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Loggerhead Turtle Projects in South Carolina

**Edited By
SALLY R. HOPKINS**

ANNUAL REPORTS FOR 1982



**S.C. Wildlife and Marine Resources Department
Division of Wildlife and Freshwater Fisheries
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LOGGERHEAD TURTLE
PROJECTS IN SOUTH CAROLINA
Annual Reports for 1982



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INTRODUCTION

Interest in the loggerhead sea turtle continues to grow along the South Carolina Coast as evidenced by the expansion of some projects and the addition of the new project on Pritchards Island. Many of the projects are deeply involved in public education which we believe is essential to the recovery of all sea turtle species.

Hopefully this report will serve to reinforce all the efforts being made along our coast toward protection of our loggerhead turtles. Any questions concerning these reports should be directed to the individual authors.

SRH

Project Turtle Watch For

Hilton Head Island, South Carolina

by

Nanci Polk-Wechhorst

INTRODUCTION

The project took place on the beach of Sea Pines Plantation at Hilton Head Island, South Carolina. Its objective was to count and mark the loggerhead sea turtle nests laid on the Sea Pines Plantation Beach. Reports of nest locations were kept on file by the Sea Pines Beach Committee, in the event heavy beach equipment needed to be put into service to renourish the beach. Thus nest locations were known and could be avoided and protected.

Project Turtle Watch was funded by the Sea Pines Beach Committee. Although this was the second year a detailed sea turtle nesting survey had been taken on Hilton Head Island, South Carolina, this was the first year for funding of the Project by the Sea Pines Beach Committee.

METHODS

The Sea Pines Plantation Beach (5.2 miles long) was marked off in tenths of mile intervals by 4" P.V.C. stakes 5' long and buried a foot in the primary or secondary dunes where possible. Each stake (Base Marker) was given a number from 1-52.

The sea turtle nests were located by a measured distance from the base stake. Two small P.V.C. stakes were used to mark the nests but were placed further up in the dunes for easy checking of nest location for predation while not advertising its exact location. These stakes were also placed a measured distance from the nest and recorded.

Two persons walked and each checked 2.6 miles of the 5.2 miles of Sea Pines Beach each day. They started at dawn to avoid having the nesting tracks disturbed by the normal beach traffic.

The data was kept on daily data cards and nest locations were kept on a chart and updated daily. The weekly summary reports were kept on file by the Sea Pines Beach Committee and my office.

nests recorded independently on the rest of the Hilton Head Island Beach. Of the 44 nests recorded on the Sea Pines Beach, 14 nests and 7 false crawls were found in the northern 2.6 miles (called Section-1). This beach is heavily populated with beach traffic due to a new condo complex and private beach park and is well lit at night. Of these 14 nests only 2 were recorded as hatching.

In Section-2, the southern 2.6 miles of Sea Pines' 5.6 mile Beach, 30 of the 44 nests were laid and only 3 false crawls were recorded. This area is not so densely populated with beach traffic and only private homes and villas are near the dunes with occasional lights and flood lights showing. Of these 30 nests, 13 nests were recorded as hatching.

In both sections the hatchlings emerging tracks showed their disorientation to the light sources caused by house and flood light left on at night. Often hatchlings were found exhausted and wandering in the dunes and lawns or caught in the reeds unable to get to the ocean.

Of the 44 nests laid, 6 nests were recorded low on the beach, none of which hatched. Of 5 nests laid at the base of paths or in areas where they would be hurt by foot or vehicle traffic, only one hatched. Had these nests been moved, a larger number may have hatched. All the nests this season had a longer incubation time due possibly to the moist cloudy summer. The normal number of days to hatch are 60 days, however, our nests hatched from 52 days to 85 days.

PROBLEMS

The main problem encountered was the continual removal of our small nesting stakes by the unaware beach traffic, mostly in Section-1. Having to replace about 1/2 of the stakes added to the cost of the project. Usually only one stake of the "range pair" was removed which gave us a direction to work backwards from when restaking the nests. Only one 4" base stake was removed.

Problems with the nests included: 1) 6 nests were laid too low on the beach and 5 nests were laid in "bad locations," and 2) the high rise condo's and homes

close to the beach definitely affected the females laying behavior and the dis-orientation of the hatchlings from bright lights.

The predators in this area consisted of the ghost crabs and sea birds. Other areas of the island, outside of the Plantation, still had some remaining problems with poachers and raccoons. And there is always the problem of the shrimp trawlers catching immature and adult female loggerheads. The total dead turtles for 1982 was 21, most of which washed up on the south beach area. With the close distance trawlers are allowed to drag near these public beaches, it is a wonder they don't net swimmers, rafters, and sailboats, not to mention drawing sharks close to the beach and catching and drowning the sea turtles.

RECOMMENDATIONS FOR 1983

A continuing project should be carried out to aid in the protection of the threatened loggerhead sea turtles. The talk of a low cost hatchery has been suggested, and could be possible at approximately twice the cost or less of the 1982 funded project. We would need the cooperation of 2 or 3 property owners who have a stable dune system available for a low screened in (15' x 15' x 2') grid system to be used as a protected hatchery. The hatchery could be maintained by the same number of workers and a more complete study could be carried out with accurate results on the survival of the hatchlings. Also a greater survival rate would be insured due to the lack of predators, water inundation, beach traffic and build-up of Spartina reeds. Most of all, any beach renourishment procedures would not be inhibited or restricted from particular areas since the nest would be moved to two or three central locations at the hatcheries.

ACKNOWLEDGEMENTS

I would like to thank the efficient high school students and others hired and trained as the walkers. And deep thanks to Mr. John Kennedy and Mr. Krum who followed the project to the end watching and reporting the nests which hatched.

Thanks also go to the Sea Pines Property owners that reported nests and strandings to my office which allowed a double check procedure to be in effect and to the Sea Pines Beach Committee. In summary, the 1982 Project Turtle Watch proceeded very orderly and as planned.

PROJECT DESCRIPTION

A translocation project involving the nests of the loggerhead turtle (Caretta caretta caretta L.) was conducted on Pritchards Island, Beaufort County, South Carolina from May 15 to July 15, 1982. Objectives of the project were: (1) Testing the effectiveness of the translocation technique for raccoon predation control; (2) evaluating the feasibility of use of a lay work force for implementing this technique; (3) determining the effectiveness of (1) and (2) in increasing loggerhead reproductive success on an uninhabited island where predation and beach erosion destroys virtually every nest; and (4) using this set of circumstances for education of the public.

NATURAL NEST SITE PROBLEMS

Pritchards Island is a typical barrier island (4 km length) currently undergoing severe erosion. It is not permanently inhabited so there is little human interference with use of the beach by turtles. Primary problems are: (1) The mechanical obstacle of dead trees littering the highly eroded beach; (2) low beach angle and lack of an optimal sandy nesting area resulting in tidal flooding of natural nest sites; and (3) predation by raccoons, ghost crabs, etc.

TRANSLOCATION METHOD

Eggs are removed from their natural site to a suitable area above spring tide level. This dilutes the scent of the nest, which is concentrated mainly in the sand of the natural site, and provides a degree of security from raccoon predation. Nests were further protected from raccoons by a one square meter wire (5 x 10 cm mesh) cover.

RESULTS

Total Nests: 50

Total Eggs: 5,618

Average Eggs/Nest: 112 (Standard Deviation: 32.4)

Total Eggs Hatched: 4,430

Percent Hatched: 78.85%

Total Undeveloped Eggs: 932

Total Partially Developed Eggs: 96

Total Eggs Lost to Predation (Covered Nests): 15 (4 Nests)

Total Eggs Lost to Predation (Uncovered Nests): 93 (1 Nest)

Total Eggs Lost to Other Causes (Ants, Roots): 52

CONCLUSIONS

(1) The translocation method resulted in a hatch efficiency comparable to other studies.

(2) Translocation of nests into areas with Uniola paniculata (sea oats) should be avoided. Early root invasion of the nest destroyed potential hatchlings as the roots penetrated the eggs. Roots also entrapped emerging hatchlings within the nest.

(3) Raccoon predation attempts on covered nests did not appear to be correlated with nest age; i.e., predation attempts occurred over the entire incubation period.

(4) Wire covers further reduced raccoon predation even after translocation; raccoons attempted to dig into 16% of the nests. The feasibility of covering every nest may be site dependent. On low density turtle-nesting beaches, e.g. those between Jacksonville, Florida, and Charleston, South Carolina, the extra time, energy, and expense appears to be warranted. On high density turtle-nesting beaches, the cost: benefit ratio may not warrant covering the nests with wire.

(5) Utilization of lay workers was very successful. Over one hundred people had a direct contribution to make to the project. Three to five lay volunteers and a biologist (Caine, McCollum) conducted nightly beach walks

from 10:00 p.m. until 3:00 a.m. or later. Workers were given a 20-30 minute talk covering operating procedures prior to going on the walk. When a crawl was spotted, the biologist ascertained the turtle's activity while the observers remained at a distance. Once the turtle began to lay, the group was invited to observe. Nesting behavior was explained to the group as the turtle lay and then covered the nest. After the turtle returned to the water, the nests were translocated to the hatchery area. Everyone within the group was given the opportunity to dig, touch, and carry the turtle eggs to the hatchery area where they reburied the eggs.

The expenses were paid by the University of South Carolina at Beaufort while the living space was provided by concerned, local citizens. The cost to the University was less than \$2,000 (both biologists volunteered their time). We believe that this proved to be an extremely cost effective mechanism to provide public education and public service. The educational value, although not measured, seemed to be great, and the participants are eager to return next season.

Loggerhead Turtle Nesting on
Fripp Island, South Carolina

by
Morine Smoak

OBJECTIVE

To determine the effect of beach erosion control methods on loggerhead turtle nesting habits on Fripp Island.

INTRODUCTION

With a growing population of permanent residents on Fripp Island, we had an enthusiastic group of twenty (20) volunteers who checked their sections of the beach daily, and developed strong 'territorial imperatives'.

METHODS AND MATERIALS

Our count for 1982 began on "Turtle Day", 17 May, for three consecutive years, our first nesting has been on this same day. Each body pit was probed for the nest to be verified. The nest number, date and location was recorded on our white stakes. File cards on each nest contained further information, description of nest site, whether nest was in high tide zone and moved, at which time eggs were counted and recorded. Stakes were placed a certain measurement in front (ocean side) of nest. With our large summer population, many of whom plan their vacations during the nesting season, placing the marker in front of the nest protects it from foot traffic.

RESULTS

With a decrease in the raccoon population on the island, our loss to predation was extremely low. The severe storm on 18 June flooded five nests. Mortality rate of hatchlings to damage by small red ants was distressing. Again in 1982 with another hot and dry June and July, nests hatched early, producing small, premature turtles. There were 34 nests hatching between 48 and 58 days. The majority of nests incubated between 59 to 61 days, with the final nest (6 August) hatching at the end of 68 days. We had a total of 123 verified nests, with approximately 68 false crawls. Some of these false crawls made two to five futile attempts to nest on the north end of the island

having the rock revetment. Several of the false crawl dates coincided with extremely low tide nests at the south end of the island. All verified nests in the revetment area were moved to a safe location before the next high tide. There has been little difference in hatch of moved nests to natural nests.

Since there were over 8,000 hatchlings counted in 1982, we think the constant surveillance of the revetment area and the re-location of all nests from this section account for the success of our program.

CONCLUSION

With the work of the volunteers, all sections of the beach were checked early every day. Great interest in the loggerhead is evident on the entire island. Volunteers genuinely enjoyed their part in the program and helped enormously in explaining the story of the loggerhead to hundreds of people from many sections of the country.

RECOMMENDATIONS

To continue our program on Fripp Island and improve our methods of observation. Also to continue our part in the stranding network.

ACKNOWLEDGEMENTS

We received some financial aid from the Fripp Island Audubon Society, for expense of copying material to place in rental homes, purchase of paint and file cards. Coastal Contractors of Beaufort donated stakes. These we recover at the end of the turtle season, paint and have them ready for the coming season.

Loggerhead Turtle Nesting
on Hunting Island, South Carolina

by

Marjorie Reed

OBJECTIVE

The purpose of this study was to determine the number of nests laid on Hunting Island, the success rate of the nests, and the number of hatchlings released during the season.

INTRODUCTION

The beach at Hunting was described in the 1981 report. There has been a continual loss of sand since the nourishment project in 1980 and the beach is not as wide as it was in 1981.

METHODS AND MATERIALS

The three mile beach was patrolled each morning to locate turtle tracks and mark the site of nests. Nests were monitored throughout the summer to determine their success or not.

RESULTS

The total number of emergences of loggerhead turtles was 117 with 96 nests and 21 false crawls. Of the 96 nests, 37 were washed away in a storm on 18 June, raccoons depredated 26 and ghost crabs destroyed 9. Fourteen nests hatched and 1,574 hatchlings were released. During the summer there were 6 dead turtles recorded on Hunting Island.

RECOMMENDATIONS

It is hoped that nests laid in low areas of the beach can be moved to better sites next year.

Part I

Loggerhead Turtle Nesting Survey
on Edisto Island, South Carolina

1982

by

Deborah A. Mundell

OBJECTIVE

- (1) To determine distribution, frequency and success of loggerhead turtle nesting on three Edisto Island, South Carolina beaches; Edisto Beach State Park, Edisto Beach, and Botany Bay Island.
- (2) To determine causes of failure in unsuccessful loggerhead turtle nests.
- (3) To attempt protection of loggerhead turtle nests from raccoon predation on Botany Bay Island.
- (4) To evaluate the effects of human beach usage and coastal development on loggerhead turtle nesting activity.
- (5) To design and utilize programs and materials which convey information about loggerhead turtles and the Edisto Island Sea Turtle Project to further public education.

METHODS

Three beaches on Edisto Island, South Carolina were included in the 1982 Edisto Island Sea Turtle Project: Botany Bay Island, Edisto Beach and Edisto Beach State Park. Nesting surveys were conducted on all three beaches. On Botany Bay Island where raccoon predation accounted for loss of 100 of 105 nests laid in 1981 a nest protection program was conducted. To minimize loss to overwash, nests laid below the beach crest or within the tide margin were moved to safer locations within the first 24 hours.

Various educational programs and literature designed to provide information concerning sea turtle conservation efforts and the Edisto Island Sea Turtle Project, in particular, were provided to the public. A sea turtle "hotline" and Volunteer Network were established to provide researchers with additional information on sea turtle activity and to increase the number of individuals knowledgeable about and involved in the conservation efforts.

Nesting surveys were conducted for a second season on Botany Bay Island and Edisto Beach State Park. Edisto Beach, the most heavily populated beach on the

island, was surveyed for the first time. Botany Bay Island and Edisto Beach State Park were walked daily at dawn. Edisto Beach was surveyed every second or third day by beach residents involved in the Volunteer Network. Upon discovery, each turtle crawl was designated as "true", signifying nesting, or "false", meaning that no nest was laid. Occasionally, a crawl was categorized as "true/false" when visually it appeared that the turtle had nested but no eggs were actually seen. In all cases, 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.

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. Nests were monitored during subsequent beach patrols and any changes in beach or nest conditions were noted. Meteorological data were also collected during each walk.

Nests were monitored for signs of hatching beginning at 50 days incubation. Hatching tracks and a slight depression or easily penetrated spot in the sand signified that hatching and 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 travel from nest to ocean independently. Hatched fragments, unhatched eggs and number of dead and deformed hatchling were counted. Total number of eggs and number of hatchlings which had emerged from the nest were then determined and emergence success calculated using the following formula:

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

Upon discovery, verification and marking as described above, loggerhead turtle nests laid on Botany Bay Island were covered with wire screening. Several different types of wire cut in 3'x3' sections were used during the season. In each case, screens were centered directly over the nest cavity and were anchored on four sides

using logs and driftwood found on the beach. Metal and wooden stakes were tried as anchors but both proved unsuccessful due to the heavy amount of shell beneath the surface of the sand. Sand was mounded along the perimeter of the screen but not over the top as it seemed desirable to leave the nest in as natural a state as possible.

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.

Length of time screens remained on nests varied depending upon the type of wire used. Approximately half of the 2"x4" mesh welded wire screens were left in place until the nests had hatched or were certain not to hatch in order to test earlier findings that hatchlings were not impeded by the wire in their emergence from the nest (Crouse, unpub. data). The remainder of the welded wire screens were removed at random 4-7 weeks after laying and were reused to cover newly laid nests. The 1" mesh chicken wire and 1/4" mesh hardware cloth screens were removed at 50 days incubation to insure that hatchlings would not be trapped beneath the small mesh wire at emergence.

The nesting survey of Edisto Beach was accomplished by a network of volunteers who were trained and supervised by project investigators. Twenty-five permanent or part-time residents were involved in the Volunteer Network during the course of the nesting and hatching seasons with 12 working consistently throughout. Each volunteer was responsible for a specific section of beach which he agreed to walk at least every other day. Reports of turtle activity were made either to the

student intern or to one of the project leaders, who subsequently verified the observation, recorded the necessary data and marked true nests and false crawls. Volunteers then monitored the nests until hatching, at which time the project investigators were again contacted and the nest excavated to determine emergence success.

RESULTS

A total of 469 loggerhead turtle crawls were discovered during the 1982 season. 258 (55%) crawls resulted in nesting, 181 (38.6%) in non-nesting, or false crawls, and 30 (6.4%) in crawls which were categorized as true/false. On Botany Bay Island, 259 crawls were discovered with 122 (47.1%) being true nests and 137 (52.9%) false crawls. Out of 144 crawls observed on Edisto Beach State Park, 91 (63.2%) were true nests, 39 (27.1%) false crawls and 14 (9.7%) true/false. Sixty-six (66) crawls were reported for Edisto Beach with 45 (68.2%) being true nests, 5 (7.6%) false crawls and 16 (24.2%) true/false. Nesting activity on beaches surveyed during the 1982 season is summarized in Table 1.

Edisto Beach State Park

Nesting density was greatest on Edisto Beach State Park with an average of 43.3 nests per kilometer. Botany Bay Island averaged 34.9 nests per kilometer and Edisto Beach 8.2 nests per kilometer. Crawl density was greatest on Botany Bay Island with an average of 74.0 crawls per kilometer. Edisto Beach State Park averaged 68.6 crawls per kilometer and Edisto Beach 12.0 crawls per kilometer. Nesting and crawl densities are also given in Table

Hatching and/or emergence occurred in 173 (67.1%) of 258 nests, yielding in excess of 23,000 eggs and 13,000 hatchlings (Table 2). Mean number of eggs per nest was 115. Fourteen (14) nests were lost to overwash by high tides and 27 nests were completely destroyed by small animal predators. Extensive root growth into nests, heavy rainfall and partial predation are thought to have also contributed to failure of some nests. Fates of remaining nests are unknown (Table 3).

Table 1. Loggerhead Turtle Crawl Activity on Three Edisto Island Beaches, 1982.

	Edisto Beach State Park	Edisto Beach	Botany Bay Island
True Crawls	91 (63.2%)	45 (68.2%)	122 (47.1%)
False Crawls	39 (27.1%)	5 (7.6%)	137 (52.9%)
True/False Crawls	14 (9.7%)	16 (24.2%)	0
Total Crawls	144	66	259
Crawl Density	68.6	12.0	74.0
Nesting Density	43.3	8.2	34.9

Number of true nests laid on Edisto Beach State Park increased by 75% from 52 in 1981 to 91 in 1982. Success rate, or percent of nests which hatched, remained the same at 84.6%. Emergence was verified in 77 of 91 nests laid in 1982. Of 8,899 total eggs, 6,807 (76.5%) hatched and 6,765 hatchlings emerged (Table 2). An average of 116 eggs were laid pr nest, with an average of 87.9 emerging. Mean emergence success was 78.7% . Nine (9) nests were lost to overwash by high tides, and 5 nests failed to hatch for unknown reasons (Table 3). No nests were lost to predation.

Edisto Beach

At the time of discovery, 12 crawls on Edisto Beach were verified as true nests, with 8 being designated as false crawls and 34 as true/false. Hatchlings later emerged from 6 true, 3 "false" and 18 "true/false" crawls. A total of 4,771 eggs were laid with 3,864 hatchlings emerging. An average of 122 eggs were laid per nest, with an average of 99.1 hatchlings emerging. Mean emergence success for Edisto Beach was 80.7% (Table 2). One nest and one potentially true nest were lost to overwash by high tides. Fates of remaining nests and true/false crawls

are unknown (Table 3). Again, no predation of nests was observed.

Reports of hatchlings on Edisto Beach being directed away from the ocean by bright lights on or behind the beach were numerous. More than 130 hatchlings were killed while crossing the road toward the lights. Others were found alive under houses, in yards and on the roads and were returned to the ocean.

Table 2. Hatching Success of Loggerhead Turtle Nests on Three Edisto Island Beaches, 1982.

	Edisto Beach State Park	Edisto Beach	Botany Bay Island	Total
#Nests Successful	77	39	57	173
#Eggs Laid	8,899	4,772	9,338+	23,008+
#Eggs Hatched	6,807	3,874	2,490+	13,171+
#Eggs Unhatched	1,918	897	3,604+	6,419+
#Hatchlings Emerged	6,765	3,864	3,412+	14,041+
#Hatchlings Dead in Nest	42	10	192	244
Emergence Success(%)	78.7	80.7	39.8	66.4

$$* \text{Emergence Success} = \frac{\# \text{Eggs Hatched} - \# \text{Dead in Nest}}{\text{Total} \# \text{Eggs in Nest}}$$

+Represents # countable fragments only.

Botany Bay Island

Number of nests discovered on Botany Bay Island increased by 16% from 105 in 1981 to 122 in 1982. Success rate increased from 0.9% to 46.7%, with hatchlings emerging from 57 of 122 nests laid in 1982. Total number of eggs laid,

number of eggs hatched and number of eggs unhatched could not be determined precisely since the contents of 18 nests were rendered uncountable when depredated. A minimum of 9,338 eggs were laid with 2,298+ hatchlings emerging. Mean number of eggs per nest was 107, with an average of 40.3 emerging. Mean emergence success was 39.8% (Table 2).

Table 3. Success Rate of Loggerhead Turtle Nests on Three Edisto Island Beaches, 1982.

	Edisto Beach State Park	Edisto Beach	Botany Bay Island	Total
#Nests	91	45	122	258
#Successful	77 (84.6%)	39 (86.7%)	57 (46.7%)	173 (67.1%)
#Unsuccessful	9 (9.9%)	1 (2.2%)	63 (51.6%)	73 (28.3%)
#Unknown	5 (5.5%)	5 (11.1%)	2 (1.6%)	12 (4.7%)

*Represents verified nests only. Numbers do not include potentially true nests which may be among those categorized as true/false.

Three (3) nests were lost to overwash and another 17 suffered water damage from high tides and heavy rainfall. Plant roots were found growing into and around eggs in 21 nests at excavation. Fates of 2 nests remain unknown (Table 4).

Predation remained a significant problem on Botany Bay Island despite nest protection efforts. Ninety-five (95) of 122 nests laid suffered some degree of predation, 80% of which occurred during the night before nests were discovered. Twenty-seven (27) nests were completely destroyed and 68 were partially predated. The remaining 27 nests were not disturbed. Greater than 3,244 eggs were destroyed. In all cases, raccoons were the primary predators. Ghost crabs and birds were involved as secondary predators in 23 cases of nest disturbance.

Table 4. Fates of Loggerhead Turtle Nests on Three Edisto Island Beaches, 1982.

	Edisto Beach State Park	Edisto Beach	Botany Bay Island	Total
Predation:				
Complete	0	0	27	27
Partial	0	0	68	68
Plant roots/ Part. pred.	0	0	21	21
Water damage/ Part. pred.	0	0	13	13
Overwash/Beach Erosion	9	1*	7	17
Fate &/or Cause of Failure Unknown	5	5*	6	16
Successful (Hatched)	77	39*	57	173

*Represents verified nests only. Numbers do not include potentially true nests which may be among those categorized as true/false.

Of the 18 nests depredated after being marked, 13 (68%) had been covered with wire screens. With the exception of one nest covered by 1/4" mesh hardware cloth, screens covering these nests were constructed from 2"x4" mesh welded wire. Four (4) nests were depredated through the top of the wire and 4 by tunneling under the edge and into the nest cavity. Screens were not centered directly over the eggs in another 4 nests which enabled raccoons to reach in from the side and into the cavity. Six (6) of the 18 nests depredated after discovery were completely destroyed. Four (4) were screened and 2 were not.

Five (5) nests were depredated after marking but before they had been screened. Three (3) of these nests could not be verified by probing, were categorized as false and were afterwards depredated. Another nest was destroyed

before wire could be transported from the central storage area back to the nest; 3 eggs were eaten by ghost crabs. Sudden onset of a lightening storm prevented a fifth nest from being covered and it also was lost to predators.

Wire screens were left in place on 49 nests until emergence and/or excavation had taken place. Screens were removed from 40 nests prior to emergence and/or excavation and were reused. In no case were hatchlings found to be hindered by the wire enclosures in their emergence from nests. However, it was observed that 5 nests which were not protected at the time of emergence were dug by raccoons. Hatchlings were found decapitated or otherwise mutilated near opened nest cavities, the contents of which had been fragmented by the predators. Since only a small number of dead hatchlings were observed, it is not known whether predation took place prior to or following emergence or how many hatchlings were killed.

DISCUSSION

The three study areas included in the project represent varying degrees of both human usage and beach development. Botany Bay Island is characterized by low utilization and no development. Edisto Beach State Park is utilized quite heavily by humans during the summer but has very little development. Edisto Beach, the only residential area included in the study, has constant but moderate beach usage and is almost entirely developed.

Edisto Beach State Park

As was observed in 1981, the majority of nests laid on Edisto Beach State Park were successful with occasional overwash of nests being the only significant problem. Despite efforts to relocate any nests thought to be laid within the high tide line, 9 nests were still lost to overwash. Beach erosion continued throughout the season with scarps up to 6 feet in height appearing and disappearing and the beach face being reduced each time. Snow fences were eventually

installed by Park personnel in an effort to slow the encroachment. Since it is a well established fact that many beaches typically undergo alternate periods of building and erosion, it is hoped that the amount of beach lost during the season will not be permanent and that this area will prove to be a successful nesting ground for loggerhead turtles in future years.

It is proposed that Edisto Beach State Park be included again in the 1983 nesting survey primarily because of its importance as an area used cooperatively and very successfully by both man and the nesting loggerhead turtle. While the total number of crawls in the area increased by only 18% from 1981 to 1982, the number of true nests increased by 75%. Success rate remained high at 84.6%. It is also an area where project investigators can meet the public - the beach users - and can pass along information about sea turtles and responsible behavior toward them to a great many individuals.

Any inhibitory effects of human presence on nesting frequency and success should be reflected in comparisons of nesting densities, percentage of crawls resulting in nesting and number of nests hatched in the three areas. Each of these parameters would be expected to decrease as the amount of beach usage and development increased. However, Edisto Beach State Park had a higher nesting density and more nests hatched than either Botany Bay Island or Edisto Beach and had a higher percentage of true crawls than Botany Bay.

Edisto Beach

Edisto Beach had the highest percentage of true crawls but had the lowest nesting density - only one-fifth that of Edisto Beach State Park - which suggests that beach development rather than the presence of humans might have discouraged turtles from coming ashore to nest. It should be noted, however, that equally developed sections along Edisto Beach had very different nesting densities, and that factors other than the presence of buildings in itself must be considered.

While it has been suggested that artificial lighting on the beach is a probable deterrent to nesting, its adverse effect on the safe return of hatchlings to the ocean is well documented. When hatchlings emerge from nests laid on undeveloped beaches, they naturally move toward the ocean which reflects light from the moon and stars and is brighter than the opposing horizon. However, on developed beaches the landward horizon is often more brightly lit than the ocean, and hatchlings are redirected away from the water. They are then in danger of dessication, exhaustion of their energy reserve and death under the wheels of motor vehicles as they purposefully follow their instincts toward the wrong light source. Such was the case for several nests on Edisto Beach, with loss of at least 130 hatchlings reported. Nests laid in areas where vacant lots on the beachfront coincided with locations of street lights or bright porch lights were the nests most often affected. Hopefully, a plan to partially shade or shield street lights which shine directly on the beach will be adopted by the Town of Edisto Beach by next season. A campaign to encourage homeowners and vacationers to use fewer lights during nesting and hatching seasons will also be initiated.

The only other apparent problems for nests laid on Edisto Beach were overwash and beach erosion, which claimed at least two nests. Along much of this area there is only a very narrow strip of sand which remains above the high tide mark. No small animal predation was observed, even though ghost crab burrows were numerous in some sections.

Numbers of true and false nests on Edisto Beach were not precisely determined this season due to difficulty in verification of nests by probing and incomplete follow-up surveys in some sections. Fifty percent (50%) of crawls originally categorized as "true/false" were later reclassified as true after hatching and emergence were observed. It is impossible to know how many of

the remaining true/false were actually true, unhatched nests and how many were false crawls. It is proposed that Edisto Beach be surveyed again more closely in 1983 to get a more accurate assessment of nesting activity and emergence success. With more rigorous training of interns and involvement of conscientious and informed individuals in the Volunteer Network, this should be easily accomplished.

It should be noted that, while probing is the accepted method of verification among many researchers conducting similar nesting surveys, those involved in the Edisto Island Sea Turtle Project would have preferred to assess nesting versus non-nesting crawls visually rather than by probing had that been possible. Though results from the 1981 study which compare nests probed with those not probed showed no significant differences in success rate or emergence success, there still remains the danger of egg breakage during probing. To leave the nest as undisturbed as possible seems unquestionably preferable. However, this season's nest protection program on Botany Bay Island necessitated the use of probing to determine the exact location of the nest cavity so that screens might be placed directly over the eggs.

Botany Bay Island

Protection of nests from raccoon predation increased the number of hatchlings emerging from nests laid on Botany Bay Island from 45 in 1981 to over 2,490 in 1982. Only 11 nests were depredated after the initial disturbance as compared with 29 depredations in 1981. The number of undisturbed nests increased from 8 in 1981 to 27 in 1982. The goal of the nest protection program was to successfully hatch 50% of nests laid and to see an estimated 2,500 hatchlings return to the ocean. While this goal was realized, the success of the protection program was only marginal. Seventy-eight percent (78%) of nests laid still suffered predation to some degree. Most of the disturbance occurred between the time of nesting and dawn. Beach surveys at night rather than at

dawn would most likely have prevented some of this predation. Unfortunately, night patrols on this particular beach were not possible since motor vehicles could not be used and repetitive walks to cover all nests laid during the night would have been physically exhausting and would still have provided no guarantee that all nests would be reached before predation.

Thirteen (13) nests were depredated after being discovered and covered with wire which necessitated that several changes in the type of protective screening used be made. Initially, 3'x3' pieces of welded wire with a 2"x4" mesh size were used since this method had successfully protected nests laid on Smith Island, N. C. in 1981 (Crouse, unpub. data). However, on Botany Bay Island, several nests covered with the 3'x3' screens still suffered predation by raccoons digging under the edges and into the nest cavities. Subsequently, 4'x3' sections of the same wire were used. Again, raccoons dug either under the edge or through the top of the wire into the nest cavity. Several screens were then constructed using 1" mesh chicken wire. While this was successful in protecting against raccoon predation, ghost crabs were still able to burrow through into nest cavities. Chicken wire screens were also more difficult to anchor over the nest area and were less durable than welded wire screens. Since the project proposal called for removal of the wire after several weeks of incubation and reuse on newly discovered nests, the chicken wire was not a satisfactory alternative. Finally, 3'x3' sections of 1/4" mesh hardware cloth were used to cover the last 10 nests of the season. Although relatively expensive to purchase initially, hardware cloth screens proved to be most effective in protecting nests from predation and are of sufficient strength and durability to be reused during the same or successive seasons.

It was expected that some nests on Botany Bay might be lost to overwash by high tides. However, the extent to which water damage occurred in this

area was not anticipated. Nests laid within the high tide line or below the beach crest were relocated as planned. Still, other nests were inundated when certain sections of beach completely overwashed from shoreline to marsh edge at new and full moon high tides. Nests laid back on the beach face close to the marsh were also water damaged. At excavation, 13 nests were found to be water soaked. Excessive rainfall during the season might also have contributed to this problem.

Root growth into nests was also an unanticipated problem on Botany Bay Island. Dense roots were found in 17% of the unhatched nests when excavated. In some cases, roots completely surrounded the eggs and were often found matted inside egg shells, having completely absorbed the contents.

As a possible alternative to nest protection by screening on Botany Bay Island, predator control by live trapping and relocation of raccoons is suggested. This method has been used successfully for several seasons on the Cape Romain Wildlife Refuge, Sand Island and South Island, South Carolina. Studies there suggest that only small numbers of animals are actually responsible for nest destruction, having acquired a special taste for turtle eggs. If the relatively few beach patrolling raccoons can be trapped at the beginning of the season and removed from the area, predation should be largely curtailed. Given the limitations of the screening program already discussed, predator removal could possibly provide both a more efficient and a more successful approach to nest protection on this particular beach.

RECOMMENDATIONS

Plans for the Edisto Island Sea Turtle Project include use of the Volunteer Network in surveying Edisto Beach again in 1983. Project investigators will devote more time to education and training of volunteers and will accompany them on beach patrols in their respective areas several times during

nesting and hatching seasons.

One problem which turned out to be a significant one for the project was the widespread removal of flags used to mark nests. The problem was particularly bad on the State Park and also on Edisto Beach. Even though flags were marked with the message, "Please Do Not Remove; For Research Purposes," they were still pulled and taken away from nest sites repeatedly. It was impossible, then, for project investigators to know the precise locations of nest cavities, and follow-up excavations of unhatched nests could not be carried out as planned. Alternate methods of marking nests are being considered. However, it is hoped that with increased public awareness of the methods and aims of the project, residents and visitors alike will respect the importance of the markers and will instruct their children to do the same.

It became apparent as the season progressed that visitors to Edisto Beach State Park were much more familiar with or, perhaps, more responsive to the Edisto Island Sea Turtle Project than were permanent or part-time residents on Edisto Beach. To increase public awareness of the project among area residents, then, is a major goal of the 1983 project. It is believed that many cases of sea turtle activity on Edisto Beach may go unreported because people do not know who to call or even that such information is being solicited. Talks to local church and civic organizations, continued sale of Edisto Island Sea Turtle Project T-shirts in local shops and recruitment of area residents in the Volunteer Network are planned again for the 1983 season. A campaign to encourage voluntary participation in a "lights Off" program aimed at reducing the amount of light on the beach will be initiated. Proposed plans for increasing public awareness of the project also include posting of hotline telephone numbers in all rental houses on Edisto Beach and continued distribution of "Attention Beach Users" guides if available.

Note: No nests were lost to human disturbance on any of the beaches surveyed in 1982. The same man arrested in 1981 for poaching loggerhead turtle nests on Edingsville Beach was arrested again this season with 150 eggs in his possession. The number of nests lost to poaching on Edingsville Beach is not known. It is proposed that this beach be included in the 1983 nesting survey.

Part II

Education and

Public Involvement in the

Edisto Island Sea Turtle Project

1982

by

Deborah A. Mundell

Pamphlets supplied by the Center for Environmental Education were distributed to campers at Edisto Beach State Park and were made available at each of the 4 realty offices. "Attention Beach Users" pamphlets by the Sea Turtle Rescue Fund were made available to approximately 25,000 campers with over 100 additional brochures being provided to renters on Edisto Beach. T-shirts designed especially for the Edisto Island Sea Turtle Project and bearing its name were sold locally and in the Charleston area. Sea turtle T-shirts sold well at local gift shops especially following talks at the State Park, and approximately 400 have been sold to date.

"Turtle Talks" presented at the State Park each week from May until September, attracted an average of 30 people each week. During peak nesting and hatching seasons, several night walks were conducted at the State Park to give participants a chance to witness firsthand what they had just seen and heard about in the slide presentation. Approximately 100 people participated in each of the 3 night walks. The Charleston Natural History Society, which is the local chapter of the National Audubon Society and cosponsor of the Edisto Island Sea Turtle Project, also sponsored several early morning field trips to one of the study areas and 25 members accompanied project investigators on their regular beach patrols. Talks were also presented to local service organizations as well as to student groups in the area. Information about the project was published in area newsletters and newspapers. As many as 50 names and addresses of individuals interested in knowing results of the season's nesting surveys and future plans of the project were collected. A short summary is now being prepared and will be sent as requested in the near future.

The Volunteer Network, in its first year of operation, worked well on Edisto Beach. Initial response from local residents was more than satisfactory. Participants were enthusiastic, eager to learn, and, for the most part, conscientious in fulfilling obligations they had made to the project. They were

also helpful in spreading information about sea turtles to neighbors and other beach users and encouraged their participation in the conservation efforts. For instance, an entire bridge club became turtle champions after three of their members, who were also network volunteers, began to monopolize conversations each week with "turtle" talk. The only significant problem with the Network was in persuading volunteers who could not patrol their areas as often as they had pledged to notify project leaders so that temporary or permanent replacements could be made.

Many more people were involved in the Edisto Island Sea Turtle Project than just the project investigators and those working for the Volunteer Network. Campers at the State Park regularly accompanied project leaders and the student intern on beach patrols, often providing helpful information about nestings, hatchings and strandings. They were enthusiastic and eager to learn about sea turtles and the research being conducted on the Island. The degree of curiosity and sense of responsibility and support shown by the majority of people contacted far exceeded expectations and is thought to be responsible, in large part, for the unexpected frequency and success of nesting in such a heavily "populated" area.

In a study of this type where there are many lay people involved both as casual observers and as active participants, a certain amount of anecdotal information is gathered along with the scientific data. Such was the case with the Edisto Island Sea Turtle Project. The enthusiasm of an individual seeing a "live" sea turtle for the first time is unabashed and most certainly contagious. It is an experience that must be shared with someone else, and all the better if that someone be the "turtle lady" herself. Never mind that it is the middle of the night and she will be coming at dawn anyway on her usual beach patrol. The signs did say, "Turtle Hotline" and bade one call to report turtle activity of any sort...And call they did! The "Wanted" signs posted at small

businesses and at the State Park elicited over forty reports of strandings, hatchings, crawls and turtles in the process of laying. Some callers were especially conscientious, like the vacationing doctor from West Virginia who reported two nestings in progress; one in front of the "fifty-seventh house south of the Pavillion," and the second in front of the "fifty-ninth house." And the school teacher from Alexandria, Virginia who, having been to one of the talks at the State Park, found two children trying to cut the shell off of a stranded turtle. After rescuing the corpse and explaining sea turtle protection laws to the boys, she hid the turtle on the beach until one of the project investigators could be called to verify, measure and mark the stranding. South Carolina Wildlife Department officials later identified the animal as the only green turtle to be recorded in the state during the season.

Another vacationer found himself involved when, out for a morning jog, he spotted a large loggerhead turtle dragging itself down the main thoroughfare. The animal apparently had been caught by daylight after coming ashore to lay her eggs and had become disoriented as she tried to return to the ocean. Remembering that he had seen a "Wanted" poster soliciting turtle information at a nearby restaurant, he went back, got the hotline number and called one of the project leaders. Together they managed to redirect the exhausted turtle back toward the water and, amid a flurry of photographs, watched her safely plunge beneath the breakers and out of sight.

A second turtle was seen still nesting just after dawn by a summer resident of Edisto Beach. Being a very observant sort of person, she saw that the turtle had a tag on its right rear flipper --GA 1832-- and immediately called the hotline number. The information was passed on to researchers at the University of Georgia who had tagged the turtle on Wassaw Island, Georgia earlier in the season. The nest on Edisto Beach hatched 62 days later with 85 hatchlings emerging. A five dollar reward sent by the University for the tag return was

forwarded to the young lady who originally reported the information. During the course of the season, this same individual reported another nesting and three strandings to project investigators.

On another morning, as one of the project leaders and a network volunteer were patrolling a section of Edisto Beach, a couple staying at a family-owned home on the beachfront were seen putting hatchlings back into the water. The couple had seen the hatchlings in the road and, as it turned out, were simply doing what they had been doing for years--twenty-five years to be exact. The woman explained that various members of her family who vacationed at Edisto off and on during the summer had been keeping a log of turtle nests laid in front of their house for the last twenty-five years. She was surprised, however, to learn that a similar project was being conducted on a much larger scale on the Island's beaches and that the information recorded in the family journal was, in fact, valuable information.

Another interesting and very encouraging show of support came from a somewhat unexpected source---local shrimpers. One assisted the student intern regularly with beach patrols on the State Park during the nesting season. A second offered his skiff and himself as the driver for a trip over to survey an offshore island which, according to local fishermen, was a popular but unsuccessful nesting ground due to heavy raccoon predation. Another, who volunteered to do several morning beach patrols on the State Park, discovered and reported three loggerhead nests. Several shrimpers agreed to make measurements of turtles accidentally caught in nets and brought aboard for resuscitation. And still another was observed disentangling a turtle from a gill net set up in front of the State Park then swimming it out beyond the other nets to open waters. Others showed genuine interest in the research being conducted with loggerhead turtles on the Island, and the feeling of antagonism and suspicion which prevailed last season was much less apparent.

1982 Kiawah Island

Loggerhead Hatchery Program

by

Michael F. Tolley

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INTRODUCTION

The Kiawah Island Community Association, supported by Kiawah Island Company, has maintained studies of the Atlantic Loggerhead sea turtle Caretta caretta during the summer nesting season since 1977. The 1982 research project has continued the collection of information of this species along with a hatchery program.

Kiawah Island serves as a relatively small rookery for the loggerhead along the east coast of the United States. For the past ten years, the island has been used by researchers for the study of this species' nesting habits and the operation of a hatchery program.

The 1982 nesting season began on May 12, with the last nest being laid the evening of August 15. In absolute numbers, this year's project was relatively successful. A total of 110 nests were moved to the hatchery with 8,306 hatchlings being released. The overall hatch rate was 79% with a 64% release rate.

The 1982 hatchery project entailed direct burial of eggs. Procedures followed were the same as in 1979, 1980, and 1981, and are outlined in the respective Kiawah Island Hatchery Activity Reports. Cooperation in the stranding network of the Endangered Species Office of the South Carolina Wildlife and Marine Resources Department (SCWMRD) was continued in 1982. The procedures for strand data collection also were reported in 1981. Further cooperative efforts entailed supply of a total of 36 hatchlings from four wild nests (laid May 27, 1982, June 25, 1982, July 7, 1982, July 14, 1982) to the SCWMRD for the purpose of scientific research. Taking of hatchlings was in accordance with PRT 2-4214;11.D2.

In addition, it was proposed that samples of sessile organisms be taken from the carapaces of nesting turtles. However, due to the late submittal of application for an ammendment to our permit (PRT 2-4214;11.D.1) this activity was never carried out.

It is hoped, through the efforts of this group, that the negative effects of Kiawah Island's development on its loggerhead nesting population will be minimized. With this year's program improvements, and future improvements based on new results, the loggerhead sea turtle may endure the encroachment of man on this barrier island.

RESULTS

Descriptive data for each turtle emergence was recorded during the 1982 nesting season on data sheets. Eighty percent of the nests laid on the front beach were moved to the hatchery. Additional information on the fate of each egg collected was also recorded. The remaining nests (designated as wild) were left where laid and monitored for survival. Wild nest observations were incomplete, hence a hatchling success rate is unavailable for these nests.

Descriptive stranding data was also recorded for each strand that washed up on Kiawah. The following is a presentation of all hatchery information collected.

Turtle Emergence Data

Kiawah Island's front beach was divided into 18 $\frac{1}{2}$ -mile long sectors beginning at the southwestern end of the island. There were a total of 241 crawls. 57.5% of the recorded crawls resulted in nests, with the remaining crawls resulting in false crawls or body pits. Of the 138 nests laid on the beach, 110 were moved to the hatchery.

The first recorded crawl, which resulted in a nest being laid, occurred on May 12 with the last on August 15. Crawl activity was distributed relatively evenly over the nine miles of beach patrolled.

Hatchery Information

Eighty percent (80%) of the nests laid on Kiawah this year were moved to the hatchery. Each nest was given a number with the fate of all eggs being divided into categories based on data from post-hatch excavation of the nest.

Summations and statistical results are shown in Table 5.

Table 5. Summary of Hatchery Data 1982*

# of Nests	110 hatchery, 138 total
# of Eggs	12,225
Undeveloped	2,059 (16.8%)
Partly Developed	398 (3.3%)
Developed but not Hatched	113 (0.9%)
Hatched but Dead in Nest	50 (0.4%)

*Does not include 5 nests left unexcavated to test overwintering potential of late season nests.

CONCLUSIONS

The impact of human activity on loggerhead turtles through loss of nesting habitat, nest hatchling predation, and off-shore adult mortality, is being offset by the turtle hatchery program at Kiawah Island. The release of approximately 8,300 hatchlings will help bolster the endangered loggerhead population nesting on Kiawah Island.

We look forward to continuation of the hatchery program with concentration on cooperative efforts with the South Carolina Wildlife and Marine Resources Department. It is our hope that, in addition to release of hatchlings, we can collect more data on natural predation and turtle stranding.

**Nesting and Management of Loggerhead
Turtles on Cape Island, South Carolina in 1982**

by

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Gerard C. Fringeli

George R. Garris

INTRODUCTION

The 1982 nesting season of the Atlantic loggerhead turtle, (Caretta caretta), was monitored on Cape Island, the northernmost barrier island of Cape Romain National Wildlife Refuge, Charleston County, South Carolina. The major management activities used during the previous three years were practiced again during the 1982 season. These activities included monitoring the nesting of the turtles, construction of three predator-proof hatcheries to accommodate transferred clutches, beach experiments involving predator repellents, a predator control program to reduce the population of raccoons occurring on the island, and participation in the Sea Turtle Stranding and Salvage Network. Because 1982 marks the fourth reporting period for this management subject, it is no longer necessary to describe in detail the study area or the materials and methods used during this season. In an effort to simplify matters, only the results and discussion will be covered in this report. Previous management reports should be referred to for questions concerning the study area or methods and materials used during the program.

RESULTS AND DISCUSSION

Nesting Activity

Nesting of loggerheads at Cape Island began May 16th and ended August 18th, for a total of 95 days. During the season there were 2,378 (69%) false crawls, (non-nesting emergencies), and 1,087 (31%) nests laid for a total of 3,465 crawls. Nesting peaked during the second week of June and again during the first week of July. The peak of false crawls occurred during the third week of June when over 500 false crawls were recorded. The average daily number of false crawls and nesting crawls were 25.0 and 11.4 respectively. Nesting density was 135.8 per km. Table 6 lists the crawl data from 1975 to 1982. The downward trend of the late 1970's reversed and a slight increase in nesting activity was recorded for 1981 and 1982.

Table 6. Loggerhead Turtle Nesting and False Crawl Densities

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	2735	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

Hatchery Production

Three predator-proof hatchery pens (North, Main and South), were constructed on the island to accommodate transferred clutches. The north hatchery was located towards the northern end of the island as the name implies, and was designed for a capacity of 50 nests. It was situated on top of a frontal sand dune and was designed to be self-releasing. Boards were installed inside the hatchery to keep hatchlings from traveling in the wrong direction. The side facing the ocean was left open and a funnel was constructed outside to guide the turtles toward the ocean.

The other two hatcheries were located towards the middle of the island in terms of its length. The main hatchery had a capacity of 200 and was not self-releasing. Our presence each morning was required to count the turtles and transfer them to the beach where they were released on the berm. The south hatchery was located approximately 100 yards south of the main hatchery and was designed

to be self-releasing with a capacity of 150 nests. Later in the season we installed an addition and funnel for the hatchery.

This season 467 (43%) of the nests laid on Cape Island were transplanted into the hatcheries. Twenty-two nests were used in predator repellent experiments and 50 nests were marked as control nests to determine natural beach production. The remaining 548 nests were left on the beach in their natural state and were not monitored. A total of 57,710 eggs were transplanted to the hatcheries between the dates of May 29th and July 17th. The average clutch size was 123.6 eggs, ranging from the smallest containing 47 eggs to the largest with 203 eggs. The first hatch of a transplanted clutch took place in the north hatchery on July 28th, after an incubation period of 61 days. The last hatch took place in the south hatchery on September 10th, after an incubation period of 56 days. Sand temperatures were taken at depths of 0, 6, 18 and 24 inches at the main hatchery and at a designated area on the beach regularly throughout the season. There were no major differences in sand temperatures at either site. Table 7 summarizes hatchery production and percent hatch success.

Table 7. Hatching Success and Production of Nests Transferred to Hatcheries during 1982 Season.

	<u>No. Nests</u>	<u>No. Eggs</u>	<u>Mean Clutch Size</u>	<u>% Hatch</u>	<u>Hatchlings Produced</u>
North Pen	50	6,337	126.7	65.8	4,171
Main Pen	200	25,349	126.7	73.9	18,725
South Pen	<u>217</u>	<u>26,024</u>	<u>119.9</u>	<u>77.3</u>	<u>20,140</u>
Totals	467	57,710	123.6	74.5	43,036

An experiment was conducted in the south hatchery to determine if there would be any substantial difference in hatching success between nests moved 3-5 hours

after they were laid and nests moved 12-18 hours after they were laid. Sixty-four nests were transplanted 12-18 hours following the night they were laid. After the 64 nests had hatched, they were excavated and showed only two-tenths of a percent lower hatching success than the 106 night time transfers made 3-5 hours after they were laid. The remaining 47 night time transfer nests were not excavated. The results may indicate that future manpower and expense could be minimized if the work was performed during the daytime. However, it is believed that our nighttime presence on the island is a major deterrent to nocturnal predation by raccoons and poaching by humans.

Beach Experiments and Predation

Nest protection experiments were conducted on the beach again this year. Table 8. summarizes the estimated hatchlings produced. Fifty control nests were marked and monitored to serve as a basis for determining natural beach production. At the end of the season, only 50% had survived to hatch, 40% were destroyed by raccoons and 10% were destroyed as a result of beach erosion. When the surviving nests were excavated, an average of 123 eggs per clutch and 70% hatching success was determined. Based on the 50% survival rate for the control nests, it was estimated that at least 50%, or 274 of the 548 undisturbed nests survived to hatch. At an average of 123 eggs per clutch and 70% hatching success per clutch, an estimated 23,600 hatchlings were produced on the beach.

Table 8. Summary of Data Concerning Repellent Studies, Control Nests and Natural Beach Production.

<u>Nest Type</u>	<u>No. of Nests</u>	<u>%Nest Survived</u>	<u>% Predation</u>	<u>%Washed Away</u>	<u>Estimated Young Produced</u>
Controls	50	50	40	10	2,160
Bobcat Repellent	12	25	66	9	260
Human Repellent	10	30	40	30	260
Beach	*274	*50	*40	*10	<u>*23,600</u>
*estimated					26,280

Five control nests that had been recorded as "cooned out" during the season still produced some hatchlings. Apparently some viable eggs remained after the raccoons preyed on the nests. There appears to be a pattern associated with nest predation and the development of the eggs inside the nests. Usually a raccoon will prey on a nest the first night the nest is laid, or within two or three days; or the nest will be undisturbed throughout the season and then be destroyed just a few days prior to the hatch. It is believed that raccoons may possess the ability to smell a developing clutch of eggs through the sand. Also, there are visual clues that the raccoons may use to locate a nest, such as the turtle crawls in the sand or the top of the nest cavity dipping down just a few days prior to the hatch.

Human and bobcat urine experiments were conducted again this year to determine whether they can be used as effective raccoon repellents. Ten nests were treated with human urine and 12 nests with bobcat urine. The respective hatching success was 30% and 25%. These figures show a significant decrease from 1981's figures of 50% and 70%. It seems that more predation pressure was exerted on the repellent nests this year than last. This season was the third year of testing and even though the sample sizes have not been large enough to be conclusive, it appears that the two types of urine are not very effective as repellents. Of the total nests laid on Cape Island this season, 156 or 14% were destroyed by raccoons. Although only 14 raccoons were trapped this season, it appears that predation was not as intense as it had been in the past. Continued predator control through trapping would appear to be the best strategy in terms of management, and should maintain predation at a tolerable level in the future.

During the season, only one nest was found preyed on by a red fox. The nest was opened very neatly, and only a few eggs were destroyed. There was one confirmed case of nest poaching which took place early in the season on

June 10th. Our presence on the island undoubtedly discouraged further poaching.

The refuge also participated in the Sea Turtle Stranding and Salvage Network. Seventeen dead loggerheads washed up on Cape Island, an increase of six turtles from 1981's total. This information was sent on a regular basis to the South Carolina Wildlife and Marine Resources Department located at Fort Johnson, Charleston, South Carolina.

SUMMARY

The 1982 loggerhead nesting season was a success. The hatchery and predator control program have proven to be valuable and necessary management tools. Total Cape Island production for 1982 was 69,316 hatchlings. This figure was determined by combining the hatchery figures with the estimated beach production. Because Cape Island is an extremely important loggerhead rookery, future management programs should be maintained and perhaps expanded in some areas, to insure that production from the island remains at its maximum.

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