting and causes of disturbance to loggerhead turtle nests on four Edisto Island beaches:
Botany Bay Island, Edingsville Beach, Edisto Beach State Park and Edisto Beach.
- (2) To protect nests from small animal predation on Botany Bay Island by wire screening of nests.
- (3) To prevent poaching of loggerhead turtle eggs on Edingsville Beach and Edisto Beach State Park.
- (4) To initiate a "Lights Off" campaign on Edisto Beach to encourage residents and beach users to reduce the amount of light shining on the beach during nesting and hatching seasons.
- (5) To obtain from Town Council of Edisto Beach an agreement to have street lights in selected areas shielded or shaded to prevent disorientation and subsequent death of newly emerged hatchlings, and to solicit from Town Council their official endorsement of the "Lights Off" campaign.
- (6) To continue development and utilization of public education programs and materials which convey information about loggerhead sea turtles and the Edisto Island Sea Turtle Project to area residents and visitors to Edisto Beach and Edisto Beach State Park.
- (7) To continue the volunteer network program initiated in 1982 on Edisto Beach.
- (8) To evaluate the effects of human beach usage and coastal development on loggerhead turtle nesting activity.
- (9) To continue participation in the South Carolina Sea Turtle Stranding Network.

METHODS

Four beaches on Edisto Island, S. C. were included in the 1983 Edisto Island Sea Turtle Project (EDSTP): Botany Bay Island (BBI), Edingsville Beach (Ed'ville), Edisto Beach State Park (EBSF) and Edisto Beach (EB) (Fig. 1). Nesting surveys were conducted on all four beaches. On BBI, where small animal predation accounted for

loss of 95% of nests laid in 1981 and contributed to the failure of approximately 40% of nests laid in 1982, a nest protection program similar to the one used in 1982 was conducted. To minimize loss to inundation by high tides, nests laid below the beach crest or distinctly within the tide margin were moved to safer locations within the first 24 hours after discovery. Slide shows and printed material designed to provide information about sea turtle biology and conservation efforts, in general, and the EISTP in greater detail, were made available to the public. Both the Sea Turtle Hotline and the Volunteer Network, organized in 1982 to provide researchers with additional information on sea turtle activity and to increase the number of individuals knowledgeable about and involved in local conservation efforts, were utilized again in 1983. The "Lights Off" program was initiated as planned, and project investigators reported information on dead turtles to the Stranding Network as in the previous two years.

Nesting surveys were conducted for a third season on BBI and EBSP. Edisto Beach was surveyed for the second time, and Ed'ville Beach, which was included in the 1981 study, was surveyed again this season. BBI and EBSP were walked daily at dawn. EB was surveyed at least every other day by beach residents participating in the Volunteer Network. Ed'ville was patrolled on an alternate day schedule. Upon discovery, each turtle crawl was designated as "true", signifying nesting, or "false", meaning that no nest was laid. A nest was marked "true" only after verifying the presence of eggs by careful probing with a one-inch wooden dowel to locate the nest cavity and subsequent excavation by hand until an egg was observed. If eggs could not be located by probing, but it looked as if the turtle had nested, the crawl was categorized as "true/false", and was monitored for signs of disturbance and hatching as were verified true nests.

Beach, weather and nest conditions were recorded for each crawl. Crawls were

then marked with color-coded flags offset at specified locations from true nests in order to protect against possible tampering with the eggs. On EB and EBSF where large numbers of people are present on the beach and flag loss is high, two flags were used to mark each nest. Nests were then monitored during subsequent beach patrols, and any changes in beach or nest conditions were noted. Meteorological data were also collected during each walk.

To minimize loss of nests to beach erosion and tidal inundation, nests laid below the beach crest or distinctly within the tide margin were moved to safer locations within the first 24 hours after discovery. In each case, a nest cavity of similar size and shape was dug by hand in the vicinity of the original nest but in an area judged to be safe from overwash and intrusive root growth. Care was taken not to jolt or rotate eggs during relocation.

Nests were monitored for signs of hatching and/or emergence beginning at 50 days incubation. Hatchling tracks and a slight depression or easily penetrated spot in the sand signified that emergence had taken place. At this time, nests were carefully excavated by hand. Live hatchlings still in the nest were counted and their condition noted. Hatchlings were then released and allowed to migrate from nest to ocean independently. Hatched fragments, unhatched eggs and number of dead and deformed hatchlings were counted. Total number of eggs and number of hatchlings which has emerged from the nest were then determined and emergence success calculated using the following formula:

$$\text{Emergence Success} = \frac{\# \text{Hatched fragments} - \# \text{Dead in nest}}{\# \text{Total eggs}}$$

On BBI, where a nest protection program was initiated in 1982 to discourage raccoon predation, wire screening of nests was continued. Based upon results obtained by using several different types of screening material during the 1982 study, $\frac{1}{2}$ " mesh hardware cloth was selected for use this season. On a trial basis, several nests were covered with two pieces of 2"x4" mesh dogwire, overlapped to reduce the mesh size, instead of hardware cloth screens. In each case, 3'x3' sections

of wire were centered directly over nest cavities and were anchored on four sides using logs and driftwood found on the beach. Sand was mounded along the sides of the screen, and a shallow layer was scattered over the top to partially conceal the wire.

Nests discovered after already being disturbed were checked to determine whether the predation had been partial, with viable eggs still remaining in the cavity, or complete. In the case of partial predation, all egg shell fragments were removed from in and around the nest cavity and were counted. The cavity was then carefully refilled and screened as described above. Nests were checked regularly during later beach patrols for signs of additional predation attempts. Numbers of eggs destroyed in completely predated nests were also recorded and the cavities refilled.

The time at which screens were removed from nests was variable depending upon the type of wire used. Hardware cloth screens were removed after 50 days incubation to insure that hatchlings would not be trapped beneath the small mesh wire as they attempted to emerge from the nest. Initially, these nests were left uncovered until hatching and emergence, but when it was discovered that unprotected nests were being dug and depredated by raccoons and ghost crabs around the time of hatching, 3'x3' sections of dogwire were placed over the nests as the hardware cloth was removed. In the case of nests covered with two overlapping pieces of dogwire, one piece was removed at 50 days incubation and one was left in place to protect the nest against predation at hatch. Results from the 1982 study on BBI confirmed that hatchlings were not hindered in their emergence from nests covered with 2"x4" mesh wire. When it was later discovered that dogwire screens were not completely successful in protecting nests from predation at emergence, a method of protection used several years ago by investigators on Blackbeard Island, Ga. was initiated. Instead of removing hardware cloth screens at 50 days incubation, boards were inserted under the front edge to create a crawl space and front exit for the

hatchlings as they emerged. In this way, the nest could be protected from excavation by predators and still allow hatchlings to leave the nest unimpeded.

As in 1982, a Volunteer Network was organized to assist with the nesting survey of Edisto Beach. Volunteers assigned to beach patrol were responsible for a specific section of beach which he or she agreed to walk at least every other day. Observations of turtle activity were reported to one of the project investigators who, in turn, verified the observation, recorded the necessary data and marked crawls as true, false or true/false. Volunteers then monitored nests until signs of hatching and/or emergence were observed, at which time project investigators again were contacted and the nest excavated to determine emergence success and tally nest contents.

The "Lights Off" campaign was carried out in three phases. First, an appeal was made to the Town Council of Edisto Beach to have street lights in problem areas shielded or shaded on the beachward side. Second, letters were distributed by volunteers to beachfront homes, explaining the problem and requesting that residents reduce the amount of light used in and around the home at night during the nesting and hatching seasons. Each of the four realty offices on EB agreed to post similar notices along with "Attention Beach Users" guides in rental homes listed with their agency. Finally, notices warning of the danger to hatchlings in brightly lit areas and appeals for assistance in returning disoriented hatchlings safely to the ocean were posted in restaurants, realty offices, stores, etc. on the Island.

Pamphlets supplied by the Center for Environmental Education were distributed to campers at EBSP and were made available at each of the 4 realty offices. "Turtle Talks" were presented at the State Park each week from May until September. During peak nesting and hatching seasons, night walks were conducted at the State Park following the slide presentations so that participants might have a chance to see a nesting or hatching in progress. Talks were also presented to local service

Table 1. Loggerhead Sea Turtle Crawl Activity on Four Edisto Island Beaches, 1983.

	Botany Bay	Edingsville	Edisto Beach	Edisto	Total
	Island	Beach	State Park	Beach	
	1982 1983	*1981 1983	1982 1983	1982 1983	1982 1983
Total Crawls	259 225	(146) 98	144 110	66 91	469 524
True Crawls	122 96	(63) 20	91 49	45 58	258 223
False Crawls	137 125	(83) 55	39 39	5 19	181 238
True/False Crawls	0 4	(0) 23	14 22	16 14	30 63
Crawl Density	74.0 64.0	(50.3) 33.8	68.6 52.4	12.0 16.7	42.3 37.4
Nesting Density	34.9 27.4	(21.7) 6.9	43.3 23.3	8.2 10.5	23.2 15.9

* No 1982 data available for Edingsville Beach. 1981 data given for comparison instead.

reasons. Of the 63 true/false crawls which failed to show signs of hatching, 16 were described as having more false characteristics than true at the time of discovery, 38 were overwashed by high tides and 4 were disturbed by humans. Causes of failure of true nests are summarized in Table 2.

Number of nests discovered on BBI decreased by 21% from 122 in 1982 to 96 in 1983. Success rate increased from 46.7% in 1982 to 47.9% in 1983 with hatchlings emerging from 46 of 96 nests laid. Total number of eggs laid, number of eggs hatched and number of eggs unhatched could not be determined precisely since the contents of 5 completely predated nests and 22 nests depredated at hatch were too fragmented to count; another 8 nests were lost to overwash and could not be located for excavation and tally of contents. A minimum of 8668 eggs were laid with a mean number of 117 eggs per nest in nests with a known number of eggs. Total number of hatchlings emerged and mean emergence success could not be calculated for nests on BBI since total number of eggs laid and total number of eggs hatched could not be determined. However, the mean emergence success of nests with known number of total eggs and known number hatched was 52.1%; mean number of hatchlings emerged per nest was 63.0.

Fifty of the nests laid on BBI were unsuccessful. Seventeen (17) had been completely destroyed by predation, 16 were lost to tidal inundation, one suffered water damage from heavy rainfall and 5 were lost to beach erosion. Plant roots were found growing into and around eggs in 6 unhatched nests at excavation. Causes of failure of the 3 remaining unhatched nests is unknown (Table 2). Two (2) true/false crawls, verified as true nests by excavation, also failed to hatch; one for unknown reasons and one due to overwash. An additional 4 true/false crawls which showed no signs of hatching or predation had been visually assessed as more false than true at the time of discovery.

As in 1982, small animal predation continued to be a significant problem on BBI

Table 2. Success Rate and Cause of Failure of Verified Loggerhead Turtle Nests and Potentially True Loggerhead Turtle Nests on Four Edisto Island Beaches, 1983.

	Botany Bay Island		Edingsville Beach		Edisto State Park Beach		Edisto Beach		Total	
	++T	T/F	T	T/F	T	T/F	T	T/F	T	T/F
Total #	90	10	4	39	28	42	38	31	160	122
# Successful	42	4	4	16	21+	20	31	17	98+	57
# Unsuccessful	48	6*	0	23	7	22	7	14	62	65*
Cause of Failure:										
Complete Predation	17	0	0	0	0	0	0	0	17	0
Overwash/Partial Predation	8	0	0	0	0	0	0	0	8	0
Overwash/No Predation	8	1	0	8	5	18	3	2	16	29
Beach Erosion	5	0	0	0	0	0	0	0	5	0
Plant Roots	6	0	0	0	0	0	1	0	7	0
Water Damage	1	0	0	0	0	0	0	0	1	0
Human Disturbance	0	0	0	4	0	0	0	0	0	4
Unknown	3	5**	0	11	2	4	3	12	8	32**

+ One false crawl also verified as true at hatching.

* Includes two verified as true nests at excavation.

** Includes one verified as true at excavation.

++ T = verified true nest

T/F = true/false crawl

despite alterations in nest protection efforts. Seventy-one (71) of the 96 nests laid suffered some degree of predation with 56 being partially or completely destroyed within the first two days after being laid and 31 being depredated after 50 days incubation. In all but two cases of early stage predation, raccoons were the primary agents. Ghost crabs were involved as primary predators in two cases and as secondary predators in six (6) cases. Raccoons were again involved in depredation of 22 nests at or near the time of hatching with ghost crabs being involved in nineteen (19) cases, birds in 5, ants in 4 and mice in 3. The exact number of eggs destroyed and hatchlings lost to predation could not be determined since the contents of nests were often too fragmented to accurately count. It is estimated that at least 3150 eggs and 300 hatchlings were lost to small animal predation, but actual numbers are thought to be considerably higher.

Thirty-nine (39) nests were partially predated and 17 completely destroyed by early stage predation. Of that number, 47 (49%) nests were disturbed during the night in which they were laid before they had been discovered and protected. Of the 10 nests depredated after being discovered, 9 had been covered with wire screens. One nest had been classified as true/false and was left uncovered when the nest cavity was not located by repeated probing. With the exception of one nest covered with two overlapping pieces of 2"x4" mesh dogwire, all of the nests predated after being screened were covered with 1/2" mesh hardware cloth. Six (6) nests were depredated by raccoons tunneling under the edge of the wire and into the nest cavity. The one nest covered with dogwire was depredated through the top of the wire. The screen was not centered directly over the eggs in another nest not located by probing, and raccoons were able to reach into the cavity under the side of the wire. Another nest was depredated by ghost crabs after the screen had been washed away by high tides. Three (3) of the 10 nests depredated after discovery were completely destroyed; each had been covered with hardware cloth screens.

Screens were removed from 51 nests at 50 days incubation and were not replaced.

Hardware cloth screens were removed from another 12 nests and were replaced with 2"x4" mesh dogwire screens, which remained in place until emergence and/or excavation. Nine nests remained covered with hardware cloth screens which had been raised in front to allow emergence of the hatchlings.

Twenty-six (26) of the 51 nests not protected at the time of emergence were found dug by predators. Four (4) of the 12 nests covered with dogwire screens at the time of hatch were also depredated. One of the 9 nests covered with hardware cloth modified to allow emergence was partially predated by ghost crabs. Although the wire had successfully protected the nest from digging and 16 hatchlings had safely emerged, a ghost crab burrow was found in the bottom of the nest at excavation; 16 hatchlings had been killed prior to emergence from the nest.

Forty (40) nests on BBI were undisturbed at the time of discovery and were successfully protected from raccoon or ghost crab predation throughout incubation. However, at the time of emergence, 17 of the 28 nests which hatched were then depredated. Twelve (12) of the 40 nests showed no signs of hatching; 9 were lost to tidal inundation, one to beach erosion and two failed to hatch for unknown reasons.

On Ed'ville Beach, a total of 98 crawls were discovered with 55 being classified as false crawls, 4 as true nests and 39 as true/false. Hatching and emergence were observed in all of the true nests and in 16 of the true/false crawls, bringing the number of verified true nests to 20. A total of 2292 eggs were discovered with 1920 hatchlings emerging. An average of 115 eggs were laid per nest, with an average of 94.0 hatchlings emerging. Mean emergence success was 84.1% (Table 3).

No nests were lost to small animal predation on Ed'ville, but 7 potentially true nests were disturbed by humans. Three of the 7 later hatched, but 4 showed no signs of hatching. Since nest cavities could not be located by probing, it is impossible to determine whether nests failed to hatch because they had been disturbed or because they were, in fact, false crawls instead of true nests.

Of the remaining 19 true/false crawls which showed no signs of hatching on

Table 3. Hatching Success of Loggerhead Turtle Nests on Four Edisto Island Beaches, 1983

	BBI	Ed'ville	EBSP	EB	Total
# Nests Successful	46	20	42	48	156
# Eggs Laid	8668+	2292	4629	5658	21,247+
Mean # Eggs/Nest (n)	117 (51)*	115 (20)	115 (40)	123 (47)	117
# Eggs Hatched	2061+	1927	3525	4425	11,938+
#Hatchlings Emerged	1692+	1920	3438	4323	12,676
Mean # Hatchlings Emerged (n)	63.0 (22)	96.0 (20)	86.0 (40)	94.0 (46)	85.8
Mean Emergence Success (%) (n)	52.1 (22)	84.1 (20)	77.2 (40)	77.6 (46)	72.8

Ed'ville, 8 were overwashed by high tides; no probable cause of failure was apparent for the remaining 11. Although no eggs were located by probing, six of the 23 true/false crawls were thought to be true nests and 3 appeared to be false crawls based upon visual assessment at the time of discovery. No nests were relocated on Ed'ville Beach since none were laid distinctly below the beach crest.

On EBSP a total of 110 crawls were discovered with 40 being classified as false crawls, 28 as true nests and 42 as true/false crawls. However, hatching and emergence were observed in one false and 20 true/false crawls, bringing the total number of verified true nests to 49. Success rate, or percent of verified true nests from which hatchlings emerged, was 75%. Emergence was observed in 42 of the 49 known nests laid, but only 40 nest cavities could be located for excavation and tally of contents following emergence. A total of 4,629 eggs were discovered with 3,525 + hatching and 3,438 + hatchlings emerging (Table 3). An average of 115 eggs were laid per nest, with an average of 86.0 emerging. Mean emergence success was 77.2%.

Five (5) true and 18 potentially true nests suffered tidal inundation. Two (2) true nests, including one which had been relocated and contained only 13 eggs, and one potentially true nest failed to hatch for unknown reasons. The remaining 3 true/false crawls which showed no signs of hatching had been visually assessed as more false than true at the time of discovery. No eggs were lost to predation during incubation, but 2 nests suffered loss of hatchlings to fire ant infestation at the time of emergence. Four (4) nests were relocated away from the high tide zone during the course of the season.

Four (4) cases of hatchling disorientation were reported on EBSP. One nest, laid just north of the boundary between the State Park and Edisto Beach, was within view of a street light and other bright lights from an adjacent beachfront restaurant. Over 40 hatchlings were reportedly found wandering in the restaurant parking lot and in the road and were returned to the ocean. The following morning, 38 more hatchlings from the same nest were found lying on the beach, many entangled in debris washed ashore with the tide. All were alive, but weak, and were returned to the ocean. In the other instances of hatchling disorientation, many of the baby turtle tracks observed following the previous night's emergence were directed toward the marsh instead of toward the ocean. Many hatchlings were found wandering on the berm between the marsh and beach crest or entangled in the vegetation. In each case, the nest from which the hatchlings had emerged was located behind a shallow dune ridge on which sea oats and other vegetation were growing. The number of hatchlings which perished due to disorientation is not known.

At the time of discovery, 38 crawls on EB were verified as true nests with 19 being designated as false crawls and 31 as true/false. Hatchlings later emerged from 28 true, 17 true/false and 3 nests not discovered when laid, bringing the total number of verified true nests to 58. A total of 5,658 eggs were laid with 4,425 hatchlings emerging. An average of 123 eggs were laid per nest, with an average of 94.0 hatchlings emerging. Mean emergence success for EB was 77.6% (Table 3).

Seven (7) true nests and 14 true/false crawls showed no signs of hatching. Three (3) nests and 2 potentially true nests were lost to overwash by high tides, and one nest was overgrown with vegetation. Causes of failure of remaining nests and true/false crawls are unknown. Eighteen eggs in 4 nests were destroyed by ghost crab predation. Three nests were relocated to protect eggs from tidal inundation.

Hatchlings were disoriented by bright lights on or near the beachfront in at least eight cases. Fifty (50) hatchlings were reported dead in the roads, and over 75 were found wandering in parking lots, under houses and in roads and were returned to the ocean.

The "Lights Off" campaign was initiated as planned. Of the 19 street lights considered to be potential sources of distraction to hatchlings emerging on EB, 4 were eventually painted on the seaward side before the beginning of hatching season. A letter supporting the "Lights Off" effort was issued by Town Council, and an article soliciting voluntary participation in the campaign from local citizens appeared in the Town newsletter. Notices warning of the potential danger of too much light shining on the beach during nesting and hatching seasons were posted in approximately 100 rental homes. Over 200 letters asking that bright lights such as flood lights and outdoor porch lights be used as little as possible during the summer months were delivered to all beachfront residents by network volunteers. Several people responded to requests made on posters that disoriented baby turtles be redirected toward the ocean and that project investigators be notified of any dead or disoriented hatchlings observed.

Of the 24 permanent or part-time residents who participated in the Volunteer Network, 16 worked consistently throughout. Volunteers assisted with a variety of jobs including beach patrols, poster making, mailings and distribution of literature. Those who were unable to patrol the beach on a regular basis served as substitutes for volunteers assigned to specific areas. Volunteers also assisted project investigators in relocation and protection of nests in all four study areas.

An average of 75 people attended each of the weekly slide presentations and "Turtle Talks" offered at the State Park, and over 100 people participated in each of the 3 night walks conducted in late July and early August. Talks were also presented to the South Carolina Association of Naturalists, the Edisto Beach Lion's Club, the Charleston Natural History Society, four classes of fifth graders at Montevieu Elementary School and the Christian women's organization on Edisto Island. "Attention Beach Users" guides supplied by the Center for Environmental Education, were again passed out to all campers registered at the State Park from May until October, and it is estimated that approximately 47,000 people were given this information. Booths were set up to distribute literature, answer questions and sell EISTP T-shirts at two community bazaars. T-shirts were also sold at a local gift shop, at the State Park each week following the "Turtle Talk", and at monthly meetings of the Charleston Natural History Society. Approximately 250 shirts were sold during the last year. Short summaries reporting the results of the 1982 nesting surveys and the proposed plans for the 1983 season were sent to approximately 50 individuals who had expressed a special interest in the project last season. An additional 125 names have been added to the mailing list this year, and an updated report will be sent as soon as plans for the 1984 season have been finalized.

DISCUSSION

Originally, it was proposed that nest protection on BBI be accomplished by live trapping and relocation of raccoons in 1983 instead of screening of nests which had been only marginally successful in 1982. Since night patrols on BBI were not possible, many nests were discovered after some degree of predation had already taken place. Therefore, it was felt that predator removal would be a more efficient means of nest protection than screening of nests. However, plans for trapping and relocation were later abandoned due to several complicating factors.

Although transfer of raccoons within county lines is permitted by law, biologists with the South Carolina Wildlife and Marine Resources Department discouraged relocation of raccoons from their immediate coastal environment due to the possibility of transmitting diseases to other populations of raccoons further inland. Endangered species biologists also felt that attempts to trap raccoons on the small barrier island adjacent to BBI would not successfully control predation since raccoons other than beach-patrolling animals might also be trapped there. It was also advised based upon experience on other beaches where live trapping of raccoons has been tried, that traps must be set either along pathways used by raccoons to the beach or beside nests which have already been laid in order to apprehend animals specifically responsible for destruction of sea turtle nests. This would necessitate that traps be located out on the beach and, on BBI, would also require that traps weighted with captured raccoons be transported back to the only accessway to the beach on foot since the use of motorized vehicles on this beach is not permitted. This procedure would obviously have required a great deal of time and tremendous effort since the northernmost point of the area surveyed is approximately 8500 feet from the accessway. With only one full-time and one part-time investigator responsible for both the nesting survey and nest protection on BBI, it was decided that live trapping of raccoons would not be used as the primary method of predator control during the 1983 season. Trapping was tried, however, on a small scale during the first several weeks of the season in order to test the success of this method on BBI. Traps were set by nests which had been laid the previous night. While the traps seemed to discourage further disturbance of nearby nests, only one raccoon was captured during the trial period and most traps were found sprung when checked the next day. Field biologists with years of experience in different methods of predator control on other beaches had discouraged the use of live trapping, reporting that raccoons readily learned to spring traps and could steal the bait without being captured. It was also advised that traps had to be baited with fresh sea turtle

eggs in order to attract the raccoons responsible for nest destruction to baited traps rather than to freshly laid nests (Garris, Hopkins, pers. comm.). For the most part, live trapping of raccoons has been abandoned on other beaches in favor of trapping with steel leg-hold traps. Instead of being relocated, raccoons are immediately sacrificed on the beach.

Instead of trapping, it was decided that screening of nests on BBI should be continued for a second season with some modifications in procedure. Hardware cloth screens were used instead of the 2"x4" mesh dogwire screens used in 1982 in an effort to minimize predation of nests after being covered with wire. The smaller mesh wire would make it impossible for raccoons and large ghost crabs to dig directly into the nest cavity through the top of the wire.

Results of the nesting survey on BBI show a 20% increase in the number of nests which remained undepredated up to the time of hatching and/or emergence. The number of nests which were completely destroyed by depredation decreased by 37% and the number of nests which suffered predation after discovery decreased from 18 in 1982 to 10 in 1983. Only 3 nests were redepredated this season, as compared with 11 redepredations in 1982. While these numbers suggest that nest protection efforts were successful in reducing the incidence of nest disturbance within the first several days of incubation, the incidence of predation at the time of hatching and emergence increased from 5 nests in 1982 to 31 nests in 1983. Twenty-one (21) of these nests had had no disturbance prior to that which occurred after 50 days incubation.

Twenty-six (26) nests from which hardware cloth screens had been removed at 50 days incubation were later found excavated by raccoons and/or ghost crabs. Four (4) nests which had been covered with dogwire screens at 50 days incubation were also found depredated through the top of the wire. Hatchlings were found decapitated or with eyes and stomachs eaten out near opened nest cavities. In many cases, baby turtle tracks leading from the nest toward the beach crest stopped abruptly at ghost

crab burrows and then disappeared. Since nest contents were always fragmented by the predators, and no whole eggs remained, it was not possible to determine whether predation took place prior to or following emergence or how many hatchlings were killed. In some cases, signs of hatching were not observed, even though nest cavities were found opened and the contents consumed. Because the depredation of each nest took place between 50 and 70 days incubation and not always immediately following removal of the wire screens, it is assumed that some change in nest conditions, i.e., hatching, must have taken place in order for predators to be attracted to the nest.

Because only one of the nine nests which remained covered with hardware cloth until emergence showed signs of hatching, it is not possible to evaluate the success of this method of nest protection on BBI. Excavation of the one nest which did hatch revealed that ghost crabs had burrowed in from the bottom. Only 16 hatchlings emerged, leaving 21 dead inside the nest.

Although former project investigators on Blackbeard Island, Ga. found this method of screening to be successful in protecting nests from raccoon predation at hatch, there is still the problem of ghost crab predation of nests and loss of hatchlings to both raccoons and ghost crabs after emergence which must be considered on BBI. Perhaps the only way to insure that hatchlings safely return to the water is for project investigators to be present on the beach at the time of emergence. If beaches could be patrolled at night, at least part of the predation might be prevented or at least curtailed.

Another possible alternative, which might also require night patrols, would be to place a wooden frame covered with hardware cloth or some other small mesh wire over the nest. This would make it impossible for predators to dig directly into the nest cavity and would provide enough space between the wire and the surface of the beach for hatchlings to emerge from the nest unimpeded. Hatchlings would later be released from the enclosure and could be watched safely to the water by project investigators.

Second to predation, tidal inundation of nests was the most frequent cause of failure of nests laid on BBI. Because of the number of nests lost to overwash in 1982, special care was taken to relocate not only those nests which were laid distinctly below the beach crest, but also those laid on or just above the beach crest as well. Of the 15 nests which were relocated, all but 2 were saved from inundation. Still, there were 16 nests which were lost to overwash and 5 to beach erosion. Thirteen (13) of the nests which were relocated were laid on the north end of the island where beach erosion during the season was severe. Dunes up to four (4) feet in height were completely washed away, and nests located up to thirty (30) feet from the beach crest when laid were among those which were washed out.

Complete prevention of nest loss to tidal inundation is unlikely on BBI since the entire beach is low and narrow and in potential danger of overwash by new and full moon high tides. As results illustrate, even nests considered to be safe from overwash when laid may be lost later in the season. It is suggested that project investigators attempt to relocate nests laid in areas known to be most often affected by changing tides and beach erosion even if nests appear to be safe when discovered. Information gathered during the last 3 years of study could possibly help researchers to project 70 days ahead to the end of incubation and predict detrimental changes in beach configuration in certain areas.

Edingsville Beach, which had not been surveyed since 1981, was patrolled every other day instead of daily as on the other three beaches. This schedule seemed appropriate for two reasons. First, the beach is sparsely inhabited and generally used only by those who cross over from the State Park at low tide to look for shells and fossils. Therefore, crawls and other signs of turtle activity are not obliterated by foot traffic and other disturbances as readily on this beach as on others. Second, the only road to the beach is privately owned and is not accessible without permission from the owners. During the 1981 season, Ed'ville had to be surveyed by crossing

Jeremy Inlet from the north end of EBSP, which added an extra 2 miles to the walk each day. Patrols also had to be conducted at low tide, and, during peak nesting season, often had to be interrupted to assure safe passage back across the inlet before high tide. Fortunately, project investigators were able to obtain permission to use the accessway to the beach this year soon after the project began. Nevertheless, the alternate day schedule was maintained throughout the season since that seemed adequate for this particular study area.

At present, there is no beachfront development of Ed'ville, and only 4 to 5 houses are located on the strip of high ground which runs parallel to the beach and is separated from it by a shallow marsh. The beach itself is flat and almost completely devoid of vegetation except on the extreme southern end. Though much of the beach is covered by a deep layer of shells, Ed'ville is still used quite heavily as a nesting ground by the loggerhead turtle.

The heavy layer of shells which covers much of Edingsville Beach makes verification of nests by probing quite difficult. Therefore, the number of true/false crawls reported for Ed'ville was high, while the number of verified true nests was low. Unfortunately, this makes it impossible to accurately assess the success rate of nests on Ed'ville Beach since the number of true/false which were actually true but failed to hatch for some reason can not be distinguished from those which were actually false. However, excavation of nests from which hatchlings emerged shows that mean emergence success was higher on Ed'ville than on any other beach surveyed, as was the mean number of eggs hatched per nest. This indicates that nests laid on Ed'ville did well and that hatchlings were not impeded by the heavy shell layer as they emerged from nests.

Edingsville was included in the 1983 study so that poaching of nests, which was the major cause of failure of nests laid on Ed'ville in 1981, might be prevented and, also, that other potential causes of failure might be identified. While human

poaching was responsible for destruction of 48% of the nests discovered on Ed'ville in 1981, only 7 cases of human disturbance of nests were noted in 1983 with evidence of poaching identified in only one. The major cause of disturbance in 1983 appeared to be inundation by high tides. By the end of the season, the north end of the beach was overwashing regularly even at times other than new and full moon high tides. Over 25% of the true and potentially true nests laid on Ed'ville were washed over by high tides at some point during their incubation. Emergence was later verified in one third of overwashed "nests" with two-thirds failing to show signs of hatching. Nests in each case had been laid above the beach crest and, therefore, had not been relocated at the time of discovery. As had been observed in 1981, no small animal predation of nests was discovered.

Although Edingsville Beach and the land adjacent to it are not developed at this time, several new houses are currently under construction and plans for wide-spread development of the area have been made. Already there is considerable traffic on the beach from three-wheeled recreational vehicles and heavy trucks used to extract and haul trees from the front beach. For this reason, it is proposed that Ed'ville be included in the 1984 survey, even though nest not subjected to overwash hatched well and did not require protection. It is expected that problems for nesting loggerheads will increase as development of the area continues and usage of the beach by humans increases. By being present on the beach, as on EBSP and EB, during nesting and hatching seasons, project investigators will be able to assess changes as they take place and might also be able to curtail or correct any detrimental practices as they develop. Beach users on Ed'ville will also be included in public education efforts.

Mean emergence success of nests laid on EBSP remained high at 77% and was decreased by only 2% from that observed in 1982. However, the number of verified true

nests discovered decreased by 46% and the total number of crawls by 24%. Likewise, the number of hatchlings which emerged from nests laid on the State Park decreased by almost 50% from 6,765 in 1982 to approximately 3,438 in 1983. Depending upon the number of true/false which were actually true nests which failed to hatch, it appears that either fewer nests were laid on ERSP this year than last or fewer nests were successful. In either case, it is suggested that beach erosion and repeated inundation of nesting areas on the State Park are at least partly responsible for these changes in nesting activity and/or success.

Severe erosion took place during the 1982 nesting season to the point that snow fences were installed by Park personnel in an effort to slow encroachment of erosion into the campground. While some rebuilding of the beach during the winter months had been hoped for, sever storms combined with unusually high tides during the spring of 1983 resulted in continued loss of beach sand. It is estimated that approximately twenty (20) feet of beach above mean high tide had been lost by the beginning of the 1983 season, leaving only a narrow strip of high ground on which turtles could nest. Unfortunately, the destruction continued until tides washed regularly to the base of the vegetation. Five (5) of the true nests and 18 of the potentially true nests which failed to show signs of hatching had been overwashed by high tides; 8 of the nests from which hatchlings emerged had also been inundated at least once during incubation. Four other nests which would have been destroyed by overwash were relocated at the time of discovery. Had the degree of erosion which occurred during the summer been anticipated, other nests laid on or just above the beach crest would also have been moved to safer locations.

Despite the problems just discussed, emergence was observed in 42 of 49 verified nests discovered on EBSA. No problems with predation or human disturbance of nests were encountered and public interest in the project remained high. It is estimated that an average of 10-20 people were contacted each day during morning beach patrols and over

950 people, mostly campers, attended the "Turtle Talks" presented at the State Park each week during the summer. For this reason, it is suggested that EBSP be included again in the 1984 nesting survey with special emphasis being given to public education and protection of nests in potential danger of overwash and erosion.

As in 1982, nesting densities, percentage of crawls resulting in nesting and number of nests hatched were compared in order to measure effects of human presence and beach development on nesting frequency and success. While nesting density continued to be lower on Edisto Beach than on either BBI or EBSP, the percentage of crawls resulting in nests and the number of nests which hatched were higher on EB than on any other beach surveyed. It is interesting to note, too, that while nesting and crawl densities decreased on BBI, EBSP and Ed'ville Beach in 1983 as compared with 1982, nesting density increased by 22% and crawl density by 39% on EB. While it is possible that these numbers reflect a random fluctuation in turtle activity from beach to beach in separate years, they may also suggest that either certain hindrances to nesting and crawl activity were decreased on EB or that possible deterrents on other beaches in the area caused EB to become a more desirable location for nesting.

As mentioned above, both EBSP and BBI suffered severe loss of beach due to erosion during the last year. Although certain sections along EB were also affected by spring storms and high tides, most of the beach appeared to be fairly stable with only a few areas on the north end of EB being completely covered by water at high tide. It is possible that the overwashed and eroded beaches on BBI and the State Park were judged to be undesirable by loggerheads who crawled ashore to scout for suitable nesting sites. It is also possible that initiation of the "Lights Off" program on EB brought about sufficient reduction in the amount of light shining on the beach to encourage more turtles to come ashore and eventually nest there.

Although ghost crab burrows were again numerous along certain sections of EB, predation still was not a significant problem with only two nests and a total of 18 eggs being depredated during the season. One potentially true nest appeared to have been dug by humans at the time of discovery, though no evidence of predation was found.

Numbers of true and false crawls on Ed'ville, EBSP and EB were not precisely determined again this season due to difficulty in verification of true nests. Interns employed by the project for the first time often were not able to locate nest cavities by probing and were forced to categorize many crawls as true/false. Because of the high incidence of overwash on these beaches, many of the true/false which might have been verified as true nests at the time of hatching were not successful and could not be distinguished from those which were actually false crawls. Forty-seven percent (47%) of crawls originally categorized as true/false were later reclassified as true after hatching and emergence were observed. Approximately one-fourth of the remaining true/false crawls which showed no signs of hatching were described as "probably false" at the time of discovery.

Although visual assessment of crawls as true or false would be a more desirable method of verification of nests, those involved in the EISTP feel that certain situations specific to this project make it necessary to continue the use of probing instead. Several years of experience are required before crawls can be assessed visually with the necessary degree of accuracy. Interns employed by the project usually work for only one year and, having had no previous experience in nesting surveys of this type, usually do not acquire even a limited ability to visually categorize crawls until late in the season, if then. Probing is also required in order to determine the exact location of nest cavities which must be covered with wire screening for protection on BBI.

Even with 3 new interns working on the project this season, only 8 eggs were broken while probing nests. It is expected that this method of verification will be continued next season with more training for interns so that they will be able to use the technique more successfully and, thereby, reduce the number of crawls categorized as true/false. This will make it possible to more accurately describe and interpret the results of the nesting survey so that changes in frequency, distribution and success of nesting can be monitored more closely.

It is expected that the problem of tidal inundation of sea turtle nests will continue to be a problem on all four of the beaches surveyed, and that more frequent

relocation of nests will be required as erosion continues. Tides already wash to the base of the vegetation on the north ends of BBI and EBSP which means that nests in danger of overwash will have to be moved back behind the front row of vegetation in order to protect them from the encroaching waters.

With the exception of one nest which suffered intrusive root growth on EB and another nest which had only 13 eggs on EBSP, all relocated nests were successful. However, in the case of 3 nests on EBSP and 7 nests on BBI, each of which was located behind very shallow dune ridges covered with sea oats and other vegetation, hatchlings appeared to have been disoriented at emergence with many of the tracks leading from the nest towards the marsh instead of towards the ocean. In several instances, hatchlings from these nests were found wandering around or entangled in vegetation behind the beach crest the following morning. Since hatchlings apparently orient themselves toward the ocean in response to the brightness of the seaward horizon as compared with the landward horizon, it is presumed that hatchlings became disoriented at emergence at least in part because their view of the ocean was blocked by high vegetation. Mrosovsky also suggests that hatchlings orient themselves toward the center of the most open horizon, which in most cases would be the ocean (Mrosovsky, 1972). However, on the sections of BBI and EBSP where the disorientation was observed, the horizon opposing the ocean is open marsh with a low line of trees in the distance. It is possible, then, that both landward and seaward horizons were perceived to be equally open or that the marsh side actually appeared to be more open than the ocean side, causing the hatchlings to become confused and migrate away from the ocean.

Although it is difficult to assess the results of the "Lights Off" campaign after only one season, a decrease in the number of hatchlings reported dead in the roads from 133 in 1982 to 50 in 1983 suggests that fewer hatchlings were lost to disorientation this year than last. However, there is still much to be done in this area, and plans for the 1984 Edisto Island Sea Turtle Project will include continued efforts to reduce the amount of light shining on the beach. Edisto Beach Town Council will be asked to reconsider the shielding of 10 lights which were identified as potential

sources of distraction to both nesting and hatching loggerhead turtles but were not painted in 1983 because the sheriff who patrols Edisto Beach felt that security would be jeopardized in those particular areas by this action. Private home owners and businesses who currently lease another 5 lights known to be sources of distraction to hatchling turtles in years past will also be contacted about having security lights on their property painted on the seaward side as well.

One of the major objectives of the 1983 study was to increase public awareness of the aims and methods of the EISTP among area residents. It is estimated that approximately one-half of the permanent residents of Edisto Beach were contacted through talks and slide shows presented to local church and civic organizations. Short articles about the EISTP appeared in area newspapers and newsletters, and project T-shirts were sold at church bazaars and gift shops on the Island. Of the 24 people who participated in the 1983 Volunteer Network, 20 were full-time residents of Edisto Island. "Attention Beach Users" guides and letters explaining the problem of hatchling disorientation were distributed to all residents with beachfront homes, and posters requesting information on sea turtle activity were located in all public buildings on the Island. A greater percentage of calls received by the turtle "hotline" number were from local residents, as opposed to vacationers, this year than last, which indicates not only an increased awareness among local citizens, but also a greater involvement.

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Part II

Public Involvement in the
Edisto Island Sea Turtle Project

1983

by

Deborah A. Mundell

Each year during the course of nesting and hatching seasons on Edisto Island, certain events take place which assure those involved with the Edisto Island Sea Turtle Project that the weekly slide shows, guided beach walks, distribution of brochures, conversations with beach users during morning patrols and other attempts to educate the public about loggerhead turtles have been successful. Our experiences confirm that most people need only to be made aware of the problems which sea turtles face or, better yet, to have some type of personal experience with these awe-inspiring creatures and they become loyal "friends" anxious to help in whatever way possible.

One morning early in the season, for instance, we came upon a nest which had been laid too close to the surf the previous night. As we prepared to move the eggs to a more suitable spot on the beach, the owner of a nearby cottage came out and told us to stop digging, that it was illegal to tamper with sea turtle nests. After inspecting the permits which we had been issued by the South Carolina Wildlife and Marine Resources Department, she seemed satisfied that we were "official" and promptly offered a bucket and shovel to help us. Another beach resident called the "Turtle Hotline" one evening to report that he had heard a loggerhead nesting directly beneath his window the night before. However, instead of going out to watch this fascinating process, he forfeited the opportunity for fear that his presence might disturb the turtle.

One evening later in the season as we conducted a group of about fifty people on a night patrol, we came upon a nest which apparently had hatched the preceding night. We began to excavate the nest in order to determine the number of hatchlings which had emerged and found another dozen or so baby turtles still trapped in the nest. The crowd was thrilled with the opportunity to see the turtles and all were anxious for the chance to assist them on their trek to the water. They became concerned, however, when several of the hatchlings turned away from the ocean and crawled persistently toward the houses. Fortunately, the discussion of the problems

associated with successful nesting and hatching on our beaches was fresh on the minds of those who had attended the "Turtle Talk" at the State Park earlier in the evening; they quickly traced the source of confusion for the baby turtles to a bright flood light which shone directly on the beach from a nearby house. Without the slightest hesitation, two men from among the group walked to the house, knocked on the door and explained to the proprietors that the light absolutely had to be turned off.

On another occasion, there were two families camping at Edisto Beach State Park who, after listening with fascination to the description of the nesting and hatching process, decided that they would very much like to see some baby turtles for themselves. They asked the project assistant to identify a nest which was due to hatch during their stay at the park and then prepared themselves for the wait. Adults, children, even babies trooped to the beach at dusk, armed with blankets, flashlights, coffee and cake. They sat quietly by the nest, and watched and waited, anticipating the once-in-a-lifetime event that they hoped desperately would take place. Finally, at nine minutes before midnight, the ground erupted right before their eyes, and baby turtles percolated from the sand. One young girl among them was so touched that she cried at the sight and was told by her mother that she would have to "toughen up" some if she really intended to be a marine biologist when she grew up.

Involvement of full and parttime residents of Edisto Beach in the Volunteer Network has provided a very effective means of disbursing information about sea turtles and has recruited much support for the local conservation efforts. Members of the Network typically are middle-aged women who have settled on Edisto Beach following retirement. Most begin working with the EISTP because they would like the exercise of a routine beach walk each day; most continue with the project because they want to help the loggerheads and feel that they are doing something positive and important for the world in which they live. Ten have worked during both the

1982 and the 1983 seasons and are somewhat of a team now; their "off-duty" conversations invariably turn to turtles at some point. Of the fourteen new recruits to the Volunteer Network this year, three were mothers whose children became as much involved as they. One little fellow, for instance, faithfully trooped out to the beach each morning with his mom and eventually became our self-appointed "nest digger" whenever there was a nest to be relocated on Edisto Beach; with a shovel twice as tall as he was, Olan would always make a trial run before digging the "real" nest.

Of all the situations encountered during the course of the season, those experienced by the Volunteers are usually the most noteworthy and, by far, the most amusing. One volunteer who is typically very protective of the nests laid in her area, happened to see a reprobate individual pull up a flag which marked a nest she was about to check for signs of hatching. Without hesitation, she hailed him to explain the significance of the flag and to strongly suggest that he replace it as near the original location as possible. Another veteran volunteer was out patrolling her area for signs of hatching one morning when she inadvertently stumbled upon two "lovers" on the beach right beside one of the nests which she intended to check. Being the calm, thoughtful person that she is, she simply said, "Excuse me", and went right over to check the nest anyway. Still another volunteer had her priorities seriously questioned one morning while doing her beach patrol by a vacationing preacher who demanded to know if she was also willing to work that hard for God!

Final Turtle Report for Seabrook Island

by

Lin Dunbar

INTRODUCTION

This was the first year of the Seabrook Island turtle project. Interested residents formed a Turtle Committee to record nestings and stranded turtles.

METHODS

The Turtle Committee patrolled the beach in the mornings and marked nests with stakes. Personnel at Camp St. Christopher informed us of any crawls in their area and these were also investigated. The date, crawl location and comments were recorded on data forms.

RESULTS AND DISCUSSION

A total of 9 nests were laid, 3 at Oyster Catcher Beaches and 6 at Camp St. Christopher. There were 2 false crawls and 2 unknowns where a nest could not be located. All of the nests were laid in June and July and were reported as occurring just before, during and after high tide periods.

To determine the percentage of successful hatchlings, the marked nests were dug after signs that some had hatched. Three out of the 9 nests hatched with yields of 100%, 75%, and 25%. The failure of the remaining 6 nests was due to predation by raccoons and ghost crabs (5) and flooding by high tides (1).

We were very fortunate this year regarding stranded turtles. Only 7 were washed up on our beach. Four in June, just as the shrimping season began, 2 in July and 1 in August.

CONCLUSION

The 1983 Seabrook Island Loggerhead Turtle Program was very successful. We learned a lot and substantiated significant loggerhead turtle data for our island. We have a greater idea of what to expect in 1984 in terms of nest locations, predation, tidal zones and the like. With this information in hand, we can make sound judgements as to the 1984 Turtle Program for Seabrook.

The information we obtained is important, but, so too is the value of the

spirit, fellowship and dedication of the committee members. They are:
Pat Leonard, Dede Adams, Valerie and Bill Schmutz, Laura Field, Pam Avery,
Charlotte Weaver, June Carney, Leilani DeMuth, John Ehrlich, Kevin Kerr,
Ozzie Shuler and Dave Fleming.

Part I

1983 Kiawah Island Loggerhead Hatchery Program

Activity Report

by

Keith Kriet

Mike Telley

Jay Pinckney

David Green

INTRODUCTION

The Kiawah Island Company and Community Association have operated a nesting beach protection program for the loggerhead turtle (Carretta caretta) since 1973. Objectives of the program during the 1983 nesting season were three-fold: (1) Protection of nests by hatchery and nest relocation techniques; (2) Public education through slide presentations and guided nesting observation tours; and (3) In-house research activities and facilitation of outside research efforts.

Past conservation efforts at Kiawah have centered around use of a direct-burial hatchery. The full percentage of nests allowed by permit (80% of those laid) were moved to the hatchery. The 1983 season marked a departure from sole reliance on the hatchery as a nest protection strategy, with utilization of the additional strategy of individual nest relocation and protection.

De-emphasis on the use of the hatchery stemmed from the desire to minimize conditions which might lead to unnatural sex ratios and reduced vigor of hatchlings, and from logistical problems associated with release of hatchlings from eggs laid after the first weeks in July.

RESULTS

A total of 132 nests were laid on the patrolled stretch of Kiawah's beach in 1983. The nesting season was from May 28 to August 25. Thirty-one (23.5%) of these nests (termed natural) were left where laid and monitored for survival. Seventy-nine (59.8%) of the total nests were moved to a chicken-wire enclosure hatchery located on the foreslope of the secondary dune. These nests were left undisturbed throughout incubation, and hatchlings were released upon emergence. The remaining 22 (16.7%) of the nests laid were relocated and protected individually with screen wire, on the foreslope of the primary dune along an undisturbed stretch of beach. These data are summarized in Table 4.

Table 4. 1983 Nesting Season Results, Kiawah Island, South Carolina

<u>Total Number of Crawls</u>		<u>N=259</u>
False crawls	127	(49%)
Nesting crawls	132	(51%)
<u>Total Nesting Crawls</u>		<u>N=132</u>
Natural nests	31	(23.5%)
Hatchery nests	79	(59.8%)
Relocated nests	22	(16.7%)
<u>Natural Nests</u>		<u>N= 31</u>
Inundated	15	(48%)
Depredated	2	(7%)
Produced Hatchlings	14	(45%)
<u>Hatchery Nests</u>		<u>N= 79</u>
Total number of eggs	9,543	
Hatchlings released	5,473	
Release success rate	57.4%	

<u>Parameter</u>	<u>Mean</u>	<u>SD</u>	<u>Range</u>	<u>N</u>
Clutch size	121.9	27.6	30-180	79
Incubation time (days)	56.6	5.6	42- 68	76
Emergence (evenings)	4.6	4.1	1- 13	76

<u>Relocated Nests</u>		<u>N= 22</u>
Total number of eggs	2,529	
Estimate of hatchlings released	1,184	

Natural Nests

In general, two out of every ten nests laid throughout the nesting season were left undisturbed. Some discretion was exercised, however, with regard to leaving a nest as natural. For example, if a nest was laid below the mean high tide line, or at the base of a dune walk-over, that nest would be relocated in

contrast to a more favorably placed nest.

All of the natural nests were excavated after a minimum of 70 days of incubation to determine the relative success of the nest. Of the thirty-one natural nests, 15 (48%) were inundated by high tides; 2 (6.5%) were depredated by either raccoons or ghost crabs; and 14 (45%) were thought to have some degree of hatchling production.

Hatchery Nests

Seventy-nine nests with an average clutch of 122 eggs were relocated to the hatchery between May 28 and July 17. Thirty-one eggs were broken in handling over the course of the entire season. A total of 9,543 eggs were buried with 5,473 hatchlings released; a 57.4% release rate. Nests were excavated after a minimum of seventy days incubation, and a hatch success rate based on shell fragments and/or intact eggs was determined. The success based on excavation data was 74%. Based on a sample size of 76 nests the average discrepancy between success based on actual release versus success based on excavation was 20%. We are unable to explain the difference but note that it is consistent with results from past seasons.

The average length of time to first hatchling emergence in the hatchery nests was 56.6 days, with a range from 42-68 days. Hatchlings would emerge from a given nest over a number of nights. The average emergence duration for the hatchery nests was 4.6 evenings. However, the range was from all hatchlings emerging in one evening to emergences stretched over 14 evenings.

Relocated Nests

Twenty-two nests with an average clutch size of 115 eggs were relocated between July 18 and August 9. A total of 2,529 eggs were relocated. Because each nest was protected by 2"x4" mesh hogwire, which allows self-release of hatchlings, an exact count of hatchlings released was not possible. Nests were excavated after a minimum of 70 days of incubation. Four of the relocated

nests received some degree of predation from raccoons. If one assumes the 57.4% release rate from the hatchery, hatchling production from the remaining 18 nests can be estimated at 1,184.

CONCLUSIONS

Total Kiawah Island production for 1983 is estimated to have been 6,657 hatchlings. This figure was determined by combining the hatchery figure with the estimated production from the relocated nests. The more conservative factor determined from actual hatchery releases was used in this estimate rather than a factor determined from excavation data. It has been our experience that estimates based on excavation data inflate actual nest production by as much as 20%.

The conditions on Kiawah are well suited to the mixed strategy of hatchery protection as well as individual nest relocation and protection.

Table 5. Yearly Summary of Hatchery Data, Kiawah Island, South Carolina

Year	Nests Relocated	Total # Eggs	Mean Clutch	# Hatchlings Released
1973	55	7,297	132.7	5,580
1974	90	11,192	124.3	0
1975	35	4,027	115.0	2,789
1976	17	1,979	116.4	1,013
1977	39	4,641	119.0	2,774
1978	55	6,329	115.1	4,595
1979	N/A	N/A	N/A	4,072
1980	75	9,092	121.2	6,876
1981	142	16,768	118.1	12,179
1982	110	13,069	118.8	8,306
1983	79	9,543	120.8	5,473
11 Years Total				53,657

Part II
Embryological Investigations on Unhatched Eggs
From Natural and Relocated Nests on
Kiawah Island

by
Jeff Seel

OBJECTIVES

1. To collect and record an embryological series for Loggerhead Sea Turtles nesting on Kiawah Island during the 1983 season.
2. To find the stage at which embryologic development was most frequently arrested, and to discern differences, if any, between differing nest protection strategies.

METHODS

Eggs were collected from nests laid on Kiawah Island approximately 21 miles south of Charleston, South Carolina. During the 1983 nesting season 80% of all nests laid were relocated to either a screened hatchery located behind the primary dune, or to a foredune location and screened individually. Protection efforts were designed to reduce the loss of nests due to predation and tidal inundation.

A minimum of 70 days was allowed between the date laid and date of excavation. Upon excavation, intact eggs from nests laid between June 25 and August 9 were taken to the College of Charleston for dissection and examination.

A total of 1,609 eggs were dissected and categorized as follows:

Undeveloped: Yolk and albumen present with no other development discernable.

Partly Developed: Embryo present in some stage other than fully developed.

Developed but not hatched: Embryo fully developed with reduced yolk sac; carapace with scutes present.

Pink: A pink-lavender pigmentation present at any stage of development.

RESULTS AND DISCUSSION

The number of eggs in each category from wild, hatchery, and relocated nests are presented in Table 6.

Table 6. Egg Dissection Results, Kiawah Island, 1983

Egg Category	Natural Nests		Hatchery Nests		Relocated Nests	
	Eggs	%	Eggs	%	Eggs	%
Undeveloped	245	41.0%	683	82.0%	149	83.2%
Partly Developed	17	2.8%	42	5.0%	3	1.7%
Developed but not Hatched	64	10.7%	81	9.7%	10	5.6%
Pink	<u>271</u>	45.5%	<u>27</u>	3.2%	<u>17</u>	9.5%
Totals	597		833		179	
Nests Excavated	30		37		22	
Average # Eggs Excavated per Nest	20		23		8	

There was no apparent difference between the two strategies of nest protection and the nests left undisturbed. The only category showing a discernable difference was the pink pigmentation found in nearly half the eggs dissected from the natural nests.

It is possible that the pigmentation was a chemical or bacterial response to inundation, however, this hypothesis would have to be more carefully tested next season.

Nesting and Management of Atlantic Loggerhead Turtles

(Caretta caretta caretta)

on Cape Island, South Carolina in 1983

by

Sally A. Huston

Gerard C. Fringeli

George R. Garris

INTRODUCTION

During the 1983 nesting season of the Atlantic loggerhead turtle (Caretta caretta caretta), management techniques were practiced on Cape Island, the northernmost barrier island of Cape Romain National Wildlife Refuge, Charleston County, South Carolina. The management activities included monitoring the nesting of turtles, construction of three predator-proof hatcheries to accommodate transferred clutches, a predator control program to reduce the population of raccoons occurring on the island, and participation in the Sea Turtle Stranding and Salvage Network. Unlike previous years, predator repellent experiments were not conducted due to the relative insignificance of the results in 1982. However, the experiment using control nests to monitor beach erosion and natural hatch success was conducted in 1983. Details of the methods and materials used in the project and a description of the study area can be found in the 1981 and 1982 Atlantic loggerhead turtle nesting and management reports. This report will include the results and discussion of the 1983 project.

RESULTS AND DISCUSSION

Nesting Activity

On Cape Island, the 1983 loggerhead nesting season lasted 97 days, beginning May 21 and ending with the last nest on August 25. The last false crawl was on August 23. Of the 2554 total crawls, 667 (26.1%) were nesting crawls and 1887 (73.9%) were false crawls (non-nesting emergences).

Nesting crawls had no outstanding peak periods. The week of June 18-24, with 80 nests, and the week of July 16-22, with 82 nests, being the high periods. The number of false crawls peaked during the week of June 18-24 (232 crawls) and again during the week of July 16-22 (311 crawls). After this last peak, false crawls dropped off sharply.

Of the 667 total nests laid, 374 were transplanted into predator-proof hatcheries, 60 were used as controls and 233 were left unmonitored on the beach. The average number of nesting crawls was 6.9/day and 19.8/day for false crawls. The nesting density on the 8 km beach was 83.4 nests/km and 235.9 false crawls/km (Table 7).

Table 7. Loggerhead Turtle Nesting and False Crawl Totals and Density per km, 1975-1983, Cape Island, South Carolina

Year	Nests	False Crawls	km of Beach	Density per km	
				Nests	False Crawls
1975	2654		8	331.8	
1976	2359		8	294.9	
1977	1329		8	166.1	
1978	1451		8	181.4	
1979	1093	2375	8	136.6	341.9
1980	856	1675	8	107.0	209.3
1981	1043	2045	8	130.4	255.6
1982	1087	2378	8	135.8	297.2
1983	667	1887	8	83.4	235.9

Also in Table 7, the total numbers of nests and false crawls for 1975-1983 are compiled. Nineteen eighty-three was a low year for nesting activity, as was 1977 and 1980. This would seem to support the idea that turtle nesting is on a three year cycle and 1983 is the low year of this cycle. From these data, it would appear 1984 would be the start of an upward trend in loggerhead nesting activity.

Hatchery Production

As in past years, three predator-proof hatcheries were constructed in 1983. Two were self-releasing and one was a nonself-releasing type. The hatchlings in the nonself-releasing hatchery were collected each morning,

Using the 51% hatch success rate and the 32% survival rate obtained from the control nest data and the 121.7 average clutch size from the hatchery data, it was estimated that 75 of the 233 unmonitored nests on the beach successfully hatched. The 121.7 eggs per clutch was used rather than the 139.4 eggs per clutch obtained when only 5 of the control nests were excavated. The 121.7 eggs per clutch is a more representative number for total nests. The control nests produced 1179 hatchlings and the unmonitored nests produced an estimated 4655 hatchlings, for a total of 5834 hatchlings produced on the beach (Table 9).

One suspected case of egg poaching by humans was early in the season on June 10. By coincidence, this is the same date for a confirmed case of egg poaching reported in 1982. It would appear that our presence on the island continues to discourage poaching. Unlike past years, much of the work done in 1983 was conducted during the day and not at night. There were five, 5 to 6 day periods of night work alternating with 8 to 9 day stretches of day work during late May, June and July. During August and September, all work was conducted during the day.

Of the total nests laid on Cape Island in 1983, 161 (24.1%) were destroyed by raccoons. This figure represents the nests destroyed on the first day and does not include predation of nests later in the season. Many nests were destroyed after the initial count and many of these were preyed upon several times. In 1983, 26 raccoons were trapped or killed on Cape Island. Eight were males, 13 were females and 5 were of unknown sex. This year, 24.1% of the turtle nests were destroyed by raccoons, compared to 14% in 1982. A larger population of raccoons, with fewer nests to prey upon, therefore a greater demand, is a possible cause for the predation increase in 1983. Continued trapping at nests and around hatcheries is recommended to keep predation under control.

Sea Turtle Stranding and Salvage Network

In 1983, only three adult loggerhead turtles were found stranded on Cape Island. These were on June 18, August 18 and September 18. This is a considerable drop in strandings from the 17 reported in 1982. In the past, many stranded turtles had been those caught in shrimp trawling nets, but in 1983, shrimping was down. Also in 1983, there were fewer turtles coming to the island to nest, which would lower the number available to be caught in the trawler nets. The information on the stranded turtles was sent to the South Carolina Wildlife and Marine Resources Department, Fort Johnson, Charleston, South Carolina.

SUMMARY

In 1983, loggerhead turtle nesting on Cape Island was considerably lower than in previous years. The total production was 38,987 hatchlings, compared to 60,316 in 1982. This figure represents the hatchlings produced in the three hatcheries combined with the estimated number produced on the beach.

Although nesting was down in 1983, the hatchery and predation control programs continued to be effective management tools. Cape Island is a very important loggerhead rookery and these management programs should be continued or expanded in the future to ensure maximum production on the island.

Management of the Atlantic Loggerhead Turtle
on the Tom Yawkey Wildlife Center 1983
South Island

by

William D. Oldland

INTRODUCTION

Previous studies by Sally Hopkins and Tom Murphy on the nesting habits of the Atlantic loggerhead sea turtle, Caretta caretta, on South Island determined that raccoon predation and erosion were two factors greatly affecting the productivity of nests laid along the three mile beach. In an attempt to mitigate these factors, a management program was implemented during the spring of 1983. By trapping raccoons on the beach, transplanting the nest laid in low areas, and protecting all nest with wire screens, it was expected that hatching success should be improved.

OBJECTIVE

The objective of this program was to reduce the number of turtle nests lost to natural predators and erosion.

METHODS AND MATERIALS

On May 6, 1983, trapping was initiated on raccoon trails crossing the dunes leading to the beach. Number 2 spring-loaded leg-hold traps were placed on dirt-hole sets along these trails. Cat food and scent attractant were used as bait. Trapping along the trails was discontinued from May 30 until June 4. During this time, traps were placed around nests visited by raccoons. Raccoons rarely eat all the eggs of a nest so trapping around these nests, preyed upon by raccoons on subsequent days, is usually more productive than on the trails. This technique used the turtle eggs as the bait. All trapping along the beach ended on July 1.

While trapping was taking place during May, the beach was divided into 28 segments with each segment being 1/10 of a mile long with a numbered sign, on an 8 foot post, marking the beginning of each segment. These signs aided in the relocation of nests. The beach was checked daily for trapped animals and turtle crawls. The first crawl occurred on May 30, 1983. Each emergence was checked to determine if it was a false or a nesting crawl. False crawls were marked with a small, plain blue plastic flag on a 3 foot wire stake until the crawl was no longer visible. At this time the flag would be removed to be used again.

In the case of a nesting emergence the nest was located using a wooden probe stick. A decision was made, according to the nest's position on the beach, as to whether it should be transplanted to higher ground. A nest not needing protection from flooding was covered by a 3 foot square section of 2" x 4" welded wire. The center of this screen was placed directly over the top of the nest and the entire screen was covered by a thin layer of sand. A small coded red plastic flag was positioned at a recorded bearing from the nest. The position of the nest was also recorded in reference to the numbered posts along the beach. A nest halfway between posts numbered 8 and 9 would be given a location of 8.5. This system gave the general location of the nest in case a flag was lost or covered by sand.

For a nest that required transplanting, the eggs were removed from the nest and placed inside a plastic bucket on a layer of sand. The eggs were then taken to the nearest high dune and carefully placed in a cavity 18 to 24 inches deep and widened at the bottom to resemble a natural nest. Sand was packed tightly over the top of the transplanted nest to avoid air pockets. Screens and flags were then positioned over the nest similar to the natural nest. All nests were checked daily for any sign of predation. At the end of a 70 day period the screens were recovered and the nests were excavated. The nest contents were then counted to determine the outcome of the eggs.

RESULTS

Out of the 300 emergences recorded there were 196 false crawls and 104 nests. Of these nests, 91 were protected by wire screening and 76 of these hatched successfully for a success rate of 83.5%. Of the 15 screened nests which did not hatch, 7 were partially destroyed by raccoons reaching down through the screen to the top of the eggs, while the other 8 were lost to extremely high tides or being covered by deep sand drifts which curtailed embryo development. Thirteen were destroyed by raccoons and poachers before they could be protected. Of 57 nests which were moved to better nests sites, 46 hatched for a survival rate of 80.7%.

During the month of May only 3 raccoons were caught along the dune trails. Two more were caught over a partially cooned-out nest in June. The total number of trap days was 262 and the success rate for trapping was only 1.9%.

DISCUSSION

Due to the high survival percentages the program was deemed very successful. Since over half of the nests needed to be transplanted, it would seem that this procedure is very important to the survival of nests laid on or below the high water mark of the beach. Of those nests which were screened raccoon predation was very low. The low figure can be attributed to screening but, because of the low success rate in trapping it may not be justified in the future.

Even though this program was very successful a few things could possibly be improved. Some nests died during embryo development because of high spring tides, or because they became buried under 4 to 5 feet of windblown sand within a short period of time. When nests are transplanted they need to be moved to high ground well above spring tide levels and if possible in areas not likely to collect deep, wind transported sand.

Another observation was that some raccoons would dig between the strands of wire to depths of about 6 inches allowing them to reach the eggs at the top of the nest. To prevent this problem the top eggs of transplanted nests should be at least 6 inches below the bottom of the screen. By digging a wider hole with a larger bottom this should be accomplished.

By implementing these 2 recommendations this program should be more successful in following years. This program shows marked improvement in the protection of loggerhead turtle nests where past losses were 90%. Therefore, this type of management for loggerhead turtles should continue on Tom Yawkey Wildlife Center's South Island beach and is recommended for other nesting areas under South Carolina Wildlife Department's jurisdiction.

Submitted by:

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