

1988 MARINE TURTLE NESTS
SCREENING PROJECT AT
CANAVERAL NATIONAL SEASHORE,
FLORIDA

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ABSTRACT

Canaveral National Seashore, Florida, is one of the most important federally-protected nesting beaches for threatened and endangered marine turtles. The 23.25 miles of beach lacks urban development, artificial lights and other intrusions of twentieth century man. In 1988, 2203 threatened loggerhead (Caretta caretta), 43 green turtle (Chelonia mydas) and 4 nests of undetermined species were deposited on the beach.

In 1988, Canaveral National Seashore completed the fifth year of a project to enhance marine turtle nests success by placing wire screens over freshly deposited nests. These screens attempt to prevent raccoons (Procyon lotor) from depredating the turtle eggs. Rangers, working in pre-dawn hours, placed screens over 887 turtle nests or 39.4 percent of the total 2250 nests deposited.

Of the screened loggerhead nests, 645 hatched successfully. An additional 24 nests that were not screened hatched, according to estimates calculated from previous years data collection. The 669 successful loggerhead nests represent an overall nesting success of 30.4 percent. This nesting success falls well below the recommendation of the Marine Turtle Recovery Plan's (Hopkins and Richardson, 1984) goal of 50 percent nesting success. Twenty green nests were successful. This represents a 46.5 percent nesting success.

Raccoons were the major predator on both turtle eggs and emergent hatchlings, destroying over 1442 nests and an unknown number of emergent hatchlings. Minor depredation was caused by humans (who depredated/poached at least one nest), ants and ghost crabs.

The concept of placing wire screens over newly deposited turtle nests was hoped to provide an economical and effective method to enhance turtle hatchling production. The five years of screening and data collection on nest success have indicated that raccoons have altered their foraging periods to coincide with nests deposition and have become adept at tunnelling under the screens to gain access to the eggs. Screening, on the scale necessary at Canaveral National Seashore, is not an effective technique to meet the recommended goals of the Recovery Plan. Alternative methods of nesting enhancement, including raccoon reduction, should be implemented in light of the five years of data now available.

INTRODUCTION

Canaveral National Seashore is a major nesting rookery for threatened and endangered marine turtles. Approximately 2000 threatened loggerhead (Caretta caretta) nests are deposited annually on the 23.25 miles of beach on the central east coast of Florida. The federally-owned beach is without major development so common throughout coastal Florida and its importance to turtle nesting will surely increase as development pressures increase in neighboring coastal communities. A small, but important number of endangered green turtles (Chelonia mydas) also nest on the sandy beach of Canaveral National Seashore. Occasionally, leatherback turtles (Dermochelys coriacea) and hawksbill turtles (Ertmochelys imbricata) nest on the beach as well.

In the early 1980s, the National Park Service recognized that raccoons (Procyon lotor) were depredating a large percentage of the marine turtle nests. The University of Georgia was contracted to document the turtle nesting density and the raccoon depredation upon turtle nests. The contract also required the University to determine a method to increase turtle production without relocating turtle nests or the removal of raccoons. The non-removal of raccoons stipulation was in consideration of National Park Service policy concerning the management of native species (raccoons are a native species at the Seashore).

Researchers from the University of Georgia documented that approximately 95 to 99 percent of the turtle nests deposited at Canaveral National Seashore were depredated by raccoons (McMurtray, 1986). The researchers experimented with numerous techniques to discourage raccoon depredation of nests and determined that a flat wire screen placed over the turtle nests was an effective method to exclude raccoons. The researchers cautioned that screening was a method which raccoons might learn to subvert (McMurtray, 1986).

In 1984, park rangers, in a pilot program, started placing wire screens over turtle nests. The initial results were encouraging and in 1985 the program was expanded to cover the entire length of the Seashore seven days per week. That year approximately 30 percent of the turtle nests hatched successfully. In 1986, over 46 percent of the nests were successful. In 1987, the hatching success fell to 40 percent as raccoons became more aggressive in their foraging behavior.

In 1988, ranger patrols were conducted to again document turtle nesting, raccoon depredation rates and nesting/hatching success.

STUDY SITE AND METHODS

Canaveral National Seashore straddles the Brevard/Volusia County line on the east coast of Florida. Bounded on the north by Bethune Beach and the south by the Kennedy Space Center Security Zone, the 23.25 miles of beach is all federally-owned. There is little development and few artificial lights. The beach is closed to the public from sunset to sunrise, except for occasional ranger-guided turtle watch programs.

Starting May 2, rangers patrolled the beach daily, weather and NASA security permitting. The 4:00 a.m. starting time was selected so that only one pass down the beach was necessary to collect all data and screen all non-depredated nests from the previous night. If a turtle nest was undisturbed upon initial examination, rangers placed a 4 feet x 4 feet wire mesh screen over the nests. The 2 inches x 4 inches mesh size allowed emerging hatchlings to pass through the screen while preventing raccoons from reaching the eggs. The screen was left in place until the nest hatched or was tunnelled into by a raccoon.

Screening of loggerhead nests ceased on August 7. Screening of green turtle nests, data collection on raccoon depredation, turtle nests hatching and emergence continued daily until September 30. The beach was monitored until the outcome of all screened nests was determined. Hatching and emergence were determined either by the visual presence of hatchling tracks or the nest cavities were excavated after 65 days of incubation time.

Full details of survey and screening methods are detailed in Bryant (1986a and 1986b).

RESULTS FOR 1988

Nesting

Table 1 shows the number of turtle nests and false crawls by species.

TABLE 1 Turtle Nests and False Crawls. 1988.
 Canaveral National Seashore

<u>Species</u>	<u>Nests</u>	<u>False Crawls</u>
Loggerhead	2203	2343
Green	43	37
Undetermined Species	<u>4</u>	<u>5</u>
Total	2250	2385

The false crawls-to-nests ratio is 1:1.06. The mean nesting density is 96.8 nests per mile or 60.1 nests per kilometer.

Predators

Raccoons were the main predators. Ants, ghost crabs and humans destroyed a minor number of nests. In at least two instances, ants (species unknown) damaged eggs in a clutch. It is unknown if the clutches had been previously disturbed by ghost crabs. Ghost crabs (*Ocypode quadrata*) were present in numerous depredated turtle nests. In at least 12 cases, ghost crabs were present where there were no signs of raccoons. Ghost crabs damaged few eggs and the nests hatched successfully. In many cases, depredated nests had visual signs of both raccoons and ghost crabs. It is unknown which was the cause of the initial depredation, but based on the extent of the destruction, it is felt that raccoons were the major offenders. If an egg clutch was depredated and signs of raccoons were visible (a major hole was dug into the clutch), the nest was considered to have been depredated by raccoons regardless of the presence of ghost crab sign. It is felt that ghost crabs were opportunistic feeders on the breached egg cavity.

Humans poached at least one nest, located near the north boundary of the Seashore. Humans also removed numerous nests markers and hence, we were unable to determine the outcome of 19 nests.

Nest Depredation Rates

Nests depredation rates were calculated by recording the number of fresh nests that were depredated by raccoons upon the arrival of the rangers. Provancha and Provancha (1985) refer to this as the twelve hour predation rate since they conducted beach surveys the following morning within twelve hours of nests deposition. The mean twelve hour depredation rate was 57.2 percent. Raccoons destroyed 1276 nests (56.7 percent) and partially depredated 11 (0.5 percent) additional nests. These partially depredated nests were cleaned, reburied and screened and 10 of them hatched successfully.

Nests Screening

Rangers placed wire screens over 887 turtle nests. This represents 39.4 percent of the nests deposited. The 861 loggerhead nests screened included 11 nests that had been partially depredated by raccoons. Green turtles accounted for 24 of the screened nests. Two of the nests screened were of undetermined species.

Table 2 summarizes the initial action taken on the 2250 nests.

TABLE 2 Turtle Nest Action Upon Initial Encounter, 1988
Canaveral National Seashore

Action	<u>Loggerhead</u>	<u>Green</u>	<u>Undetermined Species</u>
Nests Screened	850	24	2
Nests Depredated, Screened	11	0	0
Nests Depredated, No Action	1256	18	2
Not Depredated, Not Screened	<u>86</u>	<u>1</u>	<u>0</u>
Total	2203	43	4

Depredation of Screened Nests

Raccoons became highly adept at tunnelling under the wire screens. A total of 166 screened nests were destroyed by raccoons. These destroyed nests accounted for 18.7 percent of the screened nests. Screening techniques were not altered from previous years.

Outcome of Screened Nests

Of the 887 screened nests, 665 hatched and emerged successfully. Table 3 gives the outcome of the screened loggerhead nests. Table 4 gives the outcome for the screened green nests. The two nests of undetermined species are not included in the charts (one was tunneled into by raccoons and the second could not be relocated).

TABLE 3 Outcome of Screened Loggerhead Nests, 1988
 Canaveral National Seashore

<u>Outcome</u>	<u>Number</u>	<u>Percentage</u>
Hatched	645	74.9
Destroyed by raccoons	162	18.8
Lost to erosion	23	2.7
Unable to relocate	19	2.2
Did not hatch	12	1.4
Total Nests Screened	861	100.0

TABLE 4 Outcome of Screened Green Nests, 1988
 Canaveral National Seashore

<u>Outcome</u>	<u>Number</u>	<u>Percentage</u>
Hatched	20	83.3
Destroyed by raccoons	3	12.5
Unable to relocate	1	4.2
Total	24	100.0

Outcome of Unscreened Loggerhead Nests

After the screening of loggerhead nests ceased on August 7, an additional 190 loggerhead nests were deposited. The outcome of these nests is unknown. Using data from the 1986 Canaveral National Seashore Turtle Project (Bryant, 1986b), it can be estimated that 12.5 percent or 24 of these loggerhead nests hatched.

Hatching Success

The total of 645 hatched loggerhead screened nests and the estimate of 24 hatched unscreened nests, gives a total of 669 successful loggerhead nests. For 1988 at Canaveral National Seashore, 30.4 percent of the loggerhead nests deposited hatched successfully.

Twenty green nests hatched successfully. This represents a nesting success of 46.5 percent.

Disorientation Due to Artificial Lighting

No hatchling disorientation was observed from any of the emerging nests at Canaveral National Seashore. Launch Complex 39B at the Kennedy Space Center was illuminated for most of the nesting/emergence season, but none of the lights from this area shined directly on the beach front.

Excavation Of Nests

A random sampling of 29 loggerhead turtle nests that were observed to emerge were excavated in order to determine mean clutch size and mean nest success ("hatchability"). The excavations were distributed throughout the season. Counts were made of hatched and unhatched eggs. Any live hatchlings encountered in the nest cavities were released, but for statistical purposes were considered unhatched eggs since the purpose of the excavations were to determine the mean number of hatchlings emerging from nests.

The mean clutch size was 108 eggs ($N=29$, range: 61-158, $S.D.=23.9$). This figure is not statistically different ($\text{Alpha} = .05$) from the mean clutch size determined in 1986 of 111 eggs.

The mean number of hatched eggs (= emerged hatchlings) was 89.9 per undisturbed egg cavity ($N=29$, range: 39-148, $S.D.=40.0$). Hatchability, the natural hatching success, of undisturbed nests was 83.3 percent (mean number of hatched eggs divided by mean clutch size).

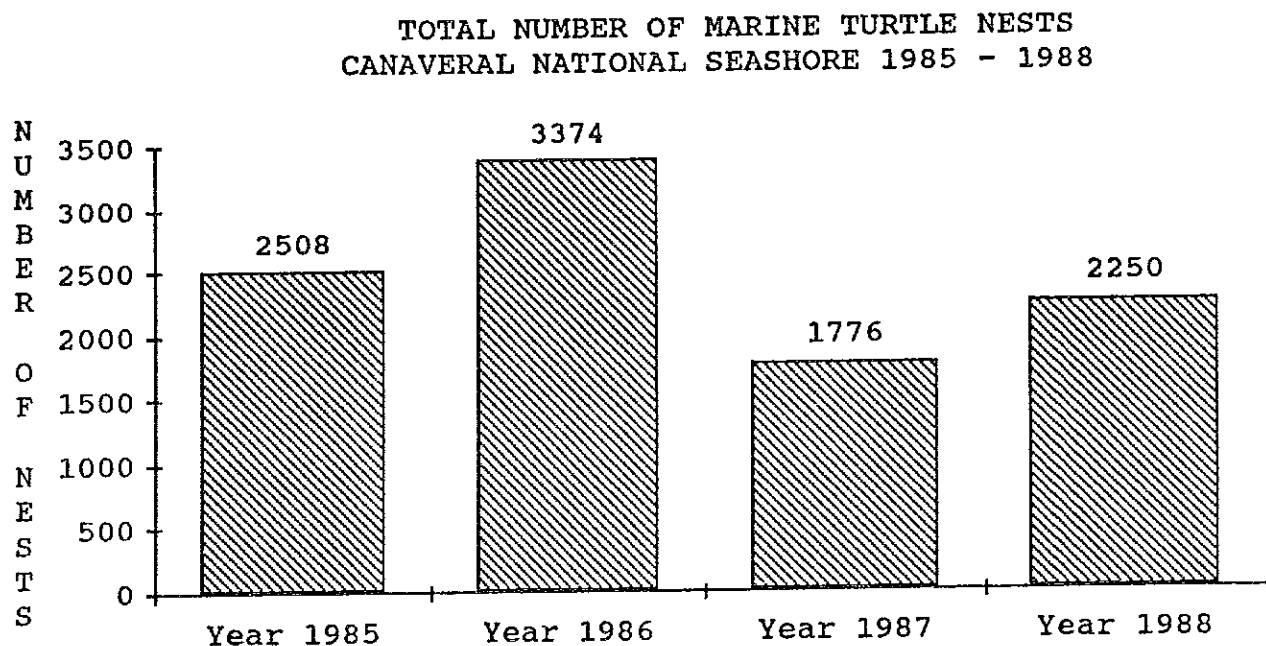
Using the mean number of emerging hatchlings from undisturbed nests (89.9) multiplied by the number of successful loggerhead nests (669) equals an estimated 60,143 hatchlings emerged from nests at Canaveral National Seashore. The number of hatchlings to actually enter the water is unknown since no attempts were made to quantify the number of hatchlings depredated by raccoons or ghost crabs.

SUMMARY OF DATA, 1984-1988, AND DISCUSSION

Yearly Nesting Totals

The number of marine turtle nests at Canaveral National Seashore has varied considerable from year to year. Chart 1 shows the number of nests per year for the last four years where data are available for the entire length of the Seashore. No attempt has been made to compare the yearly variation with other nesting beaches along the Atlantic coast.

CHART 1

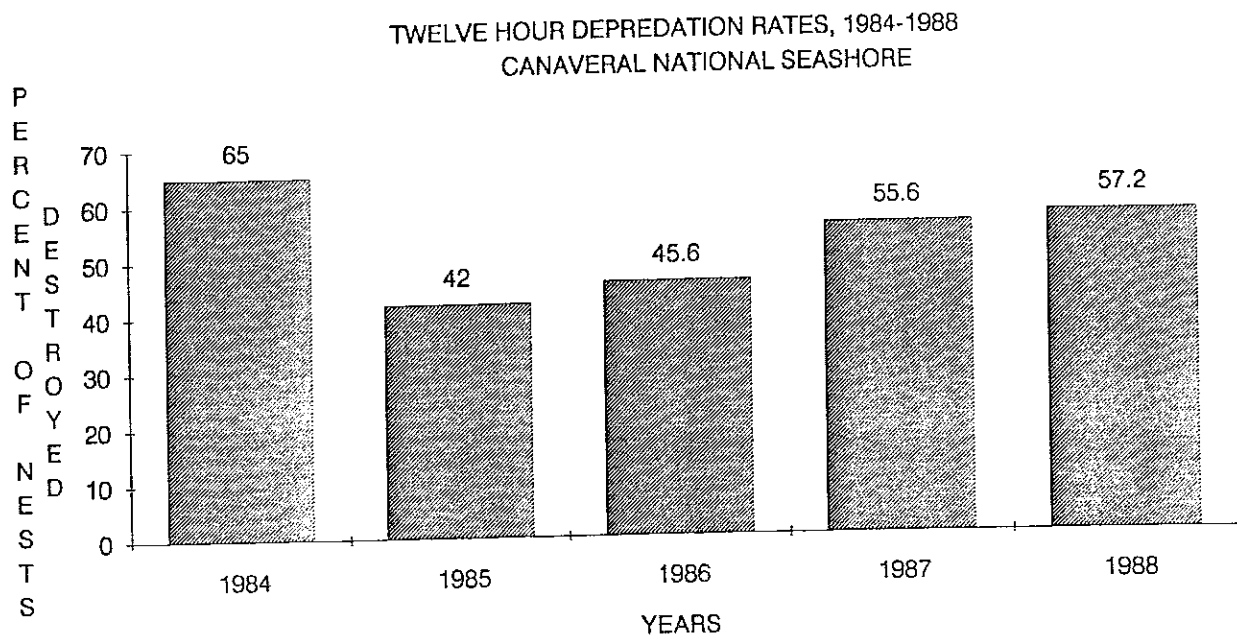


Depredation Rates

When the screening program was first started in 1984, it was hoped that the screens would cause raccoons to alter their foraging behavior to exclude turtle eggs. Instead of the raccoons shifting their food gathering to items other than turtle eggs, the raccoons continued to concentrate on turtle eggs and became more aggressive in their tunnelling under the screens. Chart 2 shows the twelve-hour depredation rates for 1984-1988. These figures indicate the number of nests that were already destroyed upon arrival of the rangers. Approximately one half the nests are depredated upon arrival of the rangers regardless of the hours of ranger operation (starting at midnight in 1987 and

at 4:00 a.m. in 1985, 1986 and 1988). Even if rangers placed screens on every undisturbed nests, Canaveral National Seashore would be unable to meet the 50 percent nesting success goal as established by the Marine Turtle Recovery Plan. The increase in twelve-hour depredation rates in 1987 and 1988 reflect the more aggressive foraging behavior of raccoons.

CHART 2

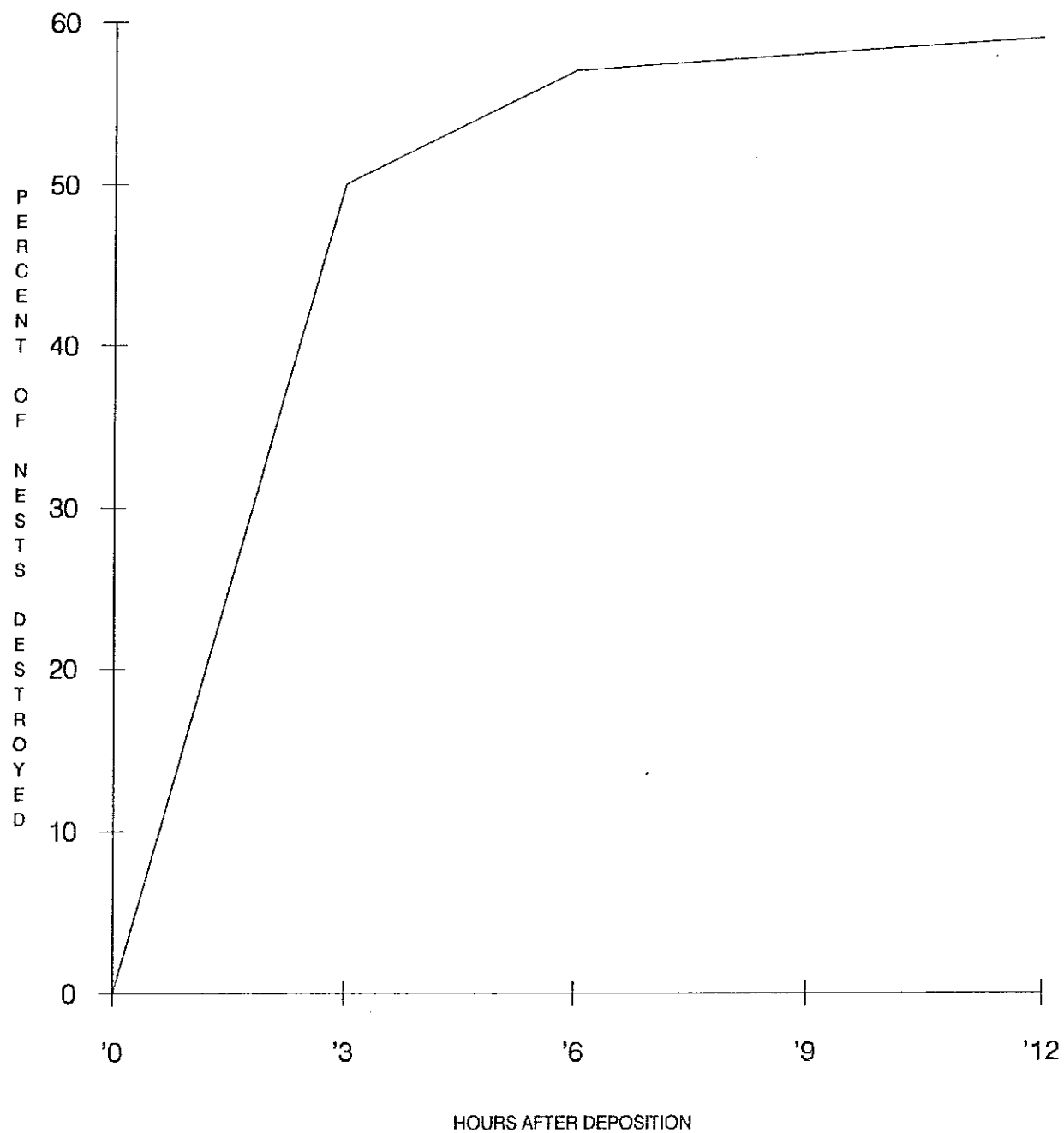


Conceptual Model Of Raccoon Depredation

Chart 3 gives an estimation, based on field observations, of the depredation of newly deposited turtle nests by raccoons. Most of the depredation occurs within three hours of nests deposition. Raccoons were observed to be eating turtle eggs during deposition. In numerous cases, destroyed eggs shells would be found beside a nesting cavity that appeared to be covered by the nesting female turtle and the egg cavity not breached. This indicates that the raccoons devoured eggs during deposition and departed the area prior to the nesting female covering the eggs. This model suggests that in order to screen a higher percentage of nests than has been accomplished in previous years, it will be necessary to increase the number of rangers so that a smaller amount of time will elapse between egg deposition and the arrival of the ranger. Datum indicates that once a nests is screened, it stands a good chance (75%) of hatching successfully. An alternative method would be to maintain the current screening effort and to decrease the raccoon population.

CHART 3

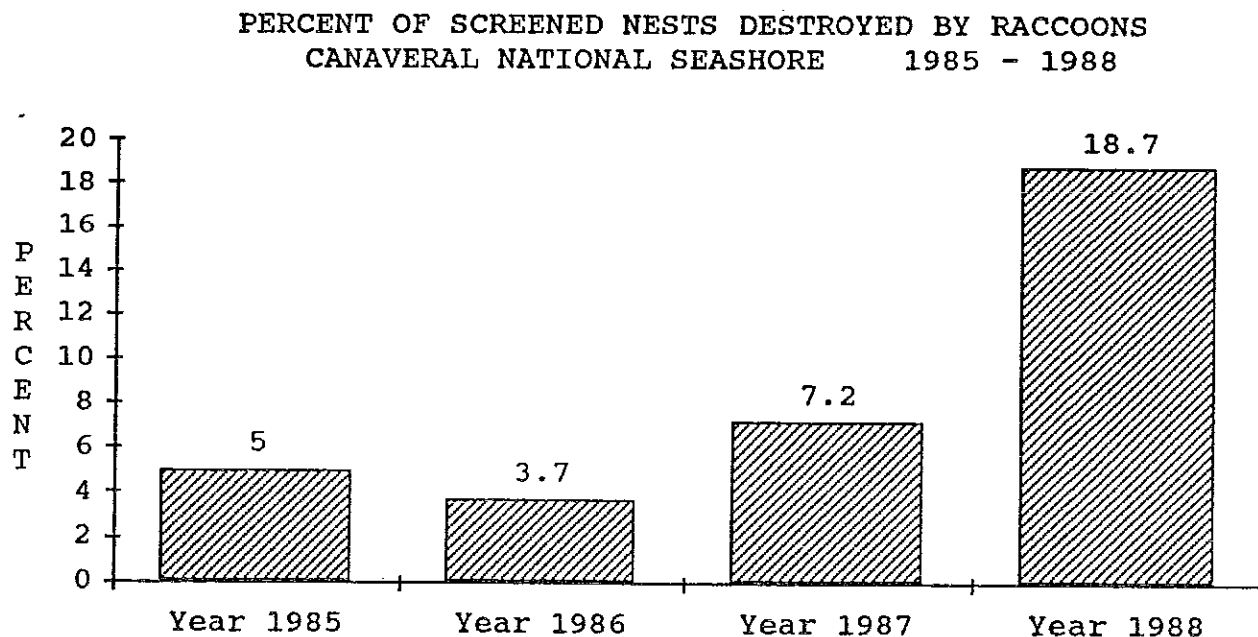
CONCEPTUAL MODEL OF RACCOON
DEPREDAATION BY HOURS AFTER
NESTS DEPOSITION



Tunnelling Behavior Of Raccoons

Since 1986, the raccoons have destroyed a higher percentage of screened nests every year. This ability to defeat the screens could be a learned ability, one that raccoons may learn from observing knowledgeable raccoons. However the tunnelling behavior was observed throughout the Seashore and not just in isolated pockets. This precludes a simple solution of eliminating only a few raccoons who have discovered the technique of tunnelling. Chart 4 shows the percentage of screened nests destroyed by raccoons for the previous four years. Note that the percentage of nests tunneled into nearly double from 1986 to 1987 and more than doubled from 1987 to 1988. If this trend should continue, it could make the screening of nests non-viable as a method to enhance hatchling production, regardless of how many nests were initially screened.

CHART 4

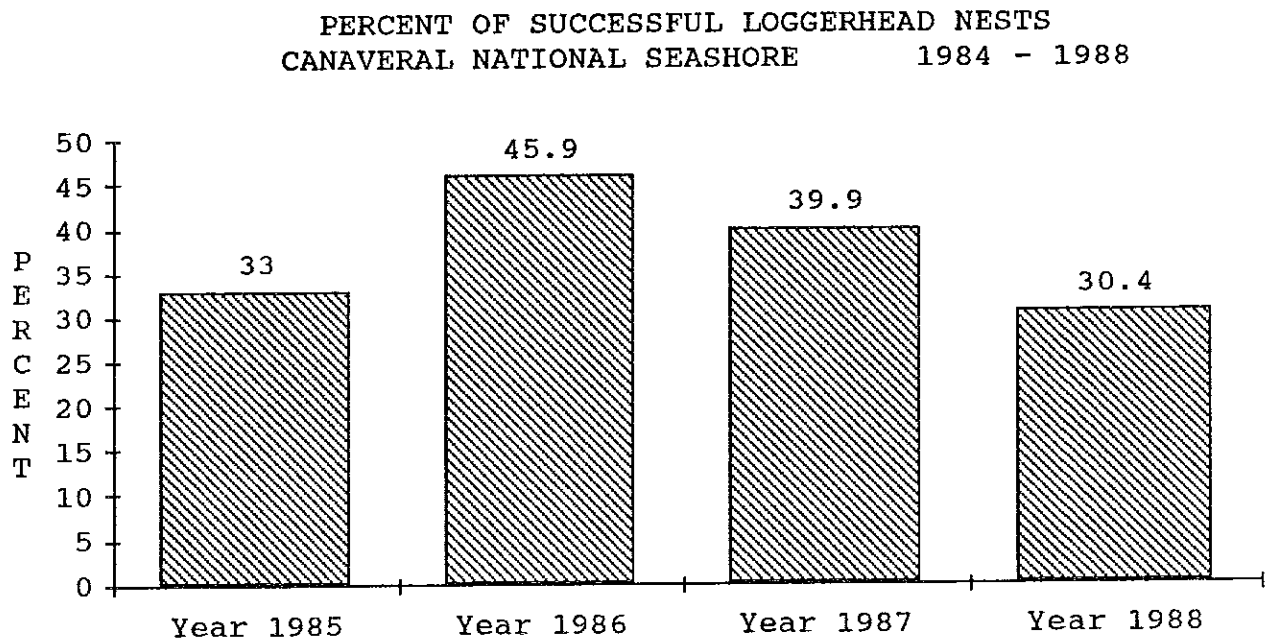


Nesting Success

Chart 5 gives the percent of loggerhead nests that were deposited at Canaveral National Seashore that hatched and emerged successfully. Note that the percent of successful nests has declined for the previous two years. In both 1987 and 1988, few

nests were lost to erosion. There were no early tropical storms that could potentially destroy a large percentage of nests. In 1988 virtually all the nests that did not hatch were destroyed by raccoons. Less than three percent of the nests were lost to factors other than raccoons. Approximately 30 percent of the nests hatched and the remaining 67 percent were destroyed by raccoons.

CHART 5



As tunnelling under screens by raccoons increases, the nesting success falls even lower than hoped. Clearly a nesting success of 30.6 percent indicates that nests screening is not a viable alternative for Canaveral National Seashore given the length of the beach, the number of raccoons and the number of rangers.

One parameter that is not measured by the data gathering techniques currently in use is the number of emergent hatchlings depredated by raccoons. Even though 30.4 percent of the nests hatched successfully, a large number of the emergent hatchlings could be destroyed by the large raccoon population on the beach.

Alternative Methods Of Nests Enhancement

The current technique of screening nests using four to seven rangers is clearly not effective in achieving the minimum goals of nesting success that the National Park Service should adhere to.

The National Park Service should at this time seriously explore other methods to enhance turtle nests success. Both the Kennedy Space Center and Cape Canaveral Air Force Station have implemented a raccoon reduction program with great success. The Kennedy Space Center has probably the highest nesting success in the county thanks to a raccoon removal program.

The importance of the rookery at Canaveral National Seashore will increase as the beaches in Florida experience increased pressure for population and development growth.

ACKNOWLEDGEMENTS

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