

A HISTORICAL ACCOUNT OF THE PROTECTIVE PROGRAM FOR
LOGGERHEAD TURTLE NESTING ON KIAWAH ISLAND, S. C.

By
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Introduction

Protection of nests of the marine loggerhead turtle (*Caretta caretta*) on Kiawah Island dates back to 1972 so the year 1992 marks the 20th anniversary of continuous protection [1]. There have been large changes in procedures during that time and one period when the program faltered and nearly expired; therefore, this seems to be an opportune time for an extensive review.

The nesting site, called a rookery, probably dates back to the creation of the island thousands of years ago, and there is evidence that turtles were a part of the culture of coastal Indians as long ago as 4000 years [1]. Certainly the Kiawah Indian tribe must have known of the nesting site. Its existence also must have been known to the European settlers in the 18th and 19th centuries, and they probably joined the other natural predators in raiding the nests. Persons still living in this area relate that it was customary for people from Johns Island and Charleston to probe with sharpened sticks for nests that the raccoons had missed, and it was not until the second half of this century that people began to abandon the practice and protect nests of this threatened species [2]. However, even as late as 1973 egg poaching by humans occurred once on Kiawah Island and was thwarted once [3]. No known poaching has occurred on the island since that date. ?

1972-1975

Much of the story of these early years comes from personal recollections of persons involved in the events or living on the island and familiar with the activities of the study teams [3]. Protection and study of the turtle rookery on Kiawah Island originated through the actions of two young friends in Charleston who had long shared an interest in reptiles. O. Rhett Talbert, Jr. and Tom McGee were unaware that the loggerhead turtle was a threatened species when they became interested in the animal and decided in 1972 to spend their summer break from college observing its nesting behavior. They received permission and encouragement from Mrs. C.C. Royal who with her children owned the island at that time. The two then approached the South Carolina Wildlife & Marine Resources Dept. (SCW&MR Dept.) and received a modest sum for supplies and the use of an old Jeep for patrolling the beach at night. They counted emergent crawls and distinctions were made between false and nesting crawls. Attempts were made to correlate the number of emergences with phases of the moon, tidal stage, and time of night. As

the study progressed, they were dismayed by the nearly total (93.8%) destruction of nests by raccoons, and they began putting 3'x3' screens of hardware cloth of 2"x4" mesh size over the nests as protection. They also discovered that if partially raided nests were relocated, even though only a short distance, further predation was reduced. Even so, some predation of nests continued despite the screens. One night they observed an adult raccoon eating an egg over a screened nest. Intrigued as to how it could reach the eggs, they approached and in the light from the headlights saw the adult leave and an immature kit come up from the nest, pass through the screen, and trot off after the adult. Presumably the kit was passing eggs up to the adult. On the basis of this observation, they began to protect the nests further with a smaller screen of finer mesh placed in the center of the large one. They also made a black & white movie film of the nesting event which is still available in Charleston.

At this time they successfully sought the guidance of Dr. John M. Dean of the Belle W. Baruch Institute of Marine Biology and Coastal Research, and based on their summer's efforts obtained a research grant from the National Science Foundation to support their further efforts [3]. During the summer of 1973 McKee and Talbert enlisted four more friends into the enterprise, and they received small stipends from the NSF grant. The study continued along the same lines as in 1972 but was enlarged to include the tagging of female turtles. Subsequent nesting returns by the tagged females were observed, and an attempt was made to estimate the nesting population of the rookery. To prevent the continuing loss of nests to raccoons, a hatchery was installed in 1973 which consisted of a wire enclosure located in the secondary dune field. Some of the nests were relocated there, and, as a control population, the rest were left as 'wild' nests.

In 1974 and 1975 an extensive environmental inventory of the island was sponsored by the Kuwait Investment Co. (Coastal Shores, Inc.) at the time of purchase of Kiawah Island for development. Among the many aspects of the natural environment that were evaluated was the loggerhead nesting on the beach. John Dean and Rhett Talbert were the logical ones to do that evaluation. Financially supported by funds for the environmental inventory, Rhett continued his ongoing studies. In 1974 both the hatchery-protected and wild nests were destroyed by extremely heavy rains that flooded Kiawah Island with an estimated 20 inches of rain in the first twenty days of August. Only nine monitored nests hatched that year. This destruction prompted a change in 1975 to a new "shed" hatchery. Eggs were packed in styrofoam coolers, stored in a shelter, and periodically moistened. Hatchlings were released above the high water mark at various locations on the beach in the evening within 24 hrs. of emergence from the sand, and it was concluded

that this was the most satisfactory protective measure for the future. The results of the 1972-75 study were reported in the Environmental Inventory of Kiawah Island in 1975 [1], and subsequently, in one of the scientific journals [4].

1976-1979

Then followed a period from 1976 through 1979 for which most records have been lost. What is clear is that the program continued with a hatchery for protection of the nests. The program was supported by the Kiawah Island Co. through the Kiawah Island Community Assoc. (KICA) and probably was operated for a short time by students from the University of South Carolina [5]. From 1977, the program was operated internally through KICA, and the change in management was marked by a shift in emphasis on program objectives. Hatchling production and resort guest and resident property owner education became the primary objectives. The tagging program was abandoned and nesting data collection was erratic [6]. It was during this period that the Federal Endangered Species Act included the loggerhead as a threatened species and the SCW&MR Dept. became involved in protection of this and other threatened or endangered species along the S.C. coast. However, the SCW&MR Dept. was not involved on Kiawah Island until about 1980 when it began issuing permits to operate the protective program. It was then that annual reports appeared on a regular basis, because this was one of the requirements for the permit.

1980-1985

Beyond 1980, annual reports have been preserved, and copies are available in the files of the Endangered Species Office of the Non-game & Heritage Trust Section of the SCW&MR Dept. The following comments for this period are from those reports. The 1982 season was a period of program reevaluation, and an emphasis was placed once again on data collection. Operations for the 1983 season reflected further changes with focus on three main objectives: 1) conservation of the species; 2) public education; and 3) comprehensive data collection [7]. In this period the program was directed by the KICA naturalist; at first this was Keith Kriet and later Sally Pruitt replaced Kieth. As an illustration of the scope of the operation at this time, the 1985 KICA budget allotted \$15,000 for the turtle program including salaries for four patrol and hatchery personnel.

The beach was patrolled throughout the night, and as has been customary every since that time no other vehicles were allowed access at night. Most of the nests were easily located because the patrol was present at the time eggs were laid. If the nest was concealed before the patrol arrived, attempts to locate it were made by digging with hands and if that failed by use of a shovel - interestingly enough the probe that we now rely upon so heavily was not employed.

About 80% of the nests were relocated to a hatchery (the maximum number possible under their State permit.) The reason a hatchery was used was that it seemed to be the best way to protect nests from predators and destructive conditions such as flooding and roots growing into the nests from beach vegetation. The hatchery was a 15'x40' structure built out of chickenwire, supported on untreated pine posts. The chickenwire excluded raccoons and a fine mesh screening installed about 18" below the ground and lining the inside of the hatchery walls to a height of 2-3 feet was intended to discourage ghost crabs. The hatchery location on a high spot in the secondary dunes was intended to protect from flooding as well as tidal overwash. By 1986, disadvantages of the hatchery were becoming apparent; the operation was very labor intensive, the structure needed to be relocated frequently in order to avoid accumulation of harmful fungi and other organisms in the sand, and there was the danger that the sex ratio might be altered by the temperature of the sand. It was at about this time that the SCW&MR Dept. also had misgiving about hatcheries as the preferred procedure. (Currently, SCW&MR Dept. permits hatcheries only when conditions are such that original locations on the beach would seriously threaten the survival of the eggs.) Nests not placed in the hatchery were left in place or relocated to a safer spot. These nests were left unprotected in some years and in other years, were protected with 3'x4' screens much like the ones we now employ. This was also a period of heavy losses of turtles to shrimp boat nets, before the time of TEDs. The peak appears to have been 1980 with 145 dead turtles washed ashore at Kiawah.

During the period of 1981-85 a public education program was initiated and vigorously pursued. The two components of the program were evening slide shows and patrol tours. For example, in 1983 the slide shows were presented twice each week throughout the summer to discuss the natural history of the loggerhead turtle and the nesting program on Kiawah. The tours with the night patrols were limited to the numbers that could be crammed into the patrol jeep and seem to have to have been quite popular (more than 200 persons participated in 1983).

1986-1988

We now come upon a dark period in the saga. The curtain began to come down in 1986 when the Kiawah Island Co. was primarily interested in selling the island and curtailed the program. William Botts, known to most people on the island as Buzz was the unsung hero at this time. Buzz directed the Jeep Safari operations and probably some of you encountered him as one of the most pleasant and knowledgeable of the guides. Buzz had participated in the

turtle program for several years and in 1986 he operated it with one other paid employee and Sally Pruitt [5]. Sally was working on the island for Ravenel Associates at the time and became the first to revive the volunteer spirit that had existed in the early years. She still is a volunteer, in fact our only off-island volunteer, but since her marriage she comes to us as Sally Robinson. In 1987 Buzz contracted to operate the turtle program for KICA, but it was abruptly cancelled a few days prior to the beginning of the nesting season and observations could not be made for another month. The reason was a budget "shortfall". Finally in mid-June operations began but under a very restricted scope because of the "shortfall". The hatchery was eliminated, as well as the lectures, night patrols were changed to once daily at dawn, and the personnel numbered two. Despite all these handicaps Buzz prevailed and a very creditable report was written for the last portion of the year.

In the beginning of 1988 and well before the nesting season, it was obvious that the protective program would not be operating. Buzz Botts was now living in Savannah, the beach gates were locked; no access was permitted. I went to Fort Johnson for a brief (2 hour) course in marine turtle nest management from Sally Murphy, the person in charge of marine turtle protection for the South Carolina coast. Returning with a permit to conduct the program, I did some arm twisting and came up with nine other "volunteers". (Names of volunteers are listed in the annual report for each year.) Most of these were members of the now defunct Committee for the Natural Environment and most had vehicles that could operate on the beach. However, it was not until the Fourth of July that I was able to obtain a key to the locked gate, so that half the season was lost. Our approach was simplistic to say the least. Our objectives were two; obtain a record of nesting crawls for the remainder of the season; and keep a record of strandings on the beach. Daily patrols were made at dawn. Each crawl was judged as false or nesting and if the latter, a small red flag numbered with the nest number was posted at the site. Location of the nest was measured in odometer mileage east or west of the Eugenia gate. Relocations were done for 4 nests that were in precarious locations. Little information was gathered on predation or tidal flooding; and because flags were removed or difficult to locate, no attempt was made to determine hatching success. However, a report was written and recommendations for the following year were made. We hoped we could recruit more volunteers, find financial support and accomplish the following: begin a public awareness program; relocate more nests; and inspect nests at hatching to judge efficacy of nest relocation and the magnitude of predation.

1989

The 1989 season began well. We persuaded KICA to provide the Comm. for the Natl. Environ. with a budget that included \$1600 for the turtle program. Further, we obtained the loan of a 4-wheel drive vehicle from Security for the summer. The vehicle, good old #510 to some, something less flattering for others, had seen better days and been subjected to too many uncaring drivers. The first thing all learned was never, never put on the emergency brake - otherwise a mechanic would need to free it. There were other minor peculiarities; often it refused to go into reverse; and always it refused to stay in 4-wheel drive unless the co-pilot held the shift in that position. With the season assured by all this material support we sought volunteers and our list jumped from the 10 of the previous year to 24 for 1989. Truly we felt that we had passed from the Dark Ages to the Renaissance (I sure hope no historian ever reads this!). Ruth Cusick attended the briefing session at Ft. Johnson so we would have two "experts" and as a first move toward diversification of responsibility, a committee of Bill Connellee, Ruth and I was formed to run the program for the season. Laminated notices of the existence of the turtle program and warnings against interference with the nesting in any way were prepared and placed at each public beach exit. This practice has been continued each year. Diamond shaped mileage markers were installed every one-quarter mile to map the beach and permit nest location. Patrols were conducted as formerly but potential nesting crawls were probed to locate the actual nest. Screen (3'x3') was installed over some nests at the eastern end where predation by raccoons was heaviest. Finally a fluorescent orange stake was placed near the nest and numbered with the nest number. Relocations were done for 13 nests that season. After the nesting terminated on August 13th, patrols were made weekly to inspect nests, report hatchings and raccoon predation and to remove plant growth from the top of nests. Hatching was not monitored in a systematic fashion but Turtle Hatching Alert sheets were drawn up listing nests, locations and probable dates of hatching. These were distributed to interested volunteers to make whatever inspections they wished. I had scheduled a little party on Sept. 28th for our volunteers to celebrate a good season, but Hurricane Hugo had other plans as it roared ashore on Sept 21st. Fortunately the hurricane did no harm to our beach so the turtles still in their nests remained undisturbed. In conclusion, 1989 was a learning year for all of us, and we felt optimistically that we could do a better job in 1990.

1990

This year we had the heady experience of being offered sponsorship by two organizations, KICA and the new Town of Kiawah Island. We chose to go with the Town of Kiawah Island and have not regretted it. The Town agreed to support the program with a budget of \$2500 from Accommodation Tax funds. Through the efforts of George Spaulding, a pickup truck was loaned to the program for the summer by the John Parker automobile dealership in Charleston. Our volunteers increased to 34 and everything looked fine. Up to this time, our objectives had been to catalog the number and location of nests, relocate some, and protect all as best we could. This comes under the heading of protection of the rookery and will always be the primary objective. However, we now felt sufficiently advanced to be able to share our experience and knowledge with others and so we took on a second objective of public education, and began a series of slide shows each Monday evening at the East Beach Conference Center. Bill Connellee collaborated with the Recreation Dept. of the Landmark organization in arranging the talks and gave most of the presentations. We increased our efforts to diminish lights shining on the beach by posting notices at regimes and individual mail-boxes. These efforts have continued but with spotty success, however the amount of potentially harmful lighting does not seem to be a major problem. ✓

Nest patrols operated essentially as before but our proficiency at locating nests by probing had now risen to 60%. A record number of 228 nests occurred this season. One cause of this large number of nests may have been the loss of nest sites to the north, between Winyah Bay and Bull's Island, as a result of the hurricane in September of 1989. However, another factor is the cyclic pattern of loggerhead turtle nesting, and 1990 appears to have been a peak year for most beaches of South Carolina. The time of incubation ranged from 53-67 days with an average of 57.5 days. This average is slightly less than the 60 day period generally accepted. Hatching was monitored extensively and we dug 75% of the marked nests for post-hatching analysis. The nesting success was 77%, which was good in consideration of the total destruction of 18 nests by raccoons and partial destruction of 20 others. A brief attempt was made to remove raccoons by trapping. The animals were easily caught, but trapping was terminated after five had been taken because of the unhappiness of some volunteers and the realization that very large numbers would need to be removed in order to be effective. It was realized after analysis of the data that more drastic protective measures would be needed in the next season to decrease these losses. ✓ *fred*

An amusing event in the midst of the season was the turtle that became disoriented and ended up touring the Ryder Cup golf course then under construction. In the morning we could see her track weaving over sand dunes that looked like a movie set for the Sahara desert. We tracked her to the large lagoon between what are now the 15th and 16th holes. She showed no inclination to come out except to lay her eggs on the "fairway" after a few days. The course designer, Pete Dye, and I relocated the nest on the beach, but early attempts by Sally Murphy and other staff of the SCW&MR Dept. failed to catch her. A similar situation had occurred a few years earlier at Fripp Island, and that turtle, which acquired the name Tootsie, was not returned to the ocean until she was rendered sluggish by cold weather in late fall. Our turtle received the name Tootsie Too, and she remained in the lagoon until a full-scale attack by scuba divers in the fall drove her into a net. Then back to the ocean she rode in the back of a pick-up truck.

The 1990 season ended on October 12th because heavy rains soaked the beach and high tides pushed up the beach by strong off-shore winds flooded the last three nests. If the storm had occurred a month earlier, the loss of nests would have been catastrophic. This illustrates that success of the rookery is not totally in the hands of man; there are threats beyond our control and against which our efforts are futile.

1991

Again in 1991 the program was supported by the Town of Kiawah Island. In addition to a generous budget, the Town purchased a new pickup truck for our program - it was so beautiful we were almost afraid to take it out on the beach! Ruth Cusick dropped out of the organizing committee because of other commitments and was replaced by George Walther. The nesting patrol continued in the same general fashion, and we became even more proficient at probing nests with a success rate of 80%. Monitoring of hatching was greatly improved this year, and 162 of the 176 marked nests were dug after hatching. The average hatching period of 57.9 days was remarkably similar to the 57.5 days reported for 1990. Predation by raccoons at the beginning of the season was heavy and foxes too were raiding on a significant scale. We began using larger screens, 4'x4' in place of the smaller one of 3'x3', and routinely placed a finer mesh screen in the center (doubled screened). This plus the installation of an electrified fence at nests already partially destroyed drastically decreased the predation. In hindsight, the lesser amount of predation encountered in 1988-9 was probably the consequence of a viral plague that swept through the raccoon population on the island in 1987-8 and decimated the population. As the population built back up

in 1990-1, predation became a real problem as is generally true for rookeries without effective protection. The predation by foxes is more unusual, probably because the species does not occur on most beaches. There was exceptionally heavy rainfall in the summer of 1991 which promoted heavy vegetation of the foredunes. This was enhanced at the east end of the island by sprigging of the dunes with American beach grass and watering all along the new Ocean golf course in an effort to stabilize the sand and keep it from blowing onto the course. Again in hindsight as we analyzed the data, we realized that we had lost quite a number of nests to flooding and to plant roots growing into the nests and robbing the eggs of moisture. The nest success rate was down to 49% as compared to 77% the previous year. More and more the fact is thrust upon us that our beach is not static and that we will always need to be vigilant to counteract changes and the problems they create. One that certainly will need to be addressed in the future is the greater utilization of the beach, both by residents and by visitors. This will probably lead to more boats, chairs, cabanas and other structures left on the beach at night to serve as obstacles to the passage both of the adult turtles and the hatchlings. Another problem is the decreased area of beach suitable for nesting. This area lies between the wrack-line below which flooding occurs and the zone of heavy vegetation above which there is destruction of eggs from plant roots. In the past few years of plentiful rainfall, the suitable area has decreased markedly; however, it is quite possible that this may correct itself with a year or two of drought.

This year marked the beginning of a new undertaking; special studies of problems of the kind just mentioned and directed toward increasing our general knowledge of the loggerhead as a species. This then is a fourth major aspect of the program in addition to the earlier ones of 1) protection of nests, 2) accumulation of comprehensive data, and 3) public education. These special studies not only add value to the program but also provide stimulating interest for some of the volunteers. Three of these studies were reported in the 1991 annual report: design of electrified fencing to repel predators; determination of the water table at spring tides; and plants capable of extending roots into nests. (The first of these, on electrified fencing, was reported at the 1992 Workshop on Sea Turtle Biology and Conservation at Jekyll Island, Ga.) A party to celebrate the year was held at the property-owners pool and this time no storm intruded to mar a happy evening.

1992

The 1992 season began with continued support by the Town of Kiawah Island, and our volunteers had by now risen to 79 members. In continuation of my efforts to diffuse responsibility and increase the sense of participation, the operating committee was increased to five by the return of Ruth Cusick and the addition of Jack Hamilton as a new member. Further, the nest patrol period was divided between three teams, each of which operated independently, although under the same general guidelines. A fourth team run by George and Kay Walther monitored the hatching and the post-hatching evaluation. To circumvent the mistakes of past years in terms of judgement of safe locations for nests near the tide line, white stakes are placed each 0.1 mile along the beach and several yards above the wrack-line of the highest tides that prevailed in April. It was decided to relocate all nests that were laid below that level, because inspection of the nesting success of previous years had indicated that nests below the wrack-line were destroyed by flooding while those at and above that line were safe. It was anticipated that a great number of nests would need to be relocated but that it would be worth the effort if the loss by flooding seen in previous years was eliminated. Also, to diminish loss by predation by foxes and raccoons, it was decided to double screen all nests on the beach at the time they were located and marked. This turned out to be very effective and virtually eliminated predation other than the few nests that the predator found before the Patrol arrived.

Public relations were strongly emphasized both with the formal lectures and the many discussions with interested people on the beach. In order to bring all the volunteers to a knowledgeable level for these latter question & answer sessions, a Natural History of the Loggerhead Turtle was written with emphasis on the local Kiawah Island circumstances and distributed to all volunteers. Favorable publicity of our program, although not aggressively promoted, has occurred over the years with articles in the Charleston newspaper, the local Islands magazine, Conte' Nast Traveler magazine, and for the past three years on one or another of the local TV stations. Members of the operating committee attended a workshop at Ft. Johnson in the spring to meet participants of other programs in the State and exchange ideas. In addition, four of the volunteers attended an international Workshop at Jekyll Island, as mentioned earlier.

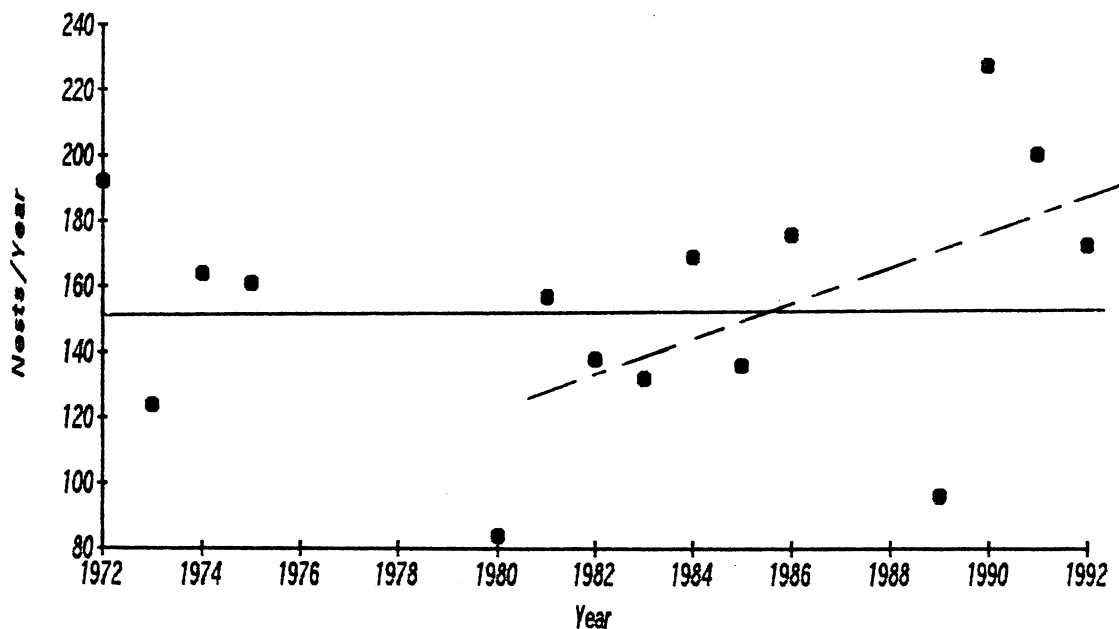
Research studies continued in several areas. The study of changes in the water table at various tide levels was continued from last year. A new study was begun on the temperature within the nest during the incubation period and relative to the changes in beach temperature from May

through October. These temperature studies are pertinent both for the length of the incubation period and for the sex ratio of the hatchlings. Finally, a very exploratory study was begun on the feasibility of identifying the nesting turtle by the unique pattern of crawl marks. This year, the study was limited to accumulation of photographs of various crawls and an attempt to classify patterns.

Some General Characteristics of the Rookery.

The number of nests/year at the Kiawah rookery has varied as is typical of rookeries along the Carolina coast. Data of the Kiawah rookery for years with reliable values from available reports are given in Figure I. Comparison of the datum points with the solid line representing the average value of 154 nests/year for 1972-92 or the dashed line as a best fit to the data in the 1980-92 interval suggest that nests on our beach have increased in the past few years. (The 1989 season was one of very low nesting numbers for South Carolina so that the low value of 96 nests on Kiawah was to be expected.)

Figure I
Turtle Nests on Kiawah Island



The distribution of nests on Kiawah is quite variable between adjacent zones along the beach and somewhat variable between seasons. The variability between zones may be as much as ten-fold between adjacent 0.2 mile zones. These variations do not seem to relate to lighting or buildings,

except for a consistently low nesting in front of the Inn. Perhaps channels between off-shore sandbars tend to lead the female turtles onto the sections of beach, most heavily nested, and these channels may change from year to year. Variation between seasons can be shown by a comparison of the percentages of nests at arbitrarily subdivided segments of the beach. For the purpose of the comparison, the beach was quartered into 0 to 2 mile, 2 to 4 mile, 4 to 6 mile and 6 to 8 mile as measured from the first nesting region at the west end, and values are given for the years in which distribution of the nests were reported.

Distribution of Nests Along the Beach

Year	0-2 mile	2-4 mile	4-6 mile	6-8 mile
1992	24%	28%	27%	20%
1991	21%	20%	23%	36%
1990	17%	29%	22%	32%
1989	13%	27%	21%	38%
1982	25%	27%	27%	21%
1980	32%	20%	26%	22%
1975	18%	24%	27%	32%

The lower value of 20% in the 6-8 mile zone for 1992 probably is the result of a large sandbar moving down off-shore at the east end and blocking the approach of turtles. Otherwise the distribution has been fairly constant in the period 1989-92 and resembles the situation in 1975. The distribution in 1980 and 1982 was more uniform over the entire beach; unfortunately data were not reported for other years.

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Heyward Robinson, resident of Charleston.
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