Sea Turtle Management – A Common Sense Approach for the Cape Hatteras Seashore Recreational Area

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FRONT COVER

“When we look up and down the ocean fronts of America, we find that everywhere they are passing behind the fences of private ownership. The people can no longer get to the ocean. When we have reached the point that a nation of 125 million people cannot set foot upon the thousands of miles of beaches that border the Atlantic and Pacific Oceans, except by permission of those who monopolize the ocean front, then I say it is the prerogative and the duty of the Federal and State Governments to step in and acquire, not a swimming beach here and there, but solid blocks of ocean front hundreds of miles in length. Call this ocean front a national park, or a national seashore, or a state park or anything you please—I say that the people have a right to a fair share of it.”

Secretary of the Interior Harold Ickes, 1938

The Loggerhead Recovery Plan covers treatment of these sea turtles for their entire breeding area and yet many differences in treatment occur. CHNS seemingly has the **most protective** sea turtle policy resulting in the **most restrictive public access** and the **poorest results** in their breeding area. It is all well and good to have loggerhead sea turtles recover without manipulation by man except that at CHNS man has changed the coastal environment (by man-made dunes) and such an approach does not work as evidenced by historically poor results (loss of 43.5% of nests). CHNS lies in the area where the Northern Recovery Unit population of loggerhead sea turtles breed and consists of an area from the Florida-Georgia border through southern Virginia. The number one listed "Recovery Objective" listed in the 2009 plan is "Ensure the number of nests in each recovery unit is increasing and this increase corresponds to an increase in the number of nesting females. " Policy under the same Recovery Plan vary so widely that in 2009 CHNS's percentage of nests lost was nearly three times that of SC and GA.

COALITION FOR BEACH ACCESS
SEA TURTLE MANAGEMENT PLAN

I. INTRODUCTION

It should be a simple matter to prepare a sea turtle management plan for Cape Hatteras National Seashore Recreational Area (CHNSRA). By use of the best available science; i.e., the data and information that has been gathered from the CHNSRA beaches, analysis could be made as to our success and failure compared to other coastal programs and estimate our potential to protect sea turtles. In other words, what works and what does not work at CHNSRA. This proposal will do that very thing.

A. NCWRC(North Carolina Wildlife Resources Commission)

Each state has a similar body that regulates wildlife protection including ESA management—guided by the USFWS. The NCWRC issues the permit and a handbook which CHNSRA uses to operate its turtle program. The least manipulative policy is used with relocation of nests prohibited, except for a few conditions.

This has been the basis for CHNSRA turtle management in the past and continues in the DEIS.

B. USFWS Loggerhead Recovery Plan.[1]

This document is about 300 pages long. Since 90% of the loggerhead nests occur in Florida much of the information and protocols are based on experience in that state. Some of the more pertinent recommendations are listed:

1. Use only the least manipulative methods to protect nests. Minimize relocation.
2. Use only scientific nest management based on:
   a. Nest productivity
   b. Hatchling fitness
   c. Sex ratio

[1] *Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle, Second Revision*

3. Relocate only if
   a. Low on beach to be washed daily by tides
   b. Laid in well documented areas that routinely experience serious erosion (river mouth or beneath eroding sea walls)
4. Storms are unpredictable. Do not move from areas threatened by storms.
5. Do not use hatcheries (this would include corrals) since they concentrate eggs and makes them susceptible to catastrophic events and predation.
6. No night vehicle driving on beach.
7. At any time: vehicle tires must not exceed 10psi impact on sand (based on ATV tire loading).
8. Linear extent of beach driving does not exceed the levels of 2006.
9. Night speed limit of 5 mph for essential vehicles except for emergencies.

The basic premises that guide USFWS in their Recovery Plan have been:

1. Loggerhead population has declined and has been listed as "threatened" under the ESA. There is an effort to upgrade this to an "endangered" classification similar to the Kemp's Ridley and Leatherback.
2. The decline is attributed to human activities such as disturbance, poaching, fisheries by catch, and destruction of natural habitat.
3. The preferred beach management is to allow natural nesting. Regulators claim natural conditions which produce physical stress will contribute to a more robust species. Other than restoring pristine habitat, mankind should keep "hands off". The doctrine of "least manipulated management" has been the backbone of agency framework on turtle policy since the first loggerhead Recovery Plan of 1996. Using such procedures, CHNSRA has consistently lost 40% to 50% of its nests every year to tides and weather on its violent beaches. (Fig. #1)
4. Orrin Pilkey has frequently commented on this violence: "Outer Banks beaches have the highest wave energy on the United States East Coast and also are subject to frequent nor'easters and hurricanes". Orrin H. Pilkey, The Virginian Pilot of January 3, 2010. AND "Oregon Inlet, which separates Hatteras Island from the northern Outer Banks, is one of the most dynamic and energetic inlets on the East Coast". "The North Carolina Shore and its Islands" by Orrin H. Pilkey et al, page 150.

Complaints against human activities observed in Florida and elsewhere have been entered into the USFWS Turtle Recovery Plan to be applied in CHNSRA—where on the ground history here does not warrant these changes.

FIGURE #1
RELATIVE RANKING TURTLE LOSSES
FOR CHNSRA

PROCEDURE	RANKING OF DETRIMENTAL EFFORT	
Natural Process	Highest	50% LOSS
Relocation on same beach	↓	↓
Large enclosures	↓	↓
Wide “U” silt fencing 50-75 ft	↓	↓
Village lighting	↓	↓
Keyhole light shields 1 ft wide	↓	↓
Volunteer nest sitters	↓	↓
Partial relocation – behind dunes	↓	↓
Back Bay cages	↓	↓
Night ban on ORV driving	Lowest	Less than 0.01% loss

The goals of the Recovery Plan are sound and should be followed. However, many recommendations (which assume requirement status in the legal arena) have proven to be inappropriate for CHNSRA. A better understanding of the magnitude of the problems associated with agency recommendations can be gained by listing some comparisons with CHNSRA experience:

COMPARISON CHART

FLORIDA CONDITIONS AND/OR AGENCY PROPOSALS	CHNSRA EXPERIENCES
A. Ambient Conditions	
1) High Air and Water Temps	1) Moderate temperatures
2) Gulf Stream is predominant ocean current	2) Conflict between cold Labrador and warm Gulf Stream
3) Tidal levels have small fluctuations	3) Significant fluctuations
4) Beach structure flatter with 18% armoring	4) High man-made dunes with steep profile. No armoring.
5) Small ghost crab population	5) Large ghost crab population
6) High density of humanity with frequent life guarded beaches	6) Low density with only three lifeguarded beaches
7) High rise buildings in cities all along the Coast	7) Individual cottages in villages with 52' height limit behind dunes
8) Canaveral NS turtle patrols start May 10	8) Start earlier May
9) Motorized night turtle patrols	9) Daytime patrols only

FLORIDA CONDITIONS AND/OR AGENCY PROPOSALS	CHNSRA EXPERIENCES
B. TURTLE BEHAVIOR	
1) High nest density 640 – 1130 nests/mile/year in Florida	1) Low density maximum was 1.7 nest/mile/ year
2) 90% female hatchlings	2) 30% - 40% females
3) Shore lighting and human activity deters nesting. Turtles swim away	3) Not observed at CHNSRA. Turtles nest along lighted piers and in front of villages and lighthouses
4) Human disturbance may cause turtles to abort eggs into water	4) Not observed at CHNSRA
5) Nesting females became confused and wander onto highway to be killed	5) Not observed at CHNSRA
6) Relocated nest hatchlings lack vigor and vitality	6)Not observed at CHNSRA and other locations with well trained handlers
C. HUMAN INVOLVEMENT	
1) Length of beaches subject to ORV travel restricted to 2006 usage	1) NC population to increase by 25% in near future. Not all 2006 restrictions were legal
2) Vehicle operation at night prohibited because nesting females run over	2) Not observed in CHNSRA. Night operation required to monitor remote nests
3) Vehicle tire sand impact restricted To 10psi typical of ATVs	3) ATVs not allowed. Vehicles must be street legal. Full size trucks will rarely meet 10psi depending on softness of sand and tire pressure. This includes NPS vehicles.
4) Nest location is by preference of female turtle	4) Natural locations cause 50% loss of nests
5) Minimal relocation allowed. Certainty, not for recreational convenience	5) Recreational access required by law. Nest relocation important for recovery and common in SC and GA where nest loss is less than 15% compared to CHNSRA 40% loss.
6) Frequent beach nourishment with sand deposits	6) Seldom nourished
7) Frequent mechanical beach cleaning to remove natural and man-made debris	7) Annual or storm event manual pick up of man-made debris by volunteers
8) Turtle patrols have 5% to 10% rate of missed nests	8) 1% to 2% rate of missed nests

C. SUMMARY

To impose all recommendations of the USUSFWS Recovery Plan as a viable management process onto CHNSRA does not recognize catastrophic results of having used these recommendations in the past at CHNSRA. Continuing with these practices would be counter to species recovery. The goal to increase the number of nests and nesting females in CHNSRA can be accomplished. The most sensible approach is to dedicate CHNSRA efforts toward increasing the number of female hatchlings that enter the water which is a primary goal of the USUSFWS recovery plan. This objective will be the basis for the proposed plan.

Turtle nesting should gradually increase from the effects of global warming. To interpret such increase as a positive aspect of recovery would be misleading. Shifts of the loggerhead population northward onto the violent beaches of the Hatteras Island will reduce the species reserves through the 50% attrition rate of natural nesting. A strong relocation program will become even more imperative as global warming is identified.

# # #

II. Turtle Management Types

A. Options

There are a number of options to manage sea turtles. They are arranged below in order of the degree of human manipulation:

OPTION	EXAMPLE
1. Absolute Natural Nesting	Historical
2. Natural Nesting	CHNSRA, NCWRC, USFWS PLAN
3. Safe Area	CALO, USFWS Pea Island
4. Beach Hatchery	USFWS Back Bay and Cape Romain
5. Corral	South Padre
6. Laboratory Hatchery	Padre Island N.S.

Within this hierarchy the number of hatchlings that are released into the ocean (% RS) is directly related to the amount of human manipulation and control.

Most of these options would be innovative for CHNSRA even though they have been proven successful elsewhere. As an aid to understanding these concepts a brief introduction is offered:

Safe Area: Supervisory personnel analyze the beach history and select those areas that have the best record of success. These will usually be the highest beaches within the park. These sites will be designated as Safe Areas and selected nests will be relocated to them. Nests that are expected to have similar hatch dates should be clustered together. A successful program requires a proper watch program with nest sitters which can be all volunteers or a blend of NPS staff and volunteers. All must be trained into their duties. Typical instructions might include:

1. Wear dark clothing.
2. Arrive at beach an hour before sunset.
3. Locate nest and deploy hatchling cage and keyhole garden fence pattern like what is done at Pea Island NWR.
4. Deploy red reflectors along fencing path.
5. Use stethoscope to monitor nest activity.
6. Manage vehicular traffic. Beach will be closed from nest to water line at time of hatching.
7. For multiple hatching events buckets may be used to transport hatchlings to a single keyhole run way.

8. At dawn all equipment is to be removed from beach.
9. Fill out all paperwork at end of shift.

Beach Hatchery: This process is somewhat similar to the Safe Area, but is more structured. The site is usually behind the primary dunes for better protection from storms. At Cape Romaine the nests are relocated in a two meter grid pattern. Each nest is identified and provided with a metal cage cover. Back Bay NWR provides extra protection from ghost crabs and other predators by completely enclosing the nest in a buried cage.

Corrals: These can be permanent or modular and removable. They are made from cyclone fencing 8 to 10 ft high with a roof of lighter weight wire to protect against climbing predators such as raccoon or possum. They are installed to be resistant to burrowing fox or coyote. Corrals in Texas use a ring of sunken buckets to trap ghost crabs. Corrals offer the ultimate in protection of all the outdoor options. Nests are laid out as a grid with identification and each nest is surrounded by a partially sunken corralito of 1/4" hardware cloth to retain hatchlings for counting and examination before release. The corralitos are simple circles and open at the top. Corrals eliminate the need for mammalian trapping.

At the very least CHNSRA must upgrade to the SAFE AREA option and increased relocation. The CORRAL option would be preferred since it provides a high level of protection from predators and is the most efficient use of human resources.

B. DEIS

Under the DEIS the NPS intends to continue their past policies for turtle management with the addition of a volunteer nest watch program. From information that will be developed later, it will be obvious that CHNSRA turtle losses of 43% will continue into the future. Such losses are unprecedented anywhere along the eastern seaboard and for NPS denial of that significance is tragic. The NPS uses the excuse that they follow NCWRC and USFWS Recovery Plan guidelines to disallow any science-based programs for relocation and corrals.

There are a number of objections to relocation and corrals contained in the DEIS that mirror positions taken by NCWRS and USFWS. These need to be examined:

1. Handling eggs can kill embryos and increase hatch failure:[2] well, this certainly is a true statement, but does it dictate that relocation cannot be used? No! Properly trained personnel are well aware and careful to prevent this from occurring. On the contrary, data from the coastal states (Cape Romain and Cape Lookout are examples) and elsewhere consistently show that relocated nests have better hatch success than nests left in-situ. Eggs are routinely handled and transported safely over 60 miles to hatcheries in Texas.

2. NPS referred to the USFWS Sea Turtle Recovery Plan that "relocating nests into hatcheries concentrates eggs in an area and makes them more susceptible to catastrophic events and predation from both land and marine predators."[3] These fears are addressed by a proper corral program. Most regulators consider corrals to be a form of hatchery so they are lumped together for dismissal by NPS. There are some important differences. Most open beach hatcheries can be subject to predation. Back Bay NWR in Virginia has circumvented that potential by using special protective cages for each nest. Similar to a corral operation, Back Bay has control over each nest and can release the hatchlings into various locations on the beach to confound marine predation. Cape Canaveral has successfully placed wire screens over nests to protect nests from raccoon predation for years

3. With regard to catastrophic events: Yes, a hurricane can destroy a beach hatchery, safe area or corral and any other building on the islands. Under such severe conditions, in situ nests are also wiped out. Use of three separate corral or safe area locations will minimize that occurrence. CHNSRA has both North to South and East to West-oriented beaches and three separate islands to disperse hurricane effects.

4. Using the above position NPS then refers to the ESA: "Any actions that would likely reduce productivity and cause a decline in the species would not be consistent with the Act." This is cited as a reason not to use corrals or safe areas.

[2] *Cape Hatteras National Seashore Off-Road Vehicle Management Plan / Environmental Impact Statement*(DEIS) : p. 87
[3] C*ape Hatteras National Seashore Off-Road Vehicle Management Plan / Environmental Impact Statement*(DEIS) : p. 87

a. Natural nesting has and will continue to cause a decline in the species.

b. Corrals or safe areas are designed to increase productivity and recover the species.

5. As an additional comment of DEIS page 125, the NPS has proposed a volunteer night watch program which may need to be prioritized depending on available personnel. Details are not provided; however, this would only be good if the Pea Island garden edged keyhole process were used. The Pea Island process would not require the buffer expansions from 10 meters to 25, 50 and 105 meters as provided in the DEIS. It might therefore be concluded that past practices of nest watch would prevail: namely, sitters would be confined outside of the silt fence to count the hatchlings as they are devoured by the ghost crabs. This does little to aid in the recovery of the loggerhead species.

6. Relocation of eggs may change the sex ratio:

For many years NCWRC objected to relocation because it might have an adverse impact on the loggerhead population and particularly the fear of altering the sex ratio of hatchlings. At the time, nobody knew what the turtle sex ratio was and no sand temperature studies had been made to determine that information except that what ever it was, it would be changed and that was bad.

In 2007 Larry Hardham and Robert Davis ran the first sand temperature studies on Hatteras Island.[4] Their data indicated CHNSRA beaches produced an average of 65% male hatchlings. Nests laid in the cool sand near the high tide line would yield 72% males and the middle to dune toe would produce 62% males. A seasonal fluctuation would favor more males in the early summer and fewer during the August heat. An increase in female hatchlings would benefit the goal of increased future nesting on these beaches. The decrease in females near the high tide line has a further penalty. Since these nests were below the spring high tide they were expected to be subject to high losses from tidal action of the usual Hatteras storms as history has shown at CHNSRA.

[4] Hardham, L.H.and Davis, R.B., Summer 2007-Beach Sand Temperature Study, NPS Scientific Research Permit #CAHA-2007-SCI-0005

An analysis of nesting data in CHNS Annual Sea Turtle reports from 1997 through 1999 shows that the hatch rates from relocated nests were greater or equal to undisturbed nests. The insistence on natural testing from 2000 to 2009 caused an inordinate loss of 46% of nests by normal Hatteras weather and wave action.

The NCWRC positions were proven to be unfounded. As the result of the sand temperature study at CHNSRA several actions were recommended.

1. Change NCWRC procedures to allow increased relocations to safer areas.
2. Initiate further sand temperature studies as part of NPS resource program.
3. Develop a corral or safe area hatching program with protocols and trial studies.
4. Develop egg transport carriers based on existing designs.
5. Prepare protective nest cages based on existing designs used at Back Bay refuge.

Sand temperature studies were conducted over the 2007 – 2009 period by resource staff, but no final results have been published. The preliminary report for 2007 by Robert M. Utley confirmed the seasonal variation, but indicated a higher incidence of female hatchlings at the dune line.[5] Comparison between high tide and dune line could not be made due to excessive loss of the HOBO temperature transponders at the high tide locations.

No other actions were adopted and the DEIS has excluded meaningful relocation or hatcheries as management options.

Soon after the sand temperature studies at CHNSRA the NCWRC shifted their relocation objectives to include fitness and vigor of the hatchlings. Our experience with such opinionated objectives is not unique. Similar complaints have surfaced in other states. As each regulator position is disproved a new one has been offered. The list now includes:

a. Sex ratio changed
b. Vigor and vitality

[5] Utley, Robert M., Estimating Hatchling Sex Ratios of Relocated Sea Turtle (caretta caretta) Nests at Cape Hatteras NS, NC – CAHA Research Grant Status Report-2008

c. Significant differences in hatchlings
d. Relocation would evolve turtles to nest below the high tide line

Michael Frick of the Caretta Research Project, Savannah, has reported that all these opinions have been debunked by studies in North Carolina, South Carolina, Georgia and Florida. In Folley Beach 70% of the nests are relocated and have better outcome than in-situ nests. Ten years experience has shown no fitness or vigor problems. In spite of the science the state regulators have persisted in their opposition to relocation. Meanwhile many managers have decided that relocation is necessary to save their turtles. In 2009 the state of South Carolina relocated 40.3% of nests and had only 12.9% with a zero hatch rate while Georgia relocated 48.85% of nests and had only 13% with a zero hatch rate (table # 7)(Exhibit – H).

Mexican managers have responded with the practical observation that corrals have worked to recover the Kemp's Ridley. East coast loggerheads have decreased under the regulator's natural nesting policies.

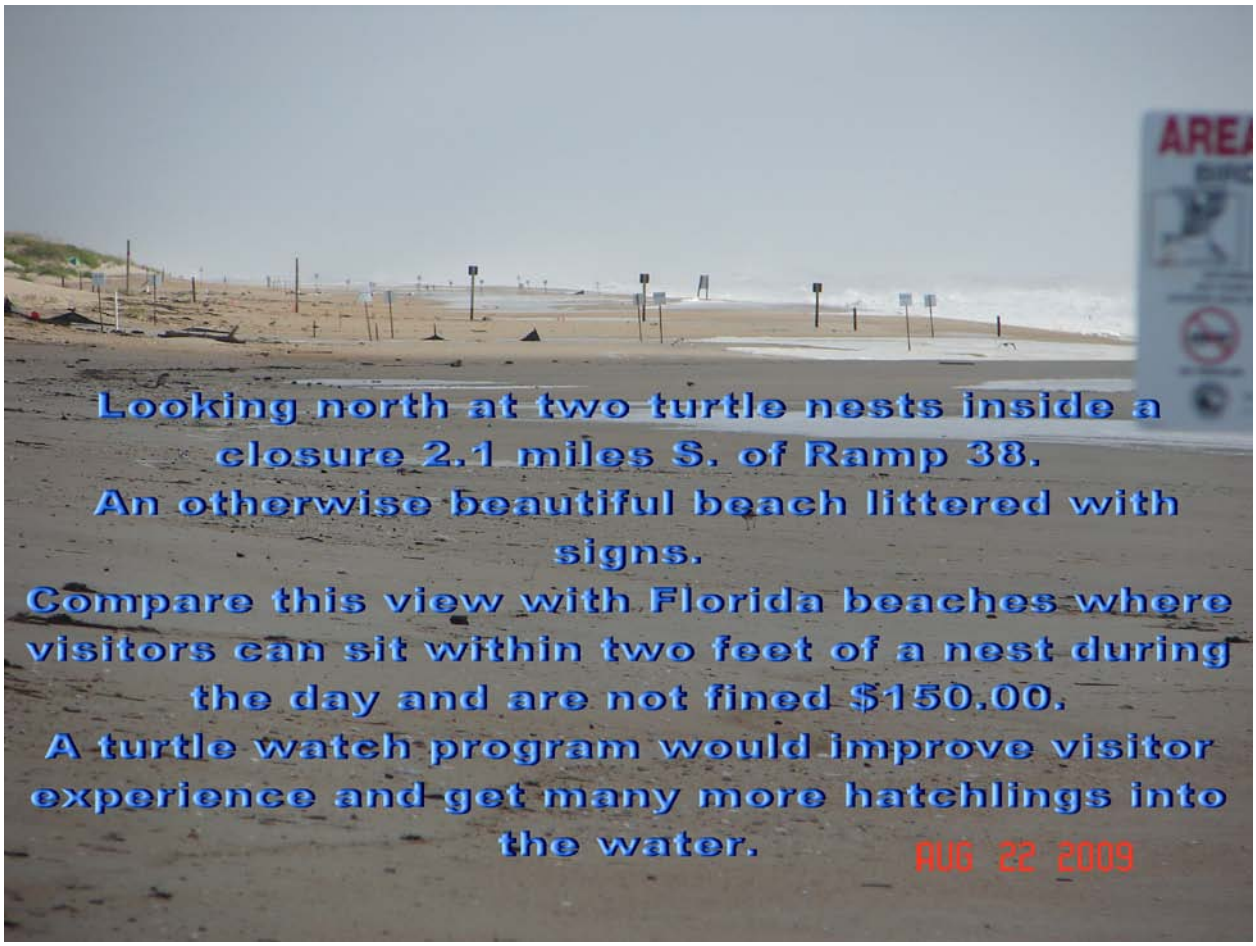
To summarize the situation:

1. All Eastern seaboard states operate under the same regulatory guideline: USFWS Turtle Recovery Plan.
2. The more successful states diverge from the Recovery Plan to protect the species yet are permitted to operate by USFWS.
3. The loggerhead population continues to decrease and soon may be reclassified from threatened to endangered status.
4. CHNSRA adheres to the plan that over the last ten years has had 38.25% of turtle nests with a zero hatch rate and an additional 6.22% hatch an average of 7.9% (table #5). Under the DEIS the NPS intends to continue their same management while being encouraged to increase nesting.
5. On some crowded Florida beaches, people can put a cooler of beer on top of a turtle nest. They can sit next to the nest or right on top of it. (Florida Exhibit A – Florida Examples) Their beaches may have one thousand nests per mile. The best year at CHNSRA had 1.7 nests per mile and we have buffers with closures that prevent public access to the surrounding beach.
6. Unlike the nesting beaches of Virginia, South Carolina and Georgia, the CHNSRA was created to have recreational beaches to draw tourists to the villages enclosed by this national park.

Continuation of the NPS turtle policy closes those beaches and has a negative impact on the economy of those villages. A change could be made to those policies that would better protect the turtles and at the same time protect the village economy.

What is wrong with this picture?
The Signic View of Hatteras Beaches.

This photo was taken at CHNSRA on 8/22/2009 showing the signs that litter our beaches. At many beaches in Florida the beaches are open to public use with little or no signage.



C. CHNSRA TURTLE PROGRAM

BACKGROUND:
The objective of the USFWS Turtle Recovery Plan is to increase "the number of nesting females" in CHNSRA. Much of the mechanism found in the Recovery Plans is laudable. (1991 and current draft) These Plans should not be accepted as a "One Size Fits All" policy, but recognition must be made as to local field situations.

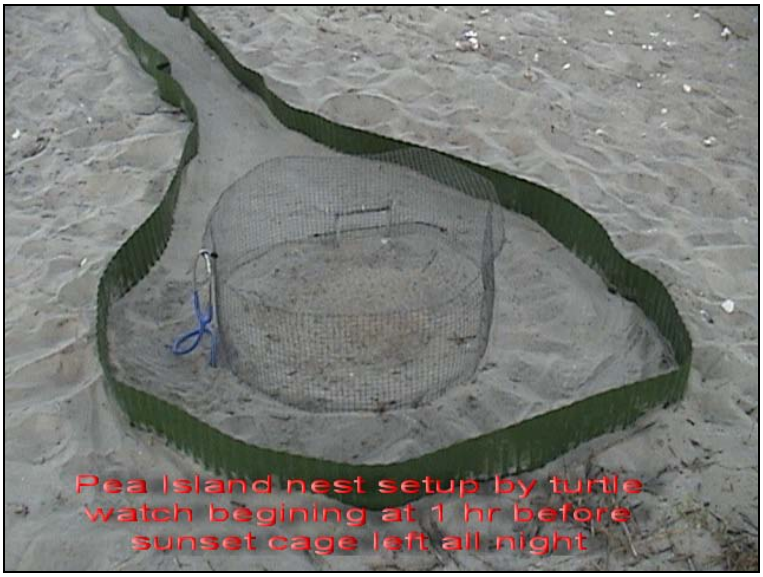
Natural processes are difficult to fulfill on these islands with synthetic dunes. Those dunes were built in the 1930's to protect the roads that allowed the Recreational Area to be developed and provided visitor access.

Turtle management in North Carolina has been dictated by the NCWRC Turtle Handbook. This allows for some latitude in interpretation. At the urging of Matthew Godfrey NCWRC, Hatteras adopted a conservative interpretation of least manipulative management with natural hatching. This reduced nest relocation from 60% in 1999 to an average 25% in the period 2000-2009.[6] When relocated now a nest is generally moved closer to the dune on the same beach regardless of topography. Previously (1997 - 1999) nests were relocated to several "safe" locations of the islands. Our neighbors at Pea Island and Cape Lookout have been allowed to choose a more liberal interpretation of the Handbook like the policy used at CHNS prior to 2000. They both survey their beaches each season and designate "safe zones" for relocation. In 2005 Matthew Godfrey convinced Jeff Cordes of Cape Lookout to follow the state guidelines conservative interpretation. The results were disastrous and Jeff Cordes was allowed by NCWRC to return to their previous policies. In the CALO 2006 turtle report Cordes cites that "Tidal flooding continues to be the principle threat to nesting success at CALO. Nest relocation is the primary management tool used to enhance hatching success in the Park…. The best management decisions can only be made by evaluating local conditions and their potential effect on nesting success."

[6] DEIS pg. 215

Pea Island has taken further steps to reduce turtle losses. They have developed a volunteer organization of nest sitters who are activated when nests reach their hatch window. Each night they smooth the sand and deploy a shield of garden edging in a tight keyhole configuration leading down to the surf line. The edging provides a shield against ambient light and protection against ghost crabs. The volunteers may use a white bucket as a target at the water line for hatchlings to follow. In addition, aggressive ghost crabs that intrude into the hatch lane are removed by the volunteers. (see Exhibit G – Ghost Crab Research) A count is made of hatchlings that emerge and successfully enter the water. Volunteers are requested to stay on duty until midnight. Unfortunately there are inadequate personnel to cover the rest of the night so each nest is covered with a wire cage for additional protection and hatchlings picked up at first light. Sea turtles at CHNSRA would benefit by using two shifts to cover the entire night.

Pea Island at hatch time uses green plastic garden edging (photos 1 and 2) which is six inches high and is placed in a keyhole shape around nest and to the water. The corridor that hatchlings travel to the water is only one foot wide. When volunteer “watch team” leaves the beach about



midnight the plastic edging is removed and wire cage is placed over the nest. Any hatchlings that emerge into the cage are recovered at dawn and released that night. Closure 10 x 10 meter through hatch – no full beach closures – all volunteer turtle watch program.

Back Bay Wildlife Refuge - Virginia takes further efforts. All nests are relocated in a centralized corral behind the primary dune for maximum protection from their dynamic beaches. Each nest is transferred to a special individual cage to prevent predation. They also work with a volunteer group of nest sitters who stay all night to release hatchlings. Cape Romain has a somewhat similar policy, but provides less protection against predation.

The ultimate in nest protection is found at Padre Island N.S. All nests are relocated to a hatching building which provides temperature (sex ratio) control and absolute protection from predators. Because of the success of their program, Padre has recognized the possibility of exceeding their hatching capacity in the future. For the past two years they have experimented with a corral of coyote-proof cyclone fencing. A top cover was added to prevent raccoon predation. The cover was made from 2” x 3” galvanized wire mesh. Ghost crabs were reduced by a ring of plastic bucket traps around the interior of the fence. Although CHNSRA has had encounters with coyotes, this design would also be effective against foxes,

raccoon or possum and would be recommended. Corrals are used widely in Mexico, and South Padre, Texas. Virtually every nest in Mexico is moved to a corral and the Ridley turtle population has responded with a successful recovery. Corrals are also used in Sri Lanka, Malaysia, Borneo and India.

The success of turtle recovery in CHNSRA will be directly related to the degree of human effort applied to the program. The government has altered the natural habitat, but is obligated to prevent its destruction.

Matthew Godfrey of NCWRC and Sandra MacPherson of USFWS are advocates for Natural Nesting with the least manipulation by humans. Following this advice over the past 10 years, CHNSRA has experienced the loss of nearly half the turtle nests. Continuation of this policy into the new DEIS Plan will not provide sea turtle recovery in CHNSRA. Without change the downward trend will not stop. CHNSRA should request a change in the NCWRC guideline.

1. Substitute “debris line from spring high tide line” for “average high tide line” as a reason to relocate a nest as is done in SC and GA.
2. Allow safe areas or corrals as relocation sites as is allowed at Back Bay NWR, Pea Island NWR and Cape Lookout National Seashore.
3. Endorsement of a Pea Island sea turtle nest watch program to ensure that hatchlings get to the water safely but expand it to dawn.

All of the above suggested changes are currently being used elsewhere under the same Loggerhead Recovery Plan and approved by USFWS.

CHNSRA should take the best ideas from our neighbors and apply those which offer the most effective opportunities for successful turtle recovery. A brief comparison of these various programs is shown in Table 7.

We have two major factors that cause loss of the turtle resource. Both can be compensated.

1. Weather: Wind and waves associated with storm events along our dynamic beaches.
2. Predation: Mammalian, Avian and ghost crabs.

Proper control over these two variables will lead to turtle recovery. Peripheral variables such as man-made lighting and disturbances are of

less value and need careful consideration before wasting precious human resources.

There are a number of deficiencies in the current CHNSRA program that should be addressed:

1. Failure to observe Section 1132 of 1991 Recovery Plan. For 17 years CHNSRA has not identified those beaches with 40% or more nest loss due to erosion and inundation.
2. Relocation of nests only closer to the dune even on low beaches instead of moving completely away to a safer location.
3. Enlargement of enclosure and installation of silt fencing in a wide “U” shape which provides little effective light shielding, but affords greater protection for the ghost crab population rather than hatchlings. Ghost crabs have been the number one CHNSRA nest predator. They invade the nests to eat eggs and pre-emergent hatchlings. The crabs attack hatchlings after emergence by nipping tendons to immobilize the hatchlings then drag them to the crab burrow. During the time that the filter fence and closure is established the ghost crabs are protected from ORV operation and establish themselves near the turtle nest. Table #10 is a survey of ghost crab concentration that shows the magnitude of the gauntlet of ghost crabs that the hatchlings face on their scamper to the water.
4. Failure to monitor the number of hatchlings that enter the water.

III. SCIENCE

A. CHNSRA RECORD

The best science for CHNSRA is the data that comes off these beaches. Larry Hardham has made a comprehensive analysis of CHNSRA's annual turtle reports which can be found in the attached (Tables # 1 through # 5). Study of this data reveals several points of interest:

1. The major cause for nest failure was weather related. Nests were washed out or inundated.
2. The ban on night driving and other extraordinary protective measures instituted under the consent decree have had no beneficial effect on sea turtle recovery.
3. Zones with high success rates are identified for evaluation as to potential sites for corral location or safe areas. This evaluation should be done each season based on both history and current topography.
4. Comparison of this data can be made to the other states in the northwest Atlantic population loggerhead area. (Table # 7). This showed the other coastal states use a higher incidence of relocation and enjoy better success than CHNSRA. They also show higher false crawl rates than at CHNSRA in years (1997-2003) with night driving which warrants a more thorough evaluation (Table # 9).
5. Natural Nesting in CHNSRA has failed as a management policy and should be terminated. Natural nesting was an admirable concept, but did not work on the CHNSRA beaches and has contributed to the reclassification of the loggerhead to an endangered status. Leatherback turtles are classified as "endangered" which is more serious than the "threatened" loggerhead. From 1997-2009 (21 of 35) 60% of the leatherback nests had zero batch success in the State of North Carolina following NCWRC rules. (Table #19)
6. There is a section of the DEIS that deals with natural catastrophes and listed six major storms to make land fall in the United States.[7] These storms seriously impacted turtle nesting.

[7] *Cape Hatteras National Seashore Off-Road Vehicle Management Plan / Environmental Impact Statement*(DEIS) : p. 219

The average complete nest loss was 28% and ranged from 16% to 54%. The 10-year average complete nest losses documented in Table 5 of 37.25% for CHNSRA are much worse than that average and shows that the authors of the DEIS have totally ignored the magnitude of our turtle losses. Under the natural nesting management at CHNSRA, every year should be classified as a catastrophe and alert NPS to the need for a change in management. (See Exhibit E – Tropical Storm Impact)

7. The attached "Hatteras Swale Exhibit" (Exhibit B) contains seven pictures of inundation typical of natural nesting in swales along Hatteras beaches. These nests were not moved because they were not laid below the "average high tide line" as required under the current NCWRC guidelines and suffered a 62% loss. Had these nests been laid in South Carolina where the "debris line marking spring high tide" (Table # 7) is the guide for relocation, they would have been relocated.
8. The continued decrease in loggerhead population, especially in the Florida region, has resulted in a further effort to reclassify this turtle to be endangered. This is a serious indictment of the USFWS flawed emphasis on natural nesting. South Carolina and Georgia long ago recognized this problem and have been forced to relocate more aggressively that NCWRC.

B. RELOCATION RECORDS

DEIS commented that this average relocation rate at CHNSRA from 2000-2009 was 25%. As of 2006 nests were no longer relocated for recreational or lighting issues. From 2006 to 2009 the relocation rate dropped to an average of 18%.

One measure of success would be to compare CHNSRA data of relocation rates and lost nests with the experience of surrounding states as done in Table # 7. The best measure would be to compare relocation versus hatchling release rate (%RS). This can not be done since very few procedures develop %RS data which requires a count of hatchlings that reach the water. All areas determine a hatch success (%HS), but the extent that lost nests became incorporated into that number vary with the area. Lost nests are not included at all in CHNSRA under NCWRC for

calculation of %HS. By not including eggs from a nest lost to erosion (like is done at Cape Lookout) in hatch success rates, the percentages are not showing a true picture.

Tables 5 and 7 clearly show that CHNSRA has the lowest relocation rate and the highest rate for lost nests along the Atlantic Seaboard. Changes in CHNSRA procedures must be made if recovery of species is desired.

C. RELOCATION PROCEDURES

Even though the Recovery Plan applies to the entire Atlantic Coast, there are varied philosophies and procedures used as condensed below:

1. Virginia: USFWS Back Bay NWR. Move all nests behind primary dune resulting in no beach closures.[8] "Having the nests relocated behind the primary dunes, offers the nests better protection from over-washes and storms". Back Bay moves <u>all</u> nests behind the primary dune. (Beach Hatchery) Per web site "The nest will be relocated to a safer location to improve the chances of a successful nest".

2. North Carolina: USFWS Pea Island NWR. Uses "on ground" (Exhibit C – Pea Island Relocation Procedures) knowledge of beaches coupled with criteria to move all nests laid in front of a dune that has been reconstructed within the past two years. They do not use NCWRC guidelines for relocation decisions and historically have lost nests at a much lower percentage than CHNSRA.

   Cape Lookout National Seashore (CALO): In 2005 relocations criteria were changed at request of NCWRC and as a result "Nests found within 30 feet of the ocean, which would have been relocated in previous years, had a success rate of only 29%. Half of the nests in this category failed completely."[9] The average (1990 – 2009) emergence rate for relocated nests is 66% and average for non-relocated is 57% which shows that when relocation is done with safe areas the emergence rate is higher than nests in situ. "Three areas on each island will be designated as closed to vehicles and nests will

[8] Fws.gov/Personal communication from Geralyn Mireles, Wildlife Biologist, Back Bay NWP 2/24/2090
[9] Cordes, Jeff, Cape Lookout National Seashore 2005 and 2006 – Sea Turtle Monitoring Progream

be relocated into the closed area closest to the original nest site." In 2008 and 2009 CALO relocated turtle nests as far as five miles from the original nesting site. Closures at the hatch window start 5 feet dune-ward of the nest and 15 feet on each side extending to the tide line where it is 60 feet wide on all beaches (ORV or pedestrian). Approved by NCWRC and USFWS.

3. South Carolina: "Use three or four stakes to mark an area around the nest.[10] These stakes should extend about 36" above the sand. Surveyor's ribbon or tape should be tied from the top of one marker to another to create a perimeter around the nest site. If concealment of nests is desired, measure the exact distance and direction with a compass to two separate marking stakes on the dune, hidden among the vegetation. If one marking stake is discovered and removed there is still one remaining. Whatever method a particular project decides to use is fine, just as long as it is uniform among all workers. For instance a project may simply choose to place the marking stake 3' seaward of the clutch. On beaches where removal of marking stakes by the public is a potential problem, an additional stake driven deeply and hidden from view, should be placed a measured distance landward of the others. As added insurance, an aluminum strip can be buried hand-deep and 24" from clutch location in a standardized direction. The metal marker can be found later with a metal detector."

   Cape Romain National Wildlife Refuge: "The current recovery strategy for the United States Atlantic population of the Loggerhead sea turtle (Caretta caretta) places emphasis on less manipulation of nests and hatchlings due to the risks of embryo mortality, reduced hatching fitness, and potential sex ratio manipulation. However, management efforts involving nest relocation at locations with high tidal amplitudes and erosion rates can have benefits that outweigh these risks."[11]

   "Find suitable beach habitat nearby that is successfully used by nesting turtles. Avoid relocating nests near inlets, as hatchlings will be swept into the marsh by incoming tides." *This suggests that all*

[10] Guidelines for Marine Turtle Permit Holders – South Carolina Department of Natural Resources
[11] http://www.fws.gov/caperomain/turtleproject.html, pg 2"loggerhead Nest Incubation Temperatures in Hatcheries" (pdf)

nests laid near inlets should be moved. "Be sure that the new nest site is above the spring high tide level and is not in dense vegetation."[12] State-wide in 2009 there were 880 nests relocated or 40.2% of the 2187 nests laid in South Carolina. "To ensure safety during the September storms that are likely to come ashore, Judi moved the clutch further away from the ocean at Folly Beach SC."[13] Cape Romain National Wildlife Refuge (Cape Island): "Hatcheries should continue to be used on Cape Island as a management tool. Due to the high erosion rate of the island and lack of suitable nesting areas nest relocation is necessary to prevent total loss of nests from erosion. Concerns regarding nest relocation include moving nests to a warmer, drier environment resulting in an increase in nest incubation temperature and a decrease in incubation duration possibly resulting in smaller, less robust hatchlings. However, our results suggest that these concerns are not valid for Cape Island." Cape Island in 2009 relocated 499 nests or 67.3% of the 741 nests laid on their beaches. "All permit holders approved to conduct nesting surveys may also relocate nests laid in poor sites (too low on beach or near dune crossovers. Normally, the only situation that justifies nest relocation is when a nest is laid seaward of the debris line marking spring high tide."

4. Georgia: "The Nongame—Endangered Wildlife Program coordinates two coast-wide programs for the conservation of sea turtles. The nesting program is a cooperative effort between the Georgia DNR, federal coastal management entities including the USFWS and NPS, as well as private foundations. The program is directed at maximizing the reproductive success of loggerheads by ensuring that the highest number of hatchlings reaches the ocean every season."[14]

5. Florida: "Ocean Reef County Park, Singer Island, Fla. protects sea turtle nests with a closure of three wood lath stakes forming a triangle approximately 3'x3'x2' and caution ribbon. No expansion of this closure is made at hatch time. Visitors can place a beach umbrella next to a nest (possibly shading it), sit, spill water onto dig holes next

[12] http://wwwseaturtle.org/nestdb?view+2 ,"South Carolina DNR Sea Turtle Conservation Program"
[13] http://www.follyturtles.com
[14] http://www.georgiawildlife.com "Reptile and Amphibian Conservation – Sea Turtle Recovery Efforts" fact sheet pg. 66

and anything else kids do at the beach without being fined $150.00 like CHNSRA.

John D. MacArthur Beach State Park, North Palm Beach, Fla. does not even put a single stake at nest sites and they as of 8/9/2009 had 846 sea turtle nests (666 Loggerhead, 132 Green and 48 endangered Leatherback). This equates to 423 nests per mile and in the best year ever CHNSRA had only 1.7 nests per mile. Chris Hardham was told by a park attendant that they "do not mark any of their nests because there would not be much space for tourists." Visitors are welcomed and can sit right on top of a nest that could hatch that night and not get fined a penny. Visitors are asked to limit the depth that a beach umbrella in placed in the sand to 12 inches but this could still impale or "take" several hatchlings waiting to emerge that night.

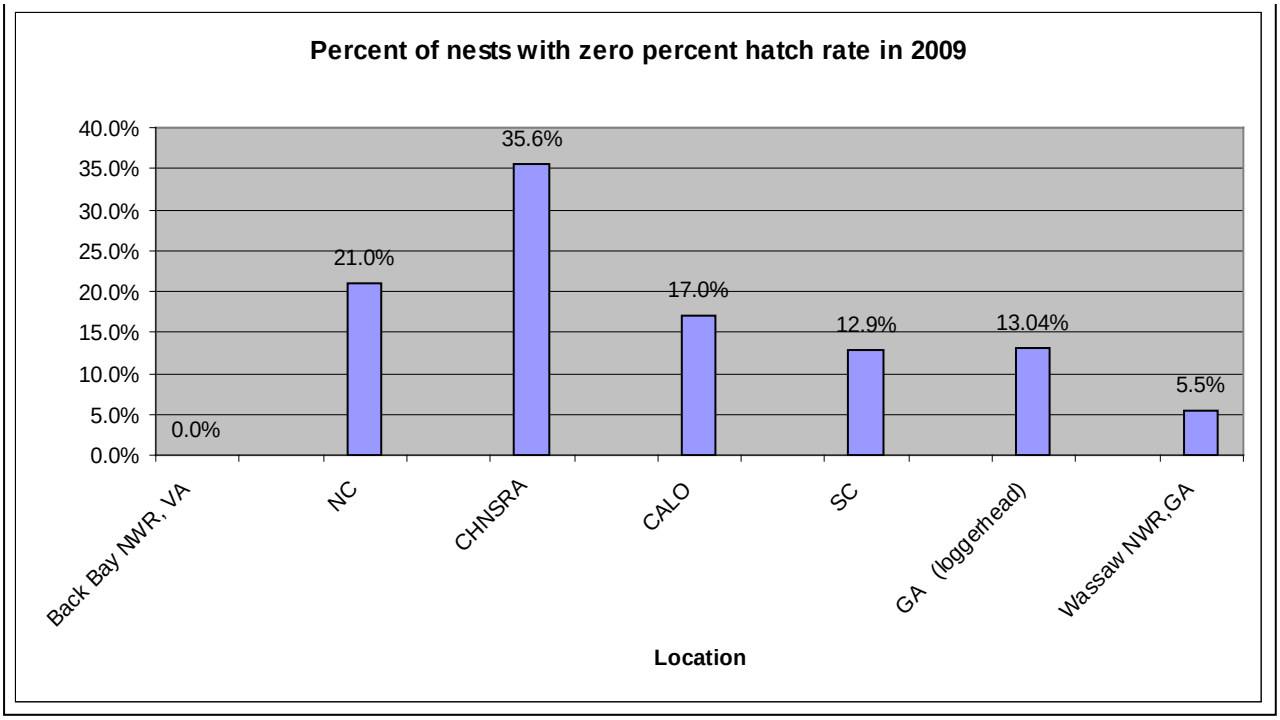
The Juno Beach-Jupiter in Jupiter, Fla. as of 8/9/2009 had 3616 sea turtle nests (3133 Loggerhead, 206 Green and 277 endangered Leatherback) or 657 nests per mile compared to CHNSRA best year of 1.7 nests per mile. Here a single PVC pipe is used to mark nests with no closure at all. Golfers pitch golf balls at the stakes.

6. CHNSRA: The Loggerhead Recovery Plan covers treatment of these sea turtles for their entire breeding area and yet many differences in treatment occur. CHNSRA seemingly has the most protective sea turtle policy resulting in the most restrictive public access and the poorest results in their breeding area. It is all well and good to have loggerhead sea turtles recover without manipulation by man except that at CHNSRA man has changed the coastal environment (by man made dunes) and such an approach does not work as evidenced by historically poor results (loss of 43% of nests). CHNSRA lies in the area where the Northern Recovery Unit population of loggerhead sea turtles breed and consists of an area from the Florida-Georgia border through southern Virginia. The number one listed "Recovery Objective" listed in the 2009 plan is "Ensure the number of nests in each recovery unit is increasing and this increase corresponds to an increase in the number of nesting females." Policies under the same Recovery Plan vary so widely that in 2009 CHNSRA's percentage of nests lost was over three times Georgia and South Carolina. Hatch window closures "…encompass the area 50 feet dune-ward of the

nest site down to the tide line. A nest on a remote beach would receive a closure of 75 feet in width; a nest in a heavy pedestrian use area such as a village would be 150 feet in width; and a nest in an off road vehicle area would be 350 feet in width."

Visitors are fined $150.00 for walking on the wet sand that could be as much as 200 feet in front of a nest let alone within one foot (at Ocean Reef FL) or on top of a nest like at John D. MacArthur State Park FL. (See Exhibit F – Management Practices)

Graph #1 is a striking portrayal of the poor performance of CHNSRA natural nesting compared to its surrounding neighbors.

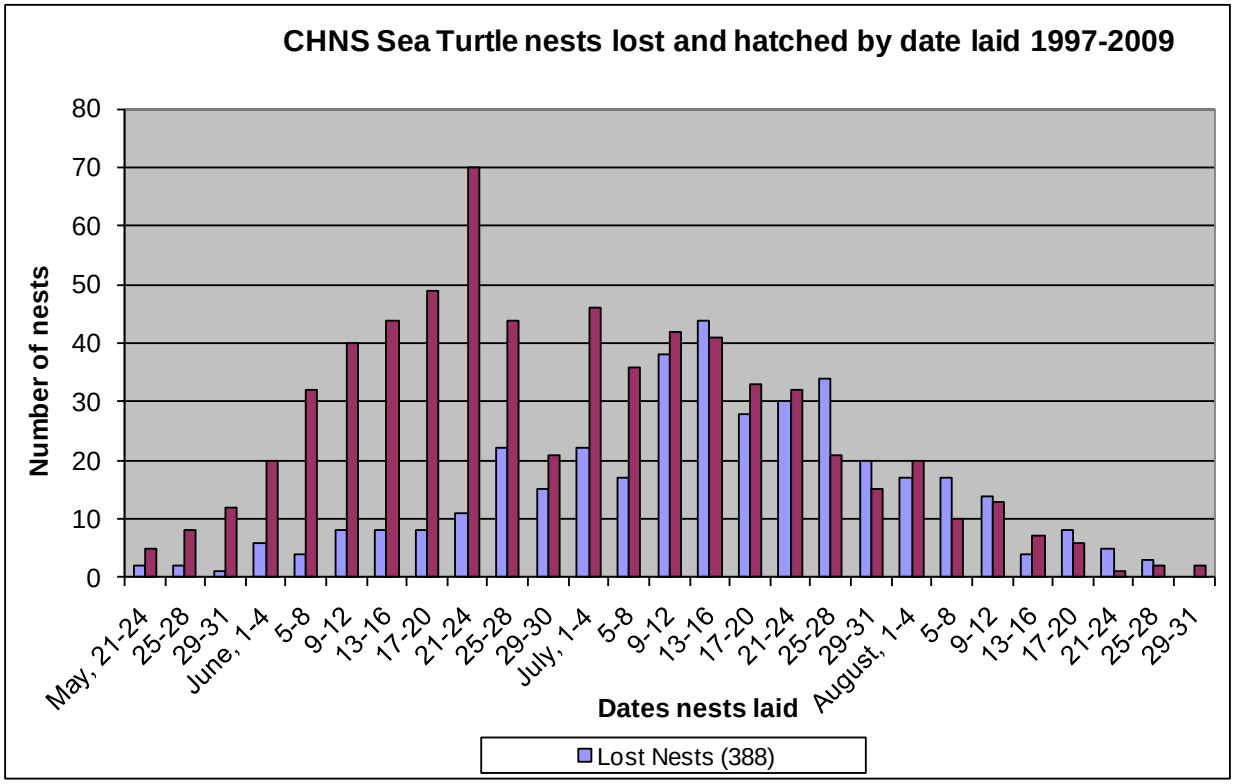


Graph 1 – Prepared by Larry Hardham 3/21/2010

In years without storms some relocated nests at CHNSRA were lost due to the fact that nests had been relocated near original nest site and “safe area” was not used.

Years of 2000 thru 2009 CHNSRA has lost an average of 37.25% of nests and when nests that hatched under 20% (52 nests with a hatch rate of 7.9%) of eggs are added the percentage goes up to 43.47% which is well above other areas and will not contribute to recovery.

Data at CHNSRA from annual reports indicate that nests laid after July 9th have a better than 50% chance of being lost.



Graph 2 – Prepared by Larry Hardham 3/21/2010

For the years 1997 thru 2009, 58.12% of nests laid at CHNSRA had an expected hatch data during the peak hurricane season as defined by “The Weather Channel” of August 20 thru September 30 and thus it would be prudent to move any nests with an expected hatch date after August 20 each year.

Frequency of Tropical Storms per "The Weather Channel"

Laid	Projected Hatch (Laid + 60 days)	Frequency of Tropical Storms	Number of Nests Expected to Hatch at CHNSRA	% of Nests
April	June	8%	36	3.36%
May	July	9%	402	37.50%
June	August	20%	499	46.55%
July	September	37%	129	12.03%
Aug	October	21%	2	0.19%
Sept	November	4%	2	0.19%
	All other months	1%	2	0.19%
	Total		1072	100.00%

Peak Hurricane Season per "The Weather Channel"
"is August 20 thru September 30"

Nests at CHNSRA expected to hatch	1997-2009	
August 20 thru 30	183	
September 1 thru 30	440	
Total expected to hatch during peak hurricane season	623	58.12%

In 2009 because of approaching weather events – forecast high tides, nor’easters, a tropical storm and a hurricane (both were over 400 miles at sea) sixteen nests were excavated before they had hatched naturally. This points out the failure of current relocation criteria at CHNSRA. Weather events happen at CHNSRA which is a sandbar 30 miles at sea with manmade dunes which require man’s intervention with nesting contrary to the latest Recovery Plan focus on using the least manipulative means. Relocation policies for Florida do not work at CHNSRA. One size does not fit all! Coastal

erosion rates here probably exceed those of Cape Island SC. The use of policies that may work in Florida at CHNSRA is arbitrary and capricious because no research has been done here in Hatteras.

NOTE: During Neg Reg proceedings Sandra MacPherson of USFWS commented that moving lights of ORV's are less disorienting than stationary lights to adults and hatchlings.

SELECTION:
CHNSRA currently relocates nests laid below the prevailing high tide line. South Carolina and Georgia have been more successful by setting the debris line from the spring high tide as their bench mark. N. Mrosovsky (a leader in turtle technology since the 1960's) considers such nests as being doomed and suggested: "Take the doomed eggs, but do not put them back into the population. Instead sell them, eat them, commercialize them as much as possible, and then use the proceeds to support conservation." This opinion is not offered here as an option, but merely to emphasize the importance of relocation. Mrosovsky was theorizing about the long term evolutionary aspects of allowing low beach nesters to pass on those traits to their progeny. With our small numbers (100) of nests, each one is too important to allow this sub-set of nests to be discarded.

Nesting success has been poor near points and spits due to high erosion rates. Any nest laid within one mile of a point or spit should be relocated. Hatchlings in these areas also face an uncertain future as they may be swept into inlets upon entering the ocean or get caught up in the violence of Cape Point thus expending excessive energy in getting off our coast.

Analysis of CHNSRA nesting (Graph #2) shows that those nests laid after July 9 each year have less than a 50% chance of hatching before they are seriously impacted by the storm season. Those nests should be relocated.

WHERE TO RELOCATE:
Since the year 2000 most relocated nests were simply moved upwards placing them closer to the dune. This has not proven adequate protection.

Our history shows they should be moved to a safer area. Determination of such areas would require an analysis of data from prior years (Table 1)(Exhibit I) combined with an assessment of the current beach topography and its implications by an experienced manager. This assessment should be done just after the spring high tide. The debris line from that tide should be marked by GPS as a guide for nest relocation. All nests laid below that line should be relocated as in South Carolina.

Any nest treated in-situ or relocated as an individual nest should be controlled by a night watch program. Two shifts of nest sitters (2 people each for safety) would be needed for each nest during the hatch window. Pea Island starts their program at day 50 after a nest is laid. CHNSRA current excavation of a hatched nest to count shell fragments gives no clue as to how many hatchlings entered the water. This information is most important to track the progress of recovery. A proper watch program generates that data and protects the hatchlings from predation by ghost crabs. Nest sitters also deter larger predators that may be more numerous in village areas.

Once a nest has been excavated there is an opportunity to improve the efficiency of management offered by Safe Areas/Corrals. A total of three would be recommended for CHNSRA. One on Ocracoke Island, one on Hatteras Island south beach with its east-west orientation and the other on the north-south oriented north beach. With a capacity of 30 to 40 nests, each corral would offer a 30 fold decrease in human resource's demand not to mention the savings generated by not having to install and maintain filter fencing used now.

Corrals have been used for over 50 years around the world to protect sea turtles. Multiple corrals are found in Mexico[15], India[16], Sri Lanka[17], Malaysia[18], and Borneo. All have developed procedures for their operation.

[15] Garcia, Andres, Ceballos, G. Adaya, R.. *Intensive Beach Management as an Improved Sea Turtle Conservation Strategy in Mexico*, Biological Conservation Vol. 111 June 2003

[16] Meena, R. L., Jadeja, L.N., Barad, I.K., Conservation of Sea Turtles in Kachchh on the Western Coast of Gujarat, Indian Ocean Turtle Letter #9

[17] Hewavisenthi, Suhashini; Turtle Hatcheries in Sri Lanka: Boon or Bane Marine Turtle News Letter 60; 19-22, 2001

[18] Sea Turtle Sanctuaries and Hatcheries in Malasia: Malasia's Wildlife and Nature

A general guideline for corral management was published in 2002.[19] CHNSRA personnel can easily become trained to build and operate their corrals if desired over safe areas.

Corrals may be permanent or portable and usually constructed of galvanized cyclone fence with lighter weight wire mesh roof to foil raccoon and possum predators. Fencing can be sunk into the sand to deter burrowing by coyote or fox. A ground level wrap of plastic sheet or fabric can reduce drifting sand.

D. FALSE CRAWLS

The USFWS currently requires CAHA to record false crawls as evidence of proper control over human activities that could interfere with turtle nesting. They cite village lighting, vehicle lights and open beach fires as primary causes for false crawls. There are many opinions on this matter, but no real studies and no data from CHNSRA beaches. F&WS has placed a target of false crawl to nest ratio under 1.1 to 1 with a maximum of 1.3 to 1.

One of the fears frequently cited by USFWS is that a false crawl represents the forcing of a female loggerhead to choose a less optimal site to make her nest. A female turtle has evolved to select the best site for nesting. When the quantity of nests relocated to prevent obvious loss in CHNSRA is combined with the recorded lost nest number, the total expected losses would range from 50% to 60% even with a ban on night driving. This does not support the "most optimal site" theory, but would be typical of a random selection. On that basis, management by relocation is imperative if we wish to recover the species.

Examination of the CHNSRA annual turtle reports (Tables 8 and 9) revealed three interesting facts for consideration:

1. **Villages** -Average FC/N ratio over the years 2000 – 2009 was 0.67 to 1 in front of the village zones with all their existing lighting and human activities (Table # 10). Non-village beaches were considerably higher. Clearly village activity did not cause any increase in false crawls.

[19] Nooren, Hanneke and Claridge, Gordon; Guidelines for Turtle Hatchery Management, Turtle Foundation, Ammerland, Germany 2002

2. **Cape Point** - Historically Cape Point has had a large number of false crawls. For many years the Park's resource management has attributed this condition to night operation of vehicles and human activities at this popular beach. In 2007 there was a massive bird closure west of the point that extended to ramp 45. There was no public activity, day or night, in this area, but there were 24 false crawls and 3 turtle nests (one of which was a green) for a FC/N ratio of 8.0 to 1. Cape Point is a natural interdiction area for turtles floating with the wind driven tides. Northerlies would have turtles hitting the beach north of the Point and south west winds would bring the turtles to the sands just west of the Point. Females may not care for those beaches and false crawl back to the water. At Reg. Neg. Sandy McPherson told us that she had inquired about the Coast Guard turning lighthouse lights off so as not to have any impact on sea turtles which may help explain the number of false crawls in the Cape Point area and to move nests from that area.
3. **Overall** - CAHA published a ten year summary of false crawls and nests in the 2009 annual report. Analysis of this data shows four years with a FC/N ratio larger than unity compared to six years that were lower than one. The overall ten-year FC/N was 0.98. In the eight years prior to the Consent Decree the average FC/N was 0.995 and during the Consent Decree 0.944, a difference of only 5% which is negligible for a biological study. The best description to fit the FC/N relationship in CHNSRA is that it is just random.

   The years 2004 and 2005 exhibited the highest FC/N data points (Table 9). In those years white plastic wands of carsonite were installed as beach markers. These wands included bright reflective decals. The whole marker would wiggle in the wind flashing light reflections which contributed to increased false crawls.

   From 2006 to 2009 brown carsonite wands were still in use on the beach. The brown carsonites still had reflective decals and wobbled in the wind with light reflected off their shiny surfaces until dimmed by nature's sand blasting. These markers might be an interesting research project in the future. A return to wooden

posts as markers were welcomed by many visitors as their natural material was better fitting for a national park setting.

Table 9 reveals another interesting aspect. In the period of 1997 through 2003 with wooden closure posts and 24/7 ORV driving (even at the spits and Cape Point) the False Crawl ratio averaged 0.76:1. The ratio was 0.95 when vehicles were removed from the beach under the Consent Decree years 2008 and 2009. This is an increase of False Crawl ratio of 20% which is a significant difference. This certainly offers no proof that night vehicular operation causes false crawls.

The 2009 Signic Photo (pg. 16) shows several brown carsonite stakes (some near the water line) mixed in with the numerous wooden posts. Particularly note the proliferation of white signs attached to the wooden posts. Studies may be required to isolate the effects of brown carsonite versus the inordinate increase in beach signage with regard to turtle nesting behavior.

The requirement by USFWS for a false crawl target based on human activity does not seem to be based the data at CHNSRA. Excessive signage can lead to a decrease in both visitor experience and negatively impact visitation and thus the economy in this region.

E. LIGHT MANAGEMENT

There is a host of references in the literature pertaining to the effects of light on loggerhead reproduction. In general the gravid females are repelled or distracted by artificial light. In pristine environments; e.g. refuges, they are accustomed to dark beaches illuminated only by moonlight.

On the other hand the hatchlings have evolved on dark beaches to seek moonlight reflected from the ocean or luminescence in the water to attract them away from their dark dune background. Artificial lighting from human development has been a problem for hatchlings, especially on some Florida beaches with high rise condominiums and hotels and many of

those areas have developed appropriate light control ordinances to deal with that problem.

Cape Hatteras does not have high rise buildings. Maximum building height is 52' by law in the villages and dunes that help block direct lighting onto our beaches. Being a vacation resort area there is considerable human activity and artificial lighting that creates light pollution over the village that interferes with a "Dark Sky" experience. With natural nesting and a lack of nest sitters there have been several occasions when hatchlings escaped the light filter fence and wandered under the houses to roads and parking lots. Use of corrals or safe areas using the Pea Island garden fencing procedure with a all night nest watch program would prevent such loss of hatchlings. Those two procedures would also eliminate problems on non-village beaches from sky glow light pollution that are not addressed by past filter-fence practices, nor would they be addressed by DEIS future plans.

Based on this information, a lighting ordinance for the villages is not warranted and would be an unnecessary expense caused by NPS selection of natural nesting management. This is another example of the "one size fits all" Recovery Plan imposing Florida policies upon Cape Hatteras without scientific justification.

Harassment of nesting turtles has occurred especially at the villages with people using flashlights and flash photography causing a false crawl. In non-village beaches there have also been reports of turtles surrounded by pedestrians and vehicle headlights causing the turtle to return to the water without nesting. CHNSRA experience has been that once a female begins to lay eggs she is no longer deterred by lights.

These harassments are best addressed by education of the public. Establishment of a night driving permit and pedestrian night beach badge carrying an educational component is recommended.

F. NIGHT DRIVING

The ultimate goal for loggerhead sea turtles is to halt the decrease in their population and promote the recovery. The Fish and Wildlife Service (USFWS) had proposed three major objectives for North Carolina:

1. Increase the number of nesting females
2. Increase the number of nests
3. Increase the number of hatchlings to reach the water.

All three of these objectives were to be accomplished by natural means, i.e. with the least manipulative methods[20].

CAHA past and current policies do not approach these objectives[21]. The death of adult females at sea has been recognized as the single greatest contributor to species decline[22], but is beyond the control of NPS beach regulation. One of the ways chosen to help reach these objectives by government agencies such as NPS, USFWS[23] [24], and NCWRC[25] is to advocate prohibition of night driving on the beaches of CHNSRA.

Since female turtles generally return to their birth beaches as they achieve sexual maturity of 20 to 30 years, it is obvious that efforts must be made to increase the quantity of female hatchlings to enter the ocean along the Outer Banks. Blair Witherington studies show that there is no shortage of male loggerheads in the population.[26].

- Night driving restrictions are not needed at CHNSRA.
    - The False Crawl to Nest ratio at CHNSRA during the period of 1997 thru 2003, with night driving allowed and wood 2x2 closure stakes on our beaches, was 0.76:1 or well below the 1:1 ration expected on an undeveloped beach. The False Crawl to Nest ratio during 2008 and 2009 without night driving was 0.945:1 or 25% higher.

[20] NCWRC, Addendum to the Final Report of the Proceedings of the Negotiated Rulemaking Advisory Committee for Off-Road Vehicle Management at CAHA
[21] NCWRC, Addendum to the Final Report of the Proceedings of the Negotiated Rulemaking Advisory Committee for Off-Road Vehicle Management at CAHA
[22] NCWRC, Addendum to the Final Report of the Proceedings of the Negotiated Rulemaking Advisory Committee for Off-Road Vehicle Management at CAHA
[23] Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle, Second Revision
[24] U.S. F&WS, Addendum to the Final Report of the Negotiated Rulemaking Advisory Committee for Off-Road Vehicle Management at CAHA, 2009
[25] North Carolina Wildlife Resources Commission, Addendum to the Final Report of the Proceedings of the Negotiated Rulemaking Advisory Committee for Off-Road Vehicle Management at CAHA
[26] Personal communication between Larry Hardham and Dubose Griffin, Sea Turtle Coordinator SCDNR

- No adult sea turtle has ever been run over at CHNS and the night driving issue evolves around the perceived impact on hatchlings.
- Moving lights have less of a disorienting effect on sea turtles than fixed light according to Sandy McPherson.
- The issue of hatchlings and light disorientation (as a result of fixed or moving lights) can be dealt with thru the use of an enhanced “Night Turtle Watch” program patterned after that in use at Pea Island National Wildlife Refuge. Since CHNS has no idea how many hatchlings avoid ghost crab predation and actually get into the ocean, or how many are actually disoriented due to light, such a program would greatly improve the number of hatchlings entering the ocean. The Pea Island night watch program should be copied and extended until dawn thru the use of volunteers and trained NPS interns.
- The use of garden fencing, similar to that used by Pea Island, blocks all disorienting light and ensures that hatchlings are not injured or eaten by ghost crabs on their way to the ocean.
- The other advantage of the Pea Island program is that closures do not need to be expanded and silt fencing installed and maintained by NPS staff. This saves much NPS staff time and money while allowing for safe public use of the beaches. The closure around a nest can remain at 30x30 and only at night when hatchlings are expected to emerge is the closure extended to the water line.
- The potential for a “take” (DEIS page 220) is also greatly reduced by the use of safe areas and the above enhanced “Night Turtle Watch” program. The concern over potential takes in the CHNS annual reports pale in comparison to the effective loss of 43.47% of nests in the past ten years due to the current NCWRC guidelines for relocation.

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At first blush the loss of 43.47% of nests would appear deplorable, but beyond the power of man to control. This is simply not true. Nearly all the weather losses can be prevented by a proper relocation program on the part of NPS. That science is readily available and practiced at many locations in Virginia[27], South Carolina[28], Georgia[29], Texas[30] and Cape Lookout N.S. by a variety of governmental agencies. Even in North Carolina the USFWS at Pea Island has a more aggressive relocation program[31] than CHNSRA and Pea Island lies within CHNSRA. Except for Texas, all the agencies manage the North Atlantic loggerhead sea turtle population and their various procedures are all approved by USFWS under the current loggerhead recovery plan.

Both F&WS and NCWRC have long advocated the philosophy of "natural nesting" in spite of the consistent 40% losses traditional to Cape Hatteras beaches. Because of their conscious decision, the 27,700 turtles killed here must be considered a "take" under the ESA.

The argument that a single storm could wipe out a safe area/corral is true, but that same storm would also have wiped out the individual nests at their original sites so this argument is not valid.

1. CHANCES FOR ORV/TURTLE CONTACT

The year 2008 had 215 sea turtle activities (112 nests and 103 false crawls). This was the highest in history between May 10 and August 24 according to the CHNSRA annual report period of 107 days. An average of two activities happened per night on the 67.5 miles of shoreline at CHNSRA. Bodie Island had 0.35 activities per mile. Hatteras Island had 3

[27] U.S. Fish F&WS Back Bay National Wildlife Refuge, Virginia
[28] South Carolina DNR Marine Turtle Conservation Program and Guidelines.
http://www.seaturtle.org/nestdb/?view+2

[29] Georgia DNR Sea Turtle Conservation Program
http://www.seaturtle.org/nestdb/?view+2

[30] Padre Island National Seashore, Texas Reports
[31] Pea Island National Wildlife Refuge

activities per mile and Ocracoke Island had 3 activities per mile. On Bodie Island with just 0.35 activities per mile over 107 nights the odds of an encounter (ORV or pedestrian) is about zero. On Hatteras Island and Ocracoke island with 3 activities per mile over 107 days the chances of an encounter are slim to none when one considers that no one knows the time of night when these activities occurred or how many people are on the beaches or where at night.

2. MISSED NESTS

"Missed Nests" is a topic which has created much angst among the three agencies (NPS, USFWS, NCWRC) at Reg. Neg. It was claimed that 5% to 10% of turtle nests are missed by morning patrols. Vehicles should be kept off the beaches until patrols have been completed (DEIS page 104). They propose that hatchlings from those missed nests would emerge in unprotected areas and be subject to the hazard of night vehicles. In their 2006 IPSMS Biological Opinion the USFWS proposed a conservative estimate that 20 to 32 turtle nests were missed each year in CHNSRA.

Analysis of the annual reports from 2000 to 2009 revealed a total of 12 nests missed over those 10 years by patrols from which hatchlings were later discovered[32]. This amounts to 1.2 nests per year. Our actual data does not agree well with the agency expectations of 5% to 10% let alone the 20 – 30 nest/year projected by USFWS.

The seminal study on missed nests was performed by Blair Witherington on Florida beaches in 2008[33]. His scientific study was very competent. However, the interpretation and alarm by the regulatory agencies has been sloppy and misleading. Witherington's study worked with one night of 451 turtle activities having 344 successful nests with eggs and 107 abandoned attempts. The morning patrol found all 451 activities, but classified 133 activities as abandoned attempts. Thus, they failed to detect 26 nests (7.6%) as containing eggs. No distinction was made between false crawls and digs such as routinely performed by resource personnel at CHNSRA. Digs, here, are not treated as abandoned attempts, but recognized only as nest cavities in which eggs were not detected and given protection as if

[32] Personal Communication, Michelle Baker Bogardus
[33] Witherington, Blair, Kubilis, Brost, Meylan; Decreasing Loggerhead Nest Count, ESA journals, Ecological Society of America, January, 2009

they really did contain eggs. Recently CHNSRA resource personnel have placed more emphasis on locating eggs in the cavities to reduce the numbers of activities reported as "digs"[34]. If the Florida experiment had been conducted with the three categories of nest, dig, and crawl, it is uncertain how many (if any) egg nests would have been unprotected. Again, this is an example of applying science when it is not applicable.

Further reduction in missed nests could be accomplished by putting additional eyes on the beach. Night patrols are used at Wassaw, Cape Canaveral and several other parks. Night driving by an educated public should be encouraged to locate turtle nesting as back up for the NPS morning patrols. This could be accomplished through a permit system that could require:

1. Educational / training component
2. Nest location flags
3. Communication equipment; e.g., cell phones or radio
4. Follow through on recorded calls

The best method to reduce missed nests is by trained dog and handler which has proven very successful in Padre Island National Seashore, Hilton Head Island, and Costa Rica[35].

The NPS needs to focus on positive programs:

1. Nest relocation to safer areas: Nests found below spring high tide line must be relocated. As done state-wide in Georgia and South Carolina.
2. Establish efficient nest safe areas/corrals
3. Utilize public night patrols
4. Develop canine missed nest capabilities
5. Provide volunteer corps of nest protectors: Use Pea Island expanded night nest watch procedures at safe areas and nests left on beach.
6. Establish a system of ORV by-pass trails.

[34] Personal Communication, Michelle Baker Bogardus

[35] Padre Island National Seashore, Dogs At Work, Ranger Ridley by Andrew N. Guthrie.
Click here: Padre Island National Seashore - Dog to Help Staff (U.S. National Park Service)

The NPS should follow the science and proven methods currently used elsewhere. Our best example of proven science might be found at Padre Island, Texas where the Kemp's Ridley turtle is being brought back from the brink of extinction[36]. In the 1980's there were only one or two nests every one to three years. By 2008 there were 195 Ridley nests in Texas and 93 of them were in Padre Island. This success was due to human intervention in Texas and Mexico. It was not brought about by such "Natural Nesting" mantras. Natural nesting is not applicable to beaches already altered by man with dune construction and development.

NPS should concentrate on the practice that will recover the loggerhead species and not continue the natural nesting policy that has produced repetitive catastrophic losses over the past 10 years.

[36] Padre Island National Seashore

IV. RECOMMENDED TURTLE PROGRAM INSTRUCTIONS

A. TURTLE PATROL:

This is composed of two separate groups in order to better detect "issued nests" and earliest protection of each nest.

1. FINDERS: Their principal purpose is to quickly survey and identify nests on their section of the beach.
   a. Check operation and fuel level of ATV.
   b. Communication check-in with cell phone or radio as equipped.
   c. Check supplies on ATV.
   d. Call in for special instructions and any information from night beach users.
   e. Start patrol on beach not later than twilight. Sufficient visibility is required for safe operation and detection of turtle activity.
   f. When suspect nest is found, identify by erecting a six foot enclosure using 4 foot pieces of ¾ inch PVC pipe. Four of these pipes around the edges of nest disturbance with string and bright color tape should be adequate. Pipes can be driven quickly into sand with a rubber mallet and are safer to carry on an ATV than wooden stakes.
   g. Call in location then immediately resume patrol.
   h. At completion of patrol call in for additional instructions then return.

2. PROTECTORS: This group will determine if location is a nest or dig and protect in place with wooden post, signs and string or upon direction will dig and transport eggs to Relocation Safe Areas/Corrals. Handling shall be by NCWRC Handbook procedures except that eggs will be transported in Styrofoam coolers and shock absorber cradles similar to those used at Padre Island N.S. which affords best protection for beach travel and egg handlers shall use rubber gloves.

   Enclosure should be a 10 meter square for those nests not relocated. Bury transponder ball and temperature recorder at nest as required for sex ratio survey.

The 10 meter size enclosure should be retained through the hatch window to allow nearby pedestrian use and ORV driving to deter ghost crab density.

B. RELOCATION SAFE AREAS AND CORRALS

1. QUANTITY: There should be at least three sites for Relocation Safe Areas/Corrals:

1) Ocracoke Island
2) South Beach Hatteras Island
3) North Beach Hatteras Island

These three sites were chosen to reduce transport time of the relocated eggs and to reduce effects of major hurricanes impacting our coast. Studies in Mexico have shown that delays up to 96 hours have no effects on resultant hatchlings. Bodie Island nests could be moved to Pea Island safe zones with concurrence of USFWS.

2. SITE SELECTION

The optimum location for safe areas/corrals is behind the primary dune for maximum protection against normal storms. At the very least, a high beach location should be used. Vegetation should be removed mechanically and root growth may be retarded by suitable herbicides.

Village beaches should be considered for safe area/corral locations whenever topography is suitable. These sites offer many advantages:

1) Ease of access for personnel and equipment by hard surface roadway
2) Source of a large pool of nearby volunteers
3) Convenient to pedestrian volunteers
4) Night safety lighting for volunteers
5) Opportunities for public education
6) Favorable publicity. Fly flags or banners during hatch windows and arrange for some public release of hatchlings

Nest placement at a corral should be laid in a 2 meter grid.
This process represents a combination of Cape Romain and Back

Bay procedures and should be modified by CHNSRA personnel if required. Nests expected to hatch at similar times could be grouped together.

It is anticipated that NPS would coordinate with USFWS and NCWRC for advice and testing of sand at the safe area/corral sites to ensure that conditions provide an appropriate incubation environment. Test parameters might include:

1) Sand Albedo
2) Grain size of sand
3) Sand, water content and Salinity
4) Proper gas exchange of O_2 and CO_2
5) Temperature range

3. PROCEDURE

Beach eggs would be transferred to cages or corralitos and buried in the sand for natural incubation. Suitable cages would be of the design successfully used at USFWS Back Bay Refuge to ensure no ghost crab predation. Adequate temperature recorders should be buried in the grid to provide data for sex ratio estimation. Shade could be provided if more males are desired. However, more females are required if nesting is to increase at CHNSRA in the future.

Procedures utilized at Back Bay or Padre Island would be used or modified as required by CHNSRA personnel.

Observation and care of hatchlings at hatch time requires the establishment of a strong NPS staff and volunteer organization. The Safe Areas/Corral principal provides efficiency in personnel management since one night observer team can monitor the 30 to 40 nests expected for each Safe Area/Corral. In the normal course of events only one or two hatches would occur each night.

The advantage of the corral process is that storm losses are minimized and predation is prevented. Only a Laboratory Hatchery would produce better success.

Concerns as to vigor or vitality of hatchlings from the relocation safe area/corral process were best answered by the Cape Romain report

of 2007 which stated: “Concerns regarding nest relocation include moving nests into a warmer, drier environment resulting in an increase in nest incubation temperature and a decrease in incubation duration possibly resulting in a smaller, less robust hatchlings. However, our results suggest that these concerns are not valid for Cape Island.”

C. IN-SITU PROTECTION

Hatching procedures used at USFWS Pea Island Refuge would be recommended for those nests allowed to incubate on their initial beach sites. Their procedures provide much better light protection and predator control than currently used at CHNSRA. However, a strong volunteer program would be needed to ensure success. Two shifts of two people each would be recommended to monitor each nest at night. Since some in-situ nests will be in remote locations, night time ORV travel would be necessary for personnel access to the nest site. Without the volunteers there would be no ghost crab protection or data gathered as to how many hatchlings survived to the ocean. Without volunteers to deploy the garden fencing the light protection from silt fencing would be no better than currently provided.

With a proper turtle watch program, silt fencing with its expense and high maintenance would no longer be required. Full beach closures would no longer be necessary except during the few minutes of active hatching.

D. BEACH EVALUATION FACTORS FOR RELOCATION

Prior to April 15 of each year experienced CHNSRA personnel should review and determine those beaches judged to be unsuccessful for turtle nesting and consult with NCWRC staff. As conditions change on the beaches, further determinations could be made that would influence a decision to relocate a particular nest.

Some parameters that could be considered would be:

1. Historical good hatch success
2. Determine the debris line spring high tide: **make GPS record for turtle patrol**
3. General topography
4. Overall elevation of beach
5. Nest elevation
6. Cliff formation
7. Swale
8. Gullies
9. Historical low erosion rate
10. Past experience of 40% or greater loss. In the past seven years 33% of our one-mile beach segments failed this test.
11. Ghost crab population
12. Conflict with Federal listed bird closure
13. Conflict with public access
14. Accessible for nest watchers
15. Within one mile of points or spits
16. Area where dune rebuilt or destroyed within last 10 years
17. Area susceptible to erosion

E. TIME FACTORS FOR RELOCATIONS

CHNSRA data from the past ten years show that nests laid after July 9 have less than a 50% chance to hatch because of summer storm activity. Therefore all nests laid after this date should be relocated to safe areas/corals.

Managers should ask themselves four questions:

1) Is the nest site safe for later hatching: above debris line of spring high tide.
2) Is the location poor by spring beach assessment
3) Is the lay date prior to July 9th

The nest needs to be relocated if any answer is negative.

F. SEASONAL DATES FOR MONITORING

Review of CHNSRA data for the 11-year period (1997-2009) show only one turtle nest was laid as early as mid-April that hatched. Sand temperatures were too cold and the nest did not hatch. The first successful nest was on May 1. No nests laid after August 31 ever hatched. Only four nests were laid after that date. (Graph # 2) Turtle monitoring by daily patrol should begin May 1 and end August 31.

G. RECORDS

The number of male and female hatchlings that safely enter the water is the factor that we can most directly control. Any recovery plan must gather and monitor data that evaluates the success of the program. Essential features should include:

1. Turtle Nest Information:
   a. Location by mile marker, GPS and position on beach profile
   b. Dates laid and hatched
   c. Sand temperature
   d. Incubation time
   e. Estimate sex ratio from c. and d. above.

2. Provide for and monitor hatchling success.
   a. Prevent predation
   b. Observe health of hatchlings
   c. Ensure safe transit from nest to ocean
   d. Record the number of hatchlings that enter the water
   e. Calculations

%HS	Hatching Success	} Per NCWRC
%ES	Emergence Success	} Turtle Handbook

To calculate average annual park %HS the number of eggs lost must be included. If a nest is lost with an unknown quantity of eggs: that year's average eggs per nest should be used for the calculation.

%RS Release Success: This is the number of hatchlings released to the water divided by the number of eggs laid. This parameter, along with the total nests laid, are the most important data points to gauge the turtle program success.

H. NIGHT ORV DRIVING PROGRAM

1. Permit required for vehicle operator.

2. PROTOCOL:
   a. Education/instruction by NPS at visitor centers
   b. Permit in possession
   c. Cell phone or radio with NPS contact number
   d. Nest flags in possession

3. OPERATION:
   a. Night driving is a privilege, not for frivolous use. Driving time with lights on should be kept at a minimum. Primary uses for fishing, night sky viewing, astronomy and turtle volunteers. Night driving is required to monitor those nests allowed to incubate in remote areas.
   b. Instructions when turtle crawl or nesting detected.
      1) Turn off all lights including flash lights
      2) Contact NPS with location
      3) Mark nest with flags
      4) Warn any other vehicles or pedestrians
   c. Speed limit should be 15mph at night

4. ENFORCEMENT:
   Failure to carry permit, flags or phone/radio in vehicle is grounds to revoke permit for night driving.

5. SYMBOLIC FENCING:
   Wooden posts should have red reflectors or reflective tape on at least two sides readily visible to ORV drivers. Discontinue all carsonite stakes visible on beach.

I. PEDESTRIAN NIGHT ACCESS/BEACH BADGES:

The annual reports contain references of female turtles harassed by pedestrians as the turtles attempted to nest. This is a problem that can be addressed through an educational component of a beach badge that would be required for pedestrians to access the beach at night. Beach badges would be available at all visitor centers, rental agencies and tackle shops. Pedestrians would be required to sign a receipt for the badge that acknowledges an understanding of responsible behavior to wildlife on the night beaches. The educational component could be a video or in pamphlet form. This offers an opportunity for NPS to educate their visitors

on control of house lights and stewardship of all wildlife. Regulations could also explain use of camp fires on the beach.

J. PREDATOR CONTROL

The Back Bay cages have proven effective against all predators.
The relocation to safe area/corral process would have little problem with predation. However, those nests left on the beach would benefit from predator control.

Ghost crabs predation can be reduced by maintaining small enclosures and encouraging ORV traffic prior to hatch. The attendance of volunteers at hatch time with the modified Pea Island night nest watch procedure can minimize predation of the hatchlings.

Other national seashores believe that their mandate to protect the natural eco-system would prohibit killing of predators. They manage predation by concentrating on nest protection methods as illustrated by the attached Cape Canaveral Exhibit (Exhibit D) and "South Carolina Guidelines for Marine Turtle Permit Holders" (ExhibitJ) page 6.

The other constraint is that excessive removal of mammals will increase the ghost crab population. The undue interference with natural systems has unintended results. (See attached article on raccoons and ghost crabs by Brandon Barton.)

K. VOLUNTEER GROUP

The key to Turtle Recovery at CHNSRA is the strong volunteer organization required for morning ATV patrols and night nest sitting that are part of the relocation safe area/corral and in-situ Pea Island modified night nest watch procedures.

This may be the most formidable task before the NPS. Some volunteers can be imported from other parts of the country. Each year new people arrive to become part of the permanent community and could serve as volunteers. The people of the villages were once a rich resource of volunteers in the past. Not long ago the lighthouse complex was all volunteers.

Animosity within the villages may increase unless NPS changes course to restore public access to their popular beaches. Public acceptance and participation will depend on how NPS pursues its policies.

The turtle program is not an exact science. We are dealing with a natural biological process subject to wide variations. Some nests are laid in areas which have the potential for high success; others are not. Within a nest some eggs do not hatch, but most produce turtles of vigor and vitality and there are individuals that range between these two extremes. Similar variations occur between nests laid by different females on the same beach.

There will be losses regardless. We can exercise diligence and try our best to minimize those losses within the confines of funding and personnel.

Technicians who dig nests and handle eggs must be properly trained. The hatch rate and health of hatchlings can be influenced by poor handling. There is no substitute for experience. Efforts must be made to retain managers who are not only an expert in turtle biology, but have obtained years of experience understanding the CHNSRA beach environment as it is impacted by wave and weather.

As the NCWRC and USFWS agencies share their vision as to the protection of wildlife within a recreational area it may be appropriate for the NPS to solicit funds and personnel from them to aid in this endeavor.

Exhibit - Management Zone Map

APPENDIX C SEA TURTLE MANAGEMENT ZONES

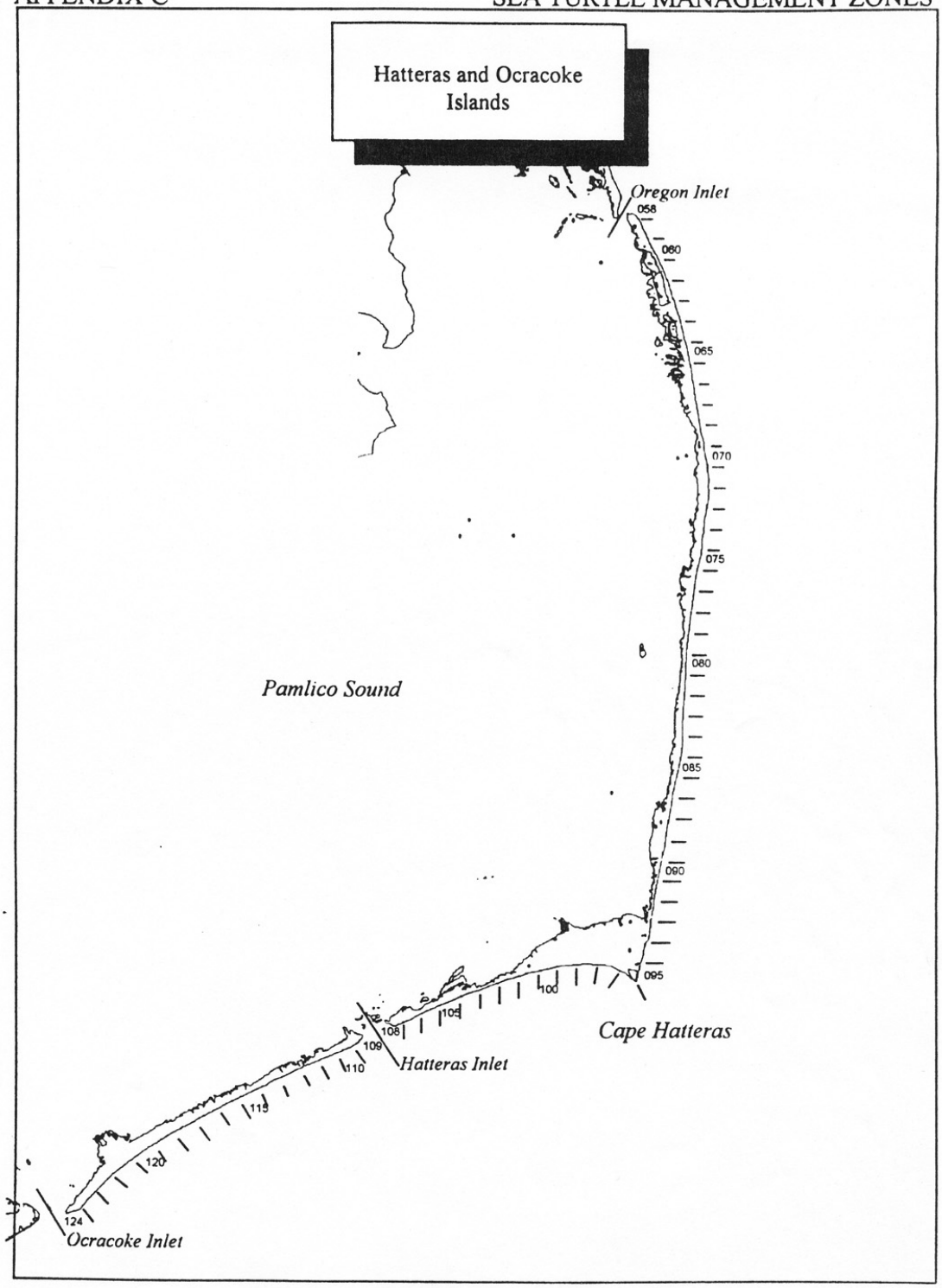

Table 1 – Hatch Success Rates by Zone at CAHA – page 1

	Hatch success rates by zone for 2000 thru 2009 at CHNS							
ZONE	2000-09 TOTAL Hatch Rate > 20%	2000-09 TOTAL Hatch Rate < 20%	2000-06 TOTAL Lost Nests	2000-09 TOTAL Activity	Approximate Location of Ramps, Piers & Villages		Percent Success (Hatch Rate > 20% / Total Activity)	
Bodie Island							**Bodie Island**	
52	2	0	1	3	**Ramp 1**		66.67%	Too few nests to draw any conclusion (less than one nest / yr.)
53	1	0	0	1			100.00%	Too few nests to draw any conclusion (less than one nest / yr.)
54	3	0	0	3			100.00%	Too few nests to draw any conclusion (less than one nest / yr.)
55	0	0	2	2	**Ramp 4**		0.00%	Too few nests to draw any conclusion (less than one nest / yr.)
56	0	0	1	1			0.00%	Too few nests to draw any conclusion (less than one nest / yr.)
57	1	0	1	2			50.00%	Too few nests to draw any conclusion (less than one nest / yr.)
B I Subtotal	**7**	**0**	**5**	**12**			**58.33%**	**Bodie Island Subtotal**
Hatteras Island							**Hatteras Island**	
70	3	0	2	5	**Rodanthe**		60.00%	Too few nests to draw any conclusion (less than one nest / yr.)
71	3	0	2	5	**Pier**		60.00%	Too few nests to draw any conclusion (less than one nest / yr.)
72	4	0	3	7	**Waves**		57.14%	Too few nests to draw any conclusion (less than one nest / yr.)
73	5	1	4	10	**Waves**		50.00%	Too few nests to draw any conclusion (less than one nest / yr.)
74	6	3	1	10	**Salvo**		60.00%	Too few nests to draw any conclusion (less than one nest / yr.)
75	3	1	3	7	**Ramp 23**		42.86%	Too few nests to draw any conclusion (less than one nest / yr.)
76	8	2	8	18		**Doomed**	44.44%	Low history of success
77	6	0	6	12		**Doomed**	50.00%	Low history of success
78	6	2	11	19	**Ramp 27**	**Doomed**	31.58%	Low history of success
79	7	0	4	11			63.64%	Fairly high success rate
80	4	1	2	7			57.14%	Too few nests to draw any conclusion (less than one nest / yr.)
81	5	0	2	7	**Ramp 30**		71.43%	Too few nests to draw any conclusion (less than one nest / yr.)
82	6	1	3	10			60.00%	Too few nests to draw any conclusion (less than one nest / yr.)
83	11	2	7	20		**Doomed**	55.00%	Low history of success
84	5	2	3	10			50.00%	Too few nests to draw any conclusion (less than one nest / yr.)
85	4	1	5	10	**Ramp 34**		40.00%	Too few nests to draw any conclusion (less than one nest / yr.)
86	7	1	0	8	**Avon**		87.50%	Too few nests to draw any conclusion (less than one nest / yr.)
87	9	1	6	16	**Pier**	**Doomed**	56.25%	Low history of success
88	7	1	10	18	**Avon**	**Doomed**	38.89%	Low history of success
89	3	0	3	6	**Ramp 38**		50.00%	Too few nests to draw any conclusion (less than one nest / yr.)
90	14	1	9	24		**Doomed**	58.33%	Low history of success
91	22	0	10	32			68.75%	Fairly high success rate
92	24	0	3	27	**Buxton**		**88.89%**	**Highest success rate on Island**
93	18	0	14	32	**Buxton**	**Doomed**	56.25%	Low history of success
94	29	1	11	41	**Ramp 43**		**70.73%**	**High success rate**
95	15	2	11	28	**Ramp 44**	**Doomed**	53.57%	Low history of success
H I East Subtotal	**234**	**23**	**143**	**400**			**58.50%**	**Hatteras Island East Subtotal**

Source: CHNS Annual Turtle Reports

prepared by: Larry Hardham

Table 1 – Hatch Success Rates by Zone – page 2

ZONE	2000-09 TOTAL Hatch Rate > 20%	2000-09 TOTAL Hatch Rate < 20%	2000-06 TOTAL Lost Nests	2000-09 TOTAL Activity	Approximate Location of		Percent Success (Hatch Rate > 20% / Total Activity)		
96	10	0	8	18		Doomed	55.56%		Low history of success
97	8	1	5	14		Doomed	57.14%		Low history of success
98	4	0	3	7			57.14%		Too few nests to draw any conclusion (less than one nest / yr.)
99	4	1	7	12		Doomed	33.33%		Low history of success
100	16	2	11	29		Doomed	55.17%		Low history of success
101	15	3	6	24	Frisco		62.50%		Fairly high success rate
102	7	1	5	13	Pier	Doomed	53.85%		Low history of success
103	10	2	5	17		Doomed	58.82%		Low history of success
104	13	2	9	24	Hatteras	Doomed	54.17%		Low history of success
105	6	1	4	11	Hatteras	Doomed	54.55%		Low history of success
106	12	0	7	19	Ramp 55		63.16%		Fairly high success rate
107	4	0	0	4			100.00%		Too few nests to draw any conclusion (less than one nest / yr.)
108	0	0	3	3			0.00%		Too few nests to draw any conclusion (less than one nest / yr.)
109	0	0	0	0			0.00%		Too few nests to draw any conclusion (less than one nest / yr.)
H I South Subtota	**109**	**13**	**73**	**195**			**55.90%**	**Hatteras Island South Subtotal**	
Ocracoke Island								**Ocracoke Island**	
110	4	0	5	9			44.44%		Too few nests to draw any conclusion (less than one nest / yr.)
111	6	1	3	10	Ramp 59		60.00%		Fairly high success rate
112	7	0	6	13		Doomed	53.85%		Low history of success
113	9	1	4	14			64.29%		Fairly high success rate
114	12	0	7	19			63.16%		Fairly high success rate
115	10	3	3	16			62.50%		Fairly high success rate
116	10	0	8	18		Doomed	55.56%		Low history of success
117	15	3	4	22			**68.18%**		**Highest success rate on Island**
118	10	1	5	16	Ramps 67 & 68		62.50%		Fairly high success rate
119	14	4	6	24		Doomed	58.33%		Low history of success
120	10	2	10	22		Doomed	45.45%		Low history of success
121	4	1	12	17		Doomed	23.53%		Low history of success
122	4	0	8	12	Ramp 70	Doomed	33.33%		Low history of success
123	6	0	6	12		Doomed	50.00%		Low history of success
124	2	0	3	5	Ramp 72		40.00%		Too few nests to draw any conclusion (less than one nest / yr.)
O I Subtotal	**123**	**16**	**90**	**229**			**53.71%**	**Ocracoke Island Subtotal**	
TOTAL	**473**	**52**	**311**	**836**			**56.58%**	**all zones success rate**	
	Nests should not be left or relocated to zones that have a 60% or less chance of success.								

Source: CHNS Annual Turtle Reports

prepared by: Larry Hardham

Table 3 – CAHA, CALO Sea Turtle Eggs & Hatched – 2000-2009

Cape Hatteras National Seashore Sea Turtle Eggs & Hatched 2000-2009

Year	Nests (A)	Average Clutch Size (B)	Eggs (A times B)	Hatchlings Emerged	Emergence Rate		% nests Relocated	Emergence Rate for Relocated	Emergence Rate for Non-Relocated
2000	84	102	8,568	4,984	58%		29%	78%	53%
2001	75	101.7	7,628	3,402	45%		43%	56%	31%
2002	99	108.7	10,761	7,201	67%		36%	70%	70%
2003	87	115.7	10,066	2,708	27%		18%	24%	27%
2004	43	103.4	4,446	1,609	36%		36%	35%	27%
2005	73	114.6	8,366	4,142	50%		40%	65%	37%
2006	76	114.8	8,725	4,444	51%		21%	51%	67%
2007	82	112.1	9,192	6,075	66%		15%	70%	56%
2008	112	109	12,208	5,965	49%		17%	50%	52%
2009	104	115	11,960	3,430	29%		31%	32%	30%
Total	**751**		**83,352**	**38,976**	**47%**	**Average**	**29%**	**50%**	**44%**

Nests are moved back from high tide line

Could be improved by use of reolcation areas like Lookout

Source of data is CHNS Annual Sea Turtle reports except as noted

Cape Lookout National Seashore Sea Turtle Eggs & Hatched 2000-2009

Year	Nests (A)	Average Clutch Size (B)	Eggs (A times B)	Hatchlings Emerged	Emergence Rate		% nests Relocated	Emergence Rate for Relocated	Emergence Rate for Non-Relocated
2000	190	111	21,090	13471	64%		63%	66%	61%
2001	119	113	13,447	9,555	71%		50%	81%	76%
2002	123	119	14,637	10,758	73%		45%	73%	84%
2003	161	119	19,159	10,067	53%		41%	47%	75%
2004	77	104	8,008	3,139	39%		44%	63%	23%
2005	142	111	15,762	6,569	42%		34%	42%	61%
2006	131	125	16,375	10,843	66%		39%	85%	64%
2007	85	109	9,265	8,759	95%		24%	79%	70%
2008	107	111	11,877	6,868	58%		30%	57%	64%
2009	141	116	16,356	7,574	46%		25%	61%	41%
Total	**1276**		**145,976**	**87,603**	**60%**	**Average**	**40%**	**65%**	**62%**

Nests are relocated to relocation areas in Seashore determined at start of season.

"Nests laid in tidal wash zone, primary berm and back swale are considered in danger of erosion or flooding" and moved.

Source of data is CALO Annual Sea Turtle reports except as noted

Entries in yellow boxes not in annual report and calculated by me.

Source: CHNS, CALO Annual Turtle Reports

prepared by: Larry Hardham

Table 4 – CAHA, CALO False Crawl to Nest Ratio – 2000-2009

FALSE CRAWL to NEST RATIO & AS PERCENT OF TOTAL ACTIVITIES

Cape Hatteras

(Source of data is CHNS annual Sea Turtle Reports as revised in 2009)

2 years when white carsonite stakes were used at all closures

24 False Crawls in bird closure at Cape Point

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009				Total	Average Thru 09
Nests	84	75	99	87	43	73	76	82	112	104				835	**83.5**
False Crawls	98	49	60	48	**78**	**104**	65	**114**	103	101				820	**82.0**
Total Activities	182	124	159	135	121	177	141	196	215	205				1655	**165.5**
False Crawl to Nest Ratio	**1.17 to one**	**0.65 to one**	**0.61 to one**	**0.55 to one**	**1.81 to one**	**1.42 to one**	**0.86 to one**	**1.39 to one**	**0.92 to one**	**0.97 to one**					**0.98 to one**
Nests as % of Total Activities	46.15%	60.48%	62.26%	64.44%	35.54%	41.24%	53.90%	41.84%	52.09%	50.73%					**50.45%**
False Crawls as % of Total Activities	53.85%	39.52%	37.74%	35.56%	64.46%	58.76%	46.10%	58.16%	47.91%	49.27%					**49.55%**

Hatteras has nearly four times the visitors that Lookout has per NPS Visitation web site.

Cape Lookout

(Source of data is CALO annual Sea Turtle Reports)

Does not have 3 ocean piers and seven ocean front villages like Hatteras.

Nests	190	119	123	161	77	142	131	85	107	140				1275	**127.50**
False Crawls	148	72	98	144	122	169	136	88	116	157				1250	**125.00**
Total Activities	338	191	221	305	199	311	267	173	223	297				2228	**247.56**
False Crawl to Nest Ratio	**0.78 to one**	**0.61 to one**	**0.80 to one**	**0.89 to one**	**1.58 to one**	**1.19 to one**	**1.04 to one**	**1.04 to one**	**1.08 to one**	**1.12 to one**					**0.98 to one**
Nests as % of Total Activities				56.21%	62.30%	55.66%	52.79%	38.69%	45.66%	49.06%	49.13%	47.98%	47.14%		**51.50%**
False Crawls as % of Total Activities				43.79%	37.70%	44.34%	47.21%	61.31%	54.34%	50.94%	50.87%	52.02%	52.86%		**50.49%**

Cape Hatteras & Cape Lookout have nearly identical percentage of Nests to Total Activities.

Cape Hatteras & Cape Lookout have identical percentage of False Crawls to Total Activities.

Both Seashores have False Crawl to Nest ratio at or lower than what is expected of an undeveloped beach.

Source: CHNS, CALO Annual Turtle Reports

prepared by: Larry Hardham

Table 5 - CAHA, CALO Lost Nests as % of Total Nests – 2000-2009

LOST NESTS AS PERCENT OF TOTAL NESTS

Cape Hatteras National Seashore

(Source of data is CHNS annual Sea Turtle Reports)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Totals Thru 09
Total Nests	84	75	99	87	43	73	76	82	112	104	835
Hatch > 20%	26	35	88	29	18	48	46	59	69	57	475
Naturally Hatch < 20%	3	6	2	2	3	1	6	10	7	12	52
Lost Nests	55	34	9	57	22	24	24	13	36	37	311
DIGS"	0	0	2	1	10	3	8	4	0	0	28
Lost as % of Total Nests	65.48%	45.33%	9.09%	65.52%	51.16%	32.88%	31.58%	15.85%	32.14%	35.58%	37.25%
Lost & < than 20%	69.05%	53.33%	11.11%	67.82%	58.14%	34.25%	39.47%	28.05%	38.39%	47.12%	43.47%

43.47% if you include the 52 "Naturally Hatch <20%" nests with lost nests totaling 363 effectively lost
These 52 nests emerged on average 7.9% of their hatchlings.

Another 18 nests in 2009 would likely have been lost if 2 had not been relocated and 16 excavated just before approaching storms.

Cape Lookout National Seashore

(Source of data is CALO annual Sea Turtle Reports)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Totals Thru 09
Total Nests	190	119	123	161	77	142	131	85	107	141	1276
Hatched Nests	188	114	116	116	41	88	112	66	98	117	1056
Lost Nests	2	5	7	45	36	54	19	19	9	24	220
Lost as % of Total Nests	1.05%	4.20%	5.69%	27.95%	46.75%	38.03%	14.50%	22.35%	8.41%	17.02%	17.24%

Cape Hatteras has over twice the percentage of nests lost that Cape Lookout has.
When lost nests are added to nests hatching under 20% Hatteras looses 43.47% of nests

Relocation criteria is different at Lookout and they use relocation areas and not just up the beach as is done at Hatteras. At Lookout in 2008 and 2009 nests have been moved five and six miles to relocation areas.

Source: CHNS, CALO Annual Turtle Reports

prepared by: Larry Hardham

Table 6 – Leatherback Sea Turtle Nests in North Carolina – 1997-2009

Leatherback Sea Turtle Nests in North Carolina

Year	Total leatherback nests	Total leatherback false crawls	Nests relocated	Nests with 0% hatch success
1997	0	0	0	0
1998	2	0	0	2
1999	0	0	0	0
2000	4	0	0	3
2001	0	0	0	0
2002	1	0	0	0
2003	0	0	0	0
2004	8	0	1	8
2005	8	1	2	5
2006	0	0	0	0
2007	9	0	0	2
2008	0	0	0	0
2009	3	0	0	1
Totals	35	1	3	21

Following NCWRC policies, 21 of 35 (60%) Endangered Leatherback nests have had a zero hatch success for 1997 thru 2009 statewide!

Source: Personal communication from Matthew Godfrey, NCWRC

Prepared by: Larry Hardham

Table 7 – Sea Turtle Relocation Comparison by State

Sea Turtle Comparisons by States on Atlantic coast

		Year	% of nests relocated	% of nests 0% hatch	Relocation Criteria
Back Bay NWR, VA		**2009**	**100%**	**0.0%**	**Move all nests behind primary dune line at this National Wildlife Refuge**
					Source: Personal communication from Geralyn Mireles USF%&W
NC		**2009**	**31.5%**	**21.0%**	**Currently use NCWRC guideline for nest relocation in most areas**
					Source: Personal communication from Matthew Godfrey NCWRC
	CHNSRA	**2009**	**31.0%**	**35.6%**	**Currently use NCWRC guideline of "average high tide" for relocation criteria**
				47.1%	if include nests that hatch under 20%
					Source: CAHA 2009 Annual Sea Turtle Report
	CHNSRA	**2000-2009**	**29.0%**	**37.3%**	**Has used NCWRC guideline of "average high tide" for relocation criteria**
				43.5%	if include 52 nests that hatched under 20% (these agerage 7.7% hatch success)
					Source: CAHA Annual Sea Turtle Reports
	CALO	**2000-2009**	**40.0%**	**17.2%**	**Does not use NCWRC guidelines - have their own criteria approved by NCWRC**
					Source: CALO 2009 Annual Sea Turtle Report
SC					**Currently use "debris line marking spring high tide" for relocation criteria**
					http://www.islc.net/~fripplog/Docs/Nest%20Protection%20Guidelines-SC%20DNR.pdf
		2009	**40.3%**		http://www.seaturtle.org/nestdb/?view+2
				12.9%	Source: Personal communication with Dubose Griffin, SCDNR on 3/11/2010
	Cape Romain NWR	**2009**	**67.30%**		
GA	**all species**	**2009**	**48.9%**		http://www.seaturtle.org/nestdb/?view+2
					and click on Georgia DNR Sea Turtle Conservation Program
	loggerhead	**2009**	**48.85%**	**13.04%**	Source: Mark Dodd Georgia Sea Turtle Program Coordinator personal communication
	loggerhead	**2000-2009**	**38.1%**	**14.35%**	Source: Mark Dodd Georgia Sea Turtle Program Coordinator personal communication
	Sapelo Island, GA	**2009**	**48.60%**		http://www.seaturtle.org/nestdb/?view+2
					and click on Georgia DNR Sea Turtle Conservation Program
	Wassaw NWR,GA	**2009**	**57.1%**	**5.5%**	**Currently use "spring high tide line" for relocation criteria**
					Source : 2009 Annual report (all lost nests were nests left *in situ*) (hatch rate for in situ nests 62.3% and hatch rate for relocated nests was 73.3%)
		2008	**49.2%**	**no data**	http://www.carettaresearchproject.org/2008_stats.htm
		2007	**46.0%**	**no data**	http://www.carettaresearchproject.org/2007_stats.htm
		2006	**46.8%**	**6.4%**	http://www.carettaresearchproject.org/2006_stats.htm
FL		**2000-08**	**3.3%**	******	**Unknown relocation criteria**
		2009			

***** "We are unable to provide the number of nests statewide with 0% hatching success as these data are not typically provided to us by the entities that collect the data." Source: Personal communication from Anne Meylan, Ph.D. FWC***

Prepared by: Larry Hardham

Table 8 – Sea Turtle Comparisons by State – False Crawl Ratios

	Sea Turtle Comparisons by States on Atlantic coast					
			FALSE			
			Crawl		**Night**	**No**
		Year	**Ratio**		**Driving**	**Night**
					Allowed	**Driving**
	USF&W Standard		**1:01**			
	Back Bay NWR, VA	**2009**	**0.33:1**			**X**
	NC	**2009**	**0.81:1**	Source: Personal communication from Matthew Godfrey NCWRC		
	Pea Island NWR	**2009**	**0.80:1**	Source: Personal communication from Kris Fair, PINWR		**X**
	CHNSRA	**2009**	**0.97:1**	Source: CAHA 2009 Annual Sea Turtle Report		**X**
		2008	**0.92:1**	Source: CAHA Annual Sea Turtle Reports		**X**
		2006-2009	**1.04:1**	Source: CAHA Annual Sea Turtle Reports **WHITE & BROWN CARSONITE STAKES**	**X**	
		2004-2005	**1.62:1**	Source: CAHA Annual Sea Turtle Reports **WHITE CARSONITE STAKES**	**X**	
		1997-2003	**0.76:1**	Source: CAHA Annual Sea Turtle Reports	**X**	
	CALO	**2000-2009**	**0.98:1**	Source: CALO 2009 Annual Sea Turtle Report	**X**	
	SC	**2009**	**1.54:1**	http://www.seaturtle.org/nestdb/?view+2		**X**
	Cape Romain NWR	**2009**	**2.32:1**	http://www.seaturtle.org/nestdb/?view+2		**X**
	GA all species	**2009**	**1.63:1**	http://www.seaturtle.org/nestdb/?view+2		
				and click on Georgia DNR Sea Turtle Conservation Program		
	loggerhead		**1.48:1**	Source: Mark Dodd Georgia Sea Turtle Program Coordinator personal communication		
	loggerhead	**2000-2009**	**1.07:1**	Source: Mark Dodd Georgia Sea Turtle Program Coordinator personal communication		
	Sapelo Island, GA	**2009**	**1.80:1**	http://www.seaturtle.org/nestdb/?view+2		**X**
				and click on Georgia DNR Sea Turtle Conservation Program		
	Wassaw NWR,GA	**2009**	**1.57:1**	http://www.carettaresearchproject.org/2009_stats.htm		**X**
		2008	**1.29:1**	http://www.carettaresearchproject.org/2008_stats.htm		**X**
		2007	**2.21:1**	http://www.carettaresearchproject.org/2007_stats.htm		**X**
		2006	**0.89:1**	http://www.carettaresearchproject.org/2006_stats.htm		**X**
		1973-2009	**1.20:1**	Source : 2009 Annual report		**X**
	FL	**2009**	info.not available			
		2000-08	**1.09:1**			

Prepared by Larry Hardham

Table 9 – Hatteras False Crawls – Impact of White Carsonite Stakes – 1997-2009

FALSE CRAWLS AT CAPE HATTERAS NATIONAL SEASHORE

Cape Hatteras	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Nests	37	98	92	84	75	99	87	43	73	76	82	112	104
False Crawls	30	76	68	98	49	60	48	78	104	**65**	114	103	101
Total Activities (nests & false crawls)	67	174	160	182	124	159	135	121	177	141	196	215	205
False Crawl to Nest ratio	0.81:1	0.77:1	0.74:1	1.17:1	0.65:1	0.61:1	0.55:1	1.81:1	1.42:1	0.86:1	1.39:1	0.92:1	0.97:1
	Wood 2x2 posts							**White Carsonite Stakes Used**		**Brown Carsonite Stakes Used**			
											24 in Cape Point bird closure		
Ratio average			**Average**	**0.76:1**				**Average**	**1.62:1**		**Average**	**1.04:1**	

DRAMATIC INCREASE IN FALSE CRAWL to NEST RATIO IN 2004 & 2005 WHEN WHITE CARSONITE STAKES WERE USED.

Average ratio for 2006 thru 2009 is still above that of 1997 thru 2003 with use of brown flexible carsonite stakes with reflective signage on tops of stakes.

The 2007 CHNS annual sea turtle report says "Without these irregular false crawls the park-wide false crawl to nest ratio would have been 1:09:1 …." Thus the false crawl to nest ratio for 2006 - 2007 (0.98:1) with night driving is not statistically different from the 2008-2009 (0.95:1)ratio when there was no night time driving.

Source: CHNS Annual Sea Turtle Reports

Prepared by: Larry Hardham

Table 10 – Cape Hatteras False Crawl Ratios – Villages Compared to Total – 2000-2009

Cape Hatteras National Seashore - Village False Crawl Ratio

	False Crawls		Nests	
	Total	**Village**	**Total**	**Village**
2000	98	15	84	7
2001	49	6	75	20
2002	60	11	99	12
2003	48	4	87	10
2004	78	11	43	10
2005	104	5	73	12
2006	65	5	76	15
2007	114	8	82	14
2008	103	15	112	15
2009	101	8	104	16
Totals	820	**88**	835	**131**

Villages have 10.7% of False Crawls and 15.7% of nests

Village FC Ratio 0.67 :1

Village lighting is not a problem regarding false crawls or nesting.

Source of information: CHNS Annual Sea Turtle Reports

Table 11 – Ghost Crab Holes at Cape Hatteras National Seashore

Ghost Crab holes at CHNS Sea Turtle nests in 2006
counted by Larry & Dee Hardham
All nests were located south of Ramp 30

		GHOST CRAB HOLES		
Nest	**Activity**	**within 30x30 Staked Closure**	**In 30 foot wide path to water**	
NH 38	Nest laid on 7/28/06			
	8/16/06	**13**	**93**	
	9/6/06	**17**	**77**	
	Fencing down 9/17			
NH 35	Nest laid on 7/25/06			
	8/15/06	**14**	**55**	
	8/26/06	**12**	**134**	
	9/6/06	**55**	**40**	
	Fencing down 9/17			
NH 34	Nest laid on 7/22/06			
	8/16/06	**20**	**103**	
	9/5/06	**25**		
	Fencing down 9/17			
NH 22	Nest laid on 7/19/06			
	8/16/06	**1**	**57**	
	8/27/06	**0**	**36**	
	9/6/06		**75+**	In silt fencing path
	Fencing down 9/10			
NH 18	Nest laid on 7/1/06			
	8/15/06	**18**	**6**	
	Fencing down 9/1			
NH 14	Nest laid on 6/25/06			
	8/25/06	**2**	**41**	
	Fencing down 8/26			

Table 12 – Sea Turtle Nests in North Carolina – 1997-2009

Larry Hardham request
Sea turtle nests in North Carolina

Year	Total logger head nests	Total logger head false crawls	Nests relocated	Nests with 0% hatch success	0% hatch at CHNS	0% hatch at CALO	Total green nests	Total green false crawls	Nests relocated	Nests with 0% hatch success	Total leather back nests	Total leatherback false crawls	Nests relocated	Nests with 0% hatch success
2000	757	572	273	112	55	2	24	2	5	2	4	0	0	3
2001	630	539	294	87	34	5	4	3	0	2	0	0	0	0
2002	694	600	247	56	9	7	13	11	4	0	1	0	0	0
2003	747	627	277	147	57	45	4	6	2	0	0	0	0	0
2004	343	327	120	105	22	36	4	2	1	2	8	0	1	8
2005	638	610	239	153	24	54	15	21	4	6	8	1	2	5
2006	761	540	160	161	24	19	15	8	1	6	0	0	0	0
2007	533	349	119	77	13	19	21	23	3	3	9	0	0	2
2008	866	586	172	183	36	9	12	2	4	2	0	0	0	0
2009	606	587	193	127	37	24	4	2	0	1	3	0	0	1
Total	6575	5337	2094	1208	311	220	116	80	24	24	33	1	3	19

Source: CHNS , CALO Annual Turtle Reports, personal communication from Matthew Godfrey, NCWRC prepared by: Larry Hardham

Table 13 – Sea Turtle Nests at CAHA, CALO, Total NC – 1997-2009

	NESTS								
				NC statewide			**TOTAL OF**		
Year	**Loggerhead**	**Green**	**Leatherback**	**Total**			**CHNS &**		
	Nests	**Nests**	**Nests**	**all nests**	**CHNS**	**CALO**	**CALO**		
2000	757	24	4	785	84	190	274		
2001	630	4	0	634	75	119	194		
2002	694	13	1	708	99	123	222		
2003	747	4	0	751	87	161	248		
2004	343	4	8	355	43	77	120		
2005	638	15	8	661	73	142	215		
2006	761	15	0	776	76	131	207		
2007	533	21	9	563	82	85	167		
2008	866	12	0	878	112	107	219		
2009	606	4	3	613	104	141	245		
Total	6575	116	33	6724	835	1276	2111		
					12.42%	18.98%	31.40%	This is % of state total	

Source: CHNS , CALO Annual Turtle Reports, personal communication from Matthew Godfrey, NCWRC prepared by: Larry Hardham

Table 14 - Sea Turtle Lost Nests at CAHA, CALO, Total NC – 1997-2009

	LOST NESTS (0% hatch success)								
				NC statewide			**TOTAL OF**	**TOTAL OF**	
Year	**Loggerhead**	**Green**	**Leatherback**	**Total**			**CHNS &**	**CHNS &**	
	Lost Nests	**Lost Nests**	**Lost Nests**	**Lost Nests**	**CHNS**	**CALO**	**CALO**	**CALO**	
2000	112	2	3	117	55	2	57	48.72%	
2001	87	2	0	89	34	5	39	43.82%	
2002	56	0	0	56	9	7	16	28.57%	Gustav
2003	147	0	0	147	57	45	102	69.39%	Isabel
2004	105	2	8	115	22	36	58	50.43%	Alex & Charley
2005	153	6	5	164	24	54	78	47.56%	
2006	161	6	0	167	24	19	43	25.75%	
2007	77	3	2	82	13	19	32	39.02%	
2008	183	2	0	185	36	9	45	24.32%	
2009	127	1	1	129	37	24	61	47.29%	
Total	1208	24	19	1251	311	220	531		
					24.86%	17.59%	42.45%	This is % of state total	
	% of nests lost in NC			18.60%	for 2000-2009				
	% of nests lost at CHNS			37.25%	for 2000-2009		**CHNS twice the NC rate**		
	% of nests lost in NC			21.04%	for 2009	**NC - well above rates of SC & GA**			
	% of nests lost at CHNS			35.58%	for 2009	**CHNS nearly 3 times the rates of SC & GA**			
	% of nests lost in SC			12.90%	for 2009				
	% of nests lost in GA (loggerhead only)			13.04%	for 2009				
	19 of 33 (57.6%) of Endangered Leatherback nests have been lost in NC from 2000-2009								

Source: CHNS , CALO Annual Turtle Reports, personal communication from Matthew Godfrey, NCWRC prepared by: Larry Hardham

Table 15 - Sea Turtle False Crawls at CAHA, CALO, Total NC – 1997-2009

FALSE CRAWLS								
				NC statewide			**TOTAL OF**	
Year	**Loggerhead**	**Green**	**Leatherback**	**Total**			**CHNS &**	Balance of
	FC	**FC**	**FC**	**all FC**	**CHNS**	**CALO**	**CALO**	**NC**
2000	572	2	0	574	98	148	246	328
2001	539	3	0	542	49	72	121	421
2002	600	11	0	611	60	98	158	453
2003	627	6	0	633	48	144	192	441
2004	327	2	0	329	78	122	200	129
2005	610	21	1	632	104	169	273	359
2006	540	8	0	548	65	136	201	347
2007	349	23	0	372	114	88	202	170
2008	586	2	0	588	103	116	219	369
2009	587	2	0	589	101	157	258	331
Total	5337	80	1	5418	820	1250	2070	3348
	2000-2009 False Crawl to Nest Ratio 0.81:1 statewide							

Source: CHNS , CALO Annual Turtle Reports, personal communication from Matthew Godfrey, NCWRC prepared by: Larry Hardham

Table 16 - Sea Turtle Relocated Nests at CAHA, CALO, Total NC – 1997-2009

	RELOCATED NESTS								
				NC statewide			TOTAL OF		
Year	Loggerhead	Green	Leatherback	Total			CHNS &	Balance of	
	Relocated	Relocated	Relocated	Relocated	CHNS	CALO	CALO	NC	
2000	273	5	0	278	24	120	144	134	
2001	294	0	0	294	32	60	92	202	
2002	247	4	0	251	36	56	92	159	
2003	277	2	0	279	16	66	82	197	
2004	120	1	1	122	18	34	52	70	
2005	239	4	2	245	29	49	78	167	
2006	160	1	0	161	16	51	67	94	
2007	119	3	0	122	12	20	32	90	
2008	172	4	0	176	19	32	51	125	
2009	193	0	0	193	32	35	67	126	
Total	2094	24	3	2121	234	523	757	1364	
					11.03%	24.66%	35.69%	This is % of state total	
	% of nests relocated in NC			31.54%	for 2000-2009				
	% of nests relocated at CHNS			28.02%	for 2000-2009				
	% of nests relocated at CALO			40.99%	for 2000-2009		CALO hatch rate higher for relocatd nests		
	% of nests relocated in NC			31.48%	for 2009				
	% of nests relocated at CHNS			30.77%	for 2009				
	% of nests relocated at CALO			24.82%	for 2009				
	% of nests relocated in SC			40.20%	for 2009				
	% of nests relocated in GA			48.90%	for 2009				

Source: CHNS , CALO Annual Turtle Reports, personal communication from Matthew Godfrey, NCWRC prepared by: Larry Hardham

Table 17 – Loggerhead Sea Turtle Nesting Data – Georgia – 2000-2009

Loggerhead Sea Turtle Nesting Data for Georgia Beaches, 2000-2009.

Year	No. of loggerhead nests	No. of loggerhead false crawls	No. of relocated loggerhead nests	No. of loggerhead nests with zero % hatch success	False Crawl to Nest Ratio	% Relocated	% Lost
2000	1074	915	305	258	0.85 :1	28.40%	24.02%
2001	851	1009	234	261	1.19 :1	27.50%	30.67%
2002	1034	1014	402	129	0.98 :1	38.88%	12.48%
2003	1504	1731	643	95	1.15 :1	42.75%	6.32%
2004	367	274	123	67	0.75 :1	33.51%	18.26%
2005	1200	1171	405	133	0.98 :1	33.75%	11.08%
2006	1398	1113	543	95	0.80 :1	38.84%	6.80%
2007	689	1000	301	87	1.45 :1	43.69%	12.63%
2008	1649	1787	654	289	1.08 :1	39.66%	17.53%
2009	997	1475	487	130	1.48 :1	48.85%	13.04%
Totals	10,763	11,489	4,097	1,544	1.07 :1	38.07%	14.35%

Source:Of yearly data shown in first five columns above is

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Table 18 – Sea Turtle Nests Statistics – Florida

FWC Fish and Wildlife Research Institute
Statewide Nesting Beach Survey Program
Annual Sea Turtle Nest and False Crawl Totals, and Number of Relocated Nests, 2000-2008

	Nests				False Crawls				Florida False Crawl to Nest Ratio
	Loggerhead	Green	Leatherback	Totals	Loggerhead	Green	Leatherback	Totals	
2000	84,386	8,404	453	93,243	81,435	8,591	174	90,200	0.97 : 1
2001	69,681	581	935	71,197	59,221	551	266	60,038	0.84 : 1
2002	62,905	9,201	596	72,702	66,122	10,524	289	76,935	1.06 : 1
2003	63,446	2,262	842	66,550	56,852	2,341	306	59,499	0.89 : 1
2004	47,173	3,577	473	51,223	55,766	4,820	135	60,721	1.19 : 1
2005	52,469	9,642	782	62,893	76,686	19,355	453	96,494	1.53 : 1
2006	49,786	4,970	540	55,296	55,972	6,978	195	63,145	1.14 : 1
2007	45,084	12,752	1,442	59,278	54,024	20,920	403	75,347	1.27 : 1
2008	61,467	9,228	728	71,423	61,939	12,799	208	74,946	1.05 : 1
2009				0				0	
Totals	536,397	60,617	6,791	**603,805**	568,017	86,879	2,429	**657,325**	**1.09 : 1**

Information requested via e-mail 2/19/2010
Reply e-mail dated 2/23/2010

Dear Mr. Hardham,
Attached please find the Florida sea turtle nesting data that you requested. **We are unable to provide the number of nests statewide with 0% hatching success as these data are not typically provided to us by the entities that collect the data.**

Thank you for your interest,

Anne Meylan

Anne Meylan, Ph.D.
Florida Fish and Wildlife Conservation Commission
Fish and Wildlife Research Institute
100 8th Avenue S.E.
St. Petersburg, FL 33701
727-896-8626 (phone); 727-893-9176 (fax)
Anne.Meylan@MyFWC.com

Exhibit A – Florida Protection Examples

How Florida

(where 90% of Loggerhead sea turtles nests are laid)

Protects Sea Turtle Nests

(Loggerhead, Green and Leatherback)

on Their Beaches

John D. MacArthur Beach State Park is "**nearly two miles of beach**" with 846 sea turtle nests (as of 8/6/09) in northern Palm Beach County Florida. Open to the public 365 days a year from 8:00AM until sunset. Nests are not even marked as there would then be "not much space for tourists" according to the park nature center staff.

Juno Beach in Jupiter Florida on 5.5 miles of beach as of 8/9/2009 had 3616 sea turtle nests or some 657 nests per mile. At Cape Hatteras, in our best year, we had only 1.7 nests per mile. A handout from the “Loggerhead Marinelife Center” of Juno Beach boasts that “the beaches adjacent to the center host up to 1,000 sea turtle nests per mile each season”.

Juno Beach Florida marks sea turtle nests with a single stake and no protective closures. My son saw two men pitching golf balls at a nest stake to see who could get their ball closest to stake. ***No $150.00 fines either!***

This is Ocean Reef County Park (a public beach), on Singer Island, Florida (just north of Palm Beach) where sea turtle nests are marked with three stakes and a sign.

Ocean Reef County Park, Florida Note size of staked off area (flip flop is approx. one foot long)

Ocean Reef County Park, Florida Unrestricted public use all around nest sites.

Ocean Reef County Park, Florida Note hatchling tracks from night before and beach is open to public use all around nest. Human footprints in Florida apparently are not the death trap to hatchlings that they are in North Carolina. This nest does not even have a sign!

Hatteras Swale Exhibit

2006 Turtle Nesting Season

South of Ramp 30 in the ORV Zone Eight Sea Turtle Nest Were Laid in the Summer of 2006

Nest # 14 - .6 miles – laid on 6-25-2006

Nest # 18 – 1.4 miles – laid on 7-1-2006

Nest # 22 – 1.5 miles – laid on 7-9-2006

Nest # 2 – 1.5 miles – laid on 6-6-2006

Nest # 38 – 2.2 miles – laid on 7-28-2006

Nest # 35 – 2.4 miles – laid on 7-25-2006

Nest # 13 – 2.5 miles – laid on 6-25-2006

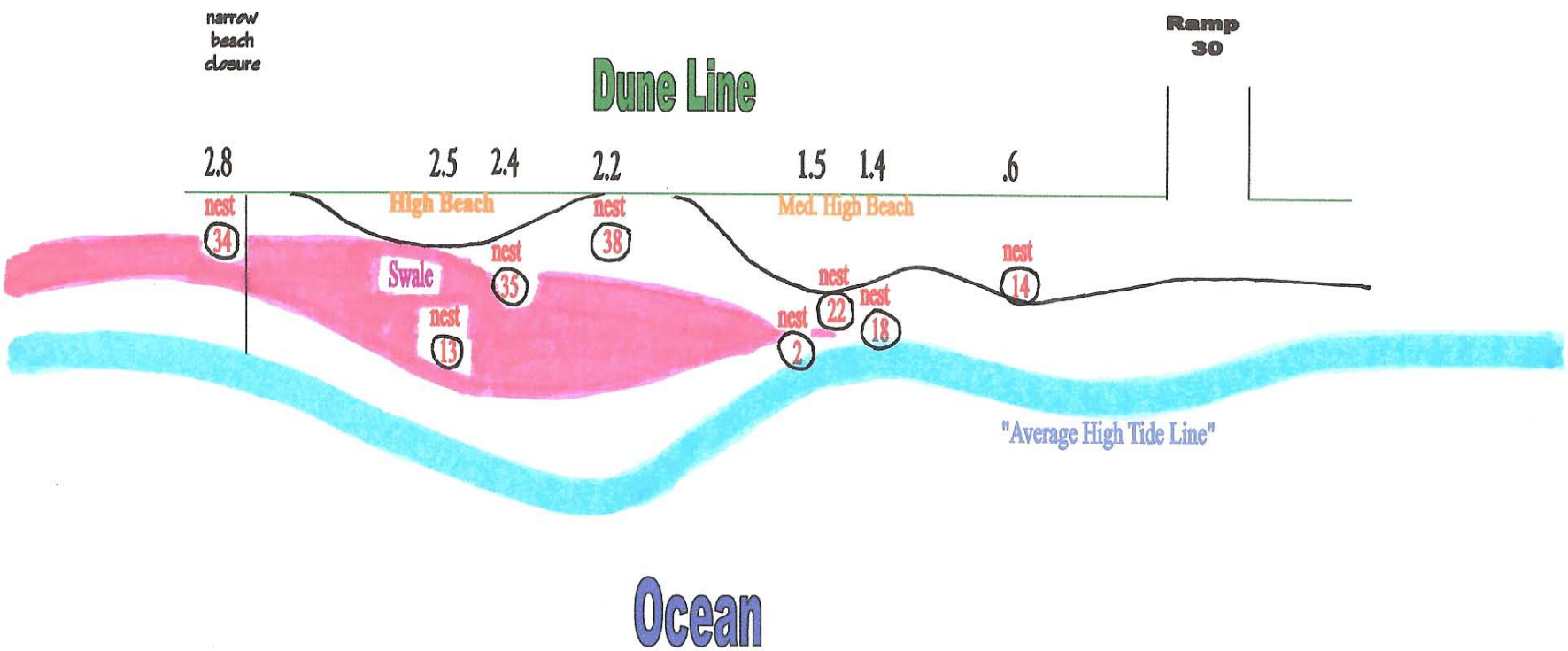
Nest # 34 – 2.8 miles – laid on 7-22-2006

None were moved and five (62.5%) failed to hatch!!!

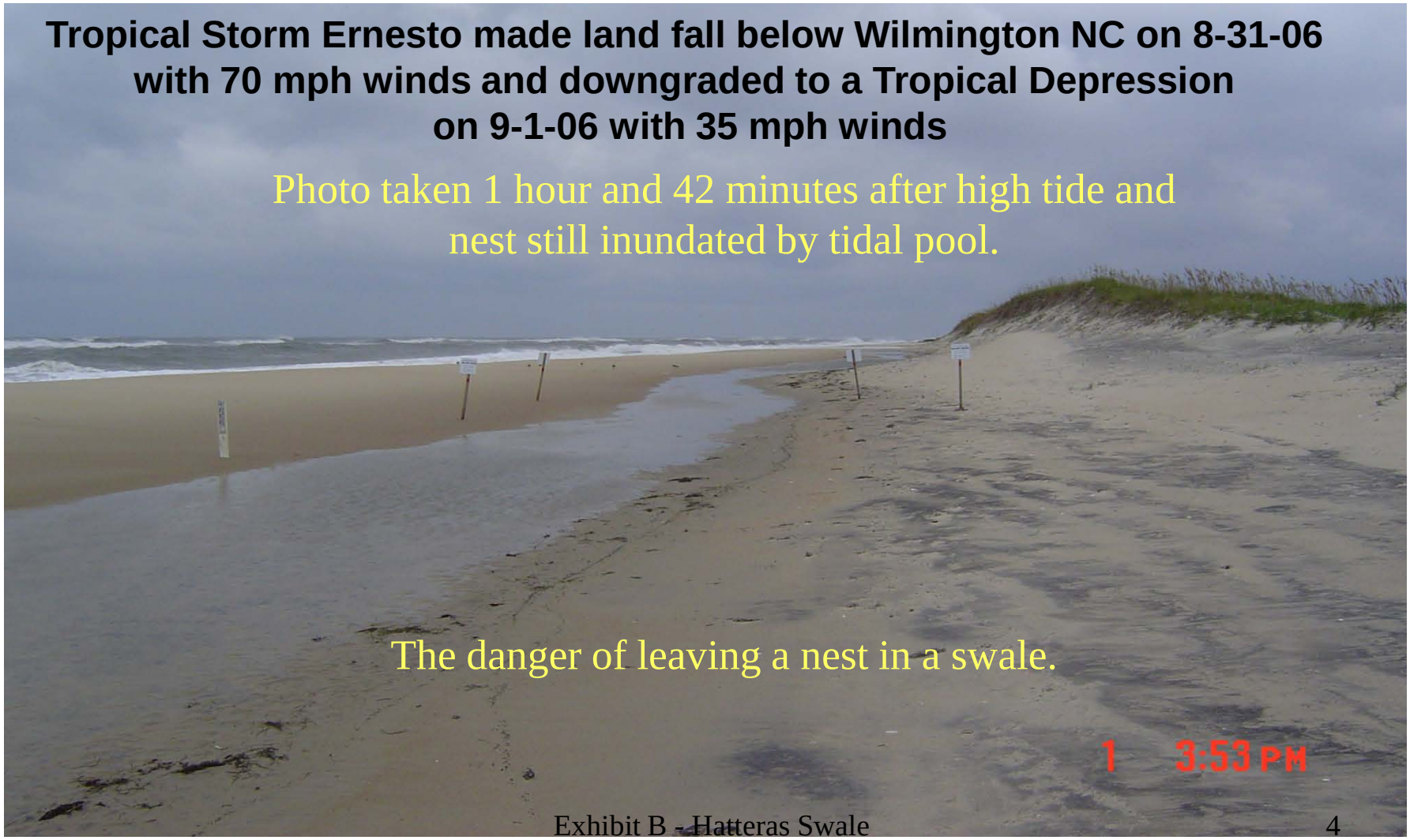
At 112 eggs per nest this is 560 dead hatchlings.

- These 8 nest sites were visited almost daily during the summer of 2006

2006 Sea Turtle Nests Located South of Ramp 30



Nest #34, 9-1-06, Day 42



Nest #34, 9-2-06, Day 43

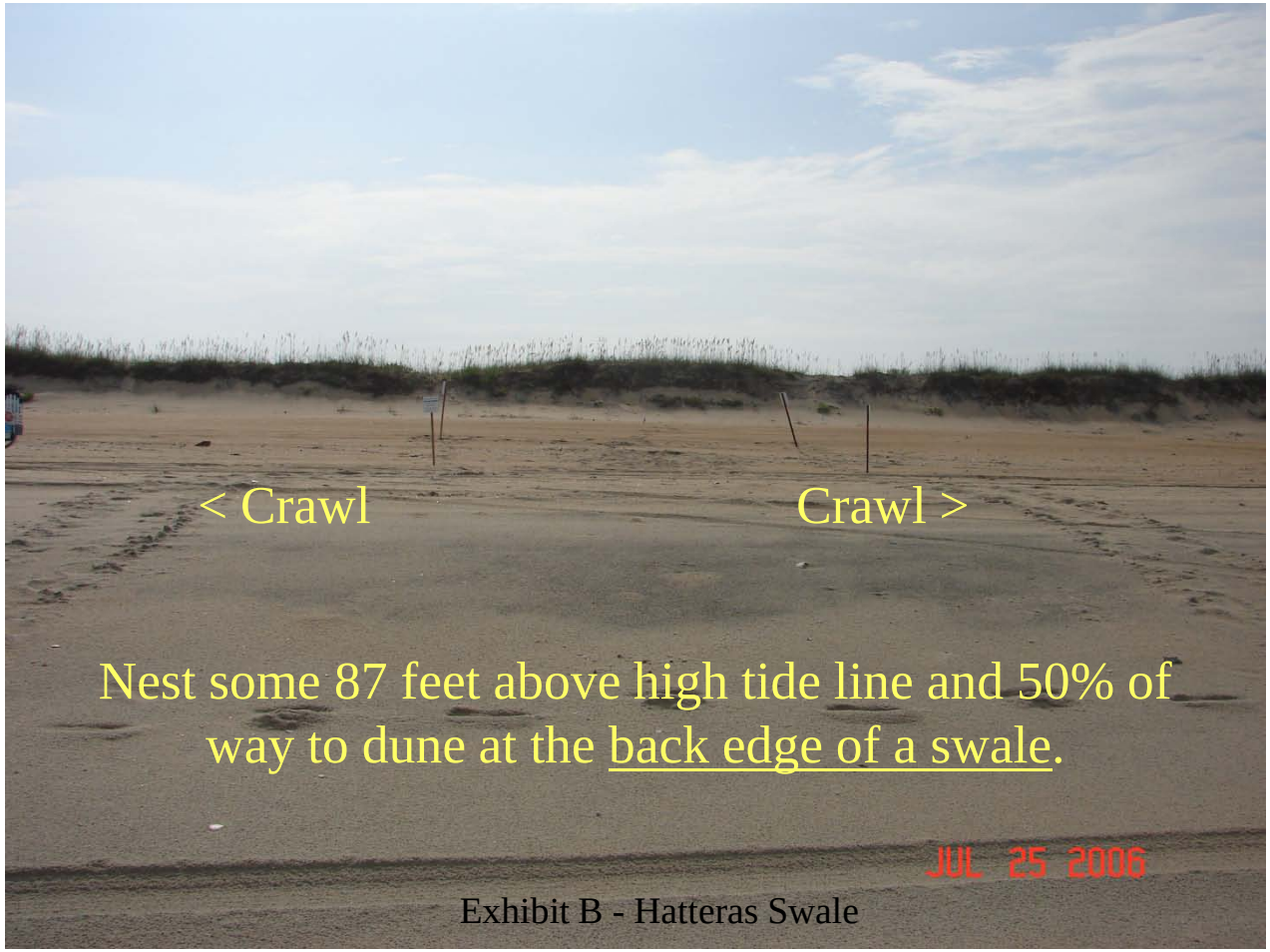
Photo's taken at 3:56 PM, high tide was at 3:14 PM

Nest #34, 9-12-06, Day 53

Doesn’t look too bad!

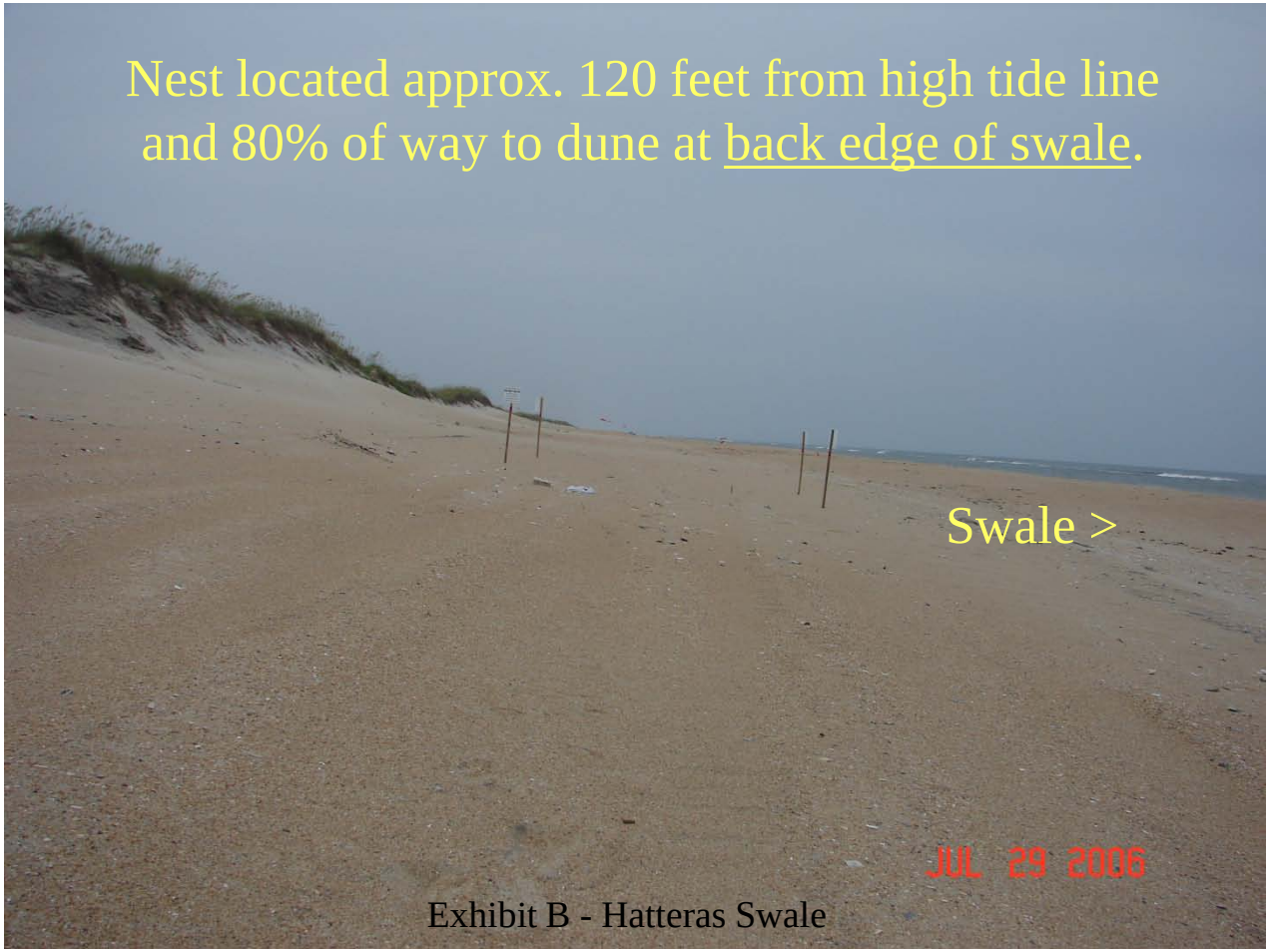
Until another wave comes in.

Nest #35, Laid 7-25-06
2.4 Miles South of Ramp 30
N 35 24.230 W 75 29.157



Nest #35, 9-13-06, Day 51
YET ANOTHER NEST LOST!

Nest #38, Laid 7-28-2006
2.2 Miles South of Ramp 30
N 35 24.405 W 75 29.145



Nest #38, 9-13-06, Day 48
YET ANOTHER NEST LOST!

Exhibit C - Pea Island Relocation Procedures

Pea Island National Wildlife Refuge
Sea Turtle Nest Relocation Procedures - 2005

Sea turtle nesting activity is quite variable on Pea Island National Wildlife Refuge beaches. Number of nests may vary annually from 1-4 up to 35-40. The greatest threats to nests are beach erosion and prolonged inundation. Since about 1984, beach erosion rates on Pea Island have been relatively high, averaging 27.4 ft/yr. It is not unusual to have flooding and ocean overwash with spring tides and a moderate northeast wind. The turtle nest relocation procedures reflect an effort to integrate these factors in assessing the feasibility of either leaving or relocating a nest.

Because of high erosion rates and, due to extensive overwash in many areas, locally known as "hot spots", it is often necessary to relocate turtle nests on Pea Island beaches. The following guidelines will be strictly adhered to when making a determination to leave or relocate a nest:

(NOTE: All nests located between the Oregon Inlet terminal groin and the Pea Island Visitor Center will be relocated to a safe area during 2005 unless they will be completely hatched by August 1 and provided they are not located in one of the identified "hot spots". This area is labeled as the "Pipeline Dredge Disposal Area" on the attached aerial photograph.)

I. Is the nest located at least 20 feet above the high tide line?
   A. Yes - Go to II.
   B. No - Nest will be relocated to the safe area

II. Is the nest located in one of the identified "hot spots" as identified on the attached map?
   (i.e. - "Groin Area", "Canal Zone", "Sandbag Section", "S-Curves", "Pipeline Dredge Disposal Area")
   A. Yes - Nest will be relocated to the safe area.
   B. No - Go to III.

III. Is the nest located in an area with one or more of the following conditions:
   - In an area where the dune was reconstructed as a result of overwash within the last 12 months?
   - in an area where dunes have been undercut by water?
   - in a low, "slough" area behind the ocean berm that would result in a flooded intertidal pool?
   - Located in an area of scarp formation?
   - Located westward of the primary dune system?

   A. Yes - Nest will be relocated to the safe area.
   B. No - Nest will be marked in place and will not be moved.

Once a decision is made to leave a nest in place, that decision is final. In most instances a nest will not be relocated at a later date due to natural processes/events. Certain mitigating circumstances may result in reconsidering this decision in some instances.

Procedures for nest relocation will follow those developed by the Refuge Biologist and those described in the publication entitled "Handbook for Sea Turtle Volunteers in North Carolina" by the North Carolina Wildlife Resources Commission (NCWRC). Nests will be moved to an area where potential for beach erosion or prolonged flooding is lowest.

Nests relocated to the "safe zone" will be placed in various sites across the beach gradient at least 50 horizontal feet above the high tide line. Nests will be placed a minimum of 25 feet apart. Nest protection procedures will follow the NCWRC volunteer handbook for nest protection guidelines. Each nest will be marked with wooden stakes on two sides and a pair of stakes on top of the dune. "Swing-tie" distances between the nest stakes and dune stakes will be recorded for future nest relocation. The same location technique will be used for nests that are left in place.

If you have questions or comments, contact Dennis Stewart, Refuge Biologist at (252) 473-1131 XT 231 or dennis_stewart@fws.gov.

Exhibit D - Cape Canaveral National Seashore Turtle Nesting

Nest closure size is 6’ x 6’

From Draft “2008 Marine Turtle Nesting Summary Canaveral National Seashore”

Nest depredation, primarily by raccoons and ghost crabs, is a serious threat. Depredation rates exceeded 90% in the early 1980s (McMurtray 1986). In 1993 and 1994, the University of Georgia compared three methods of nest protection: screening, predator removal, and conditioned-taste-aversion (Ratnaswamy 1995; Warren 1996). They found screening to be most effective and compatible with National Park Service guidelines and objectives. In 1984, the park implemented a nest screening program to protect nests while allowing the raccoon to remain an integral part of the seashore ecosystem.

. The park strives to achieve the 60% hatching rate targeted in the Loggerhead and Green sea turtle recovery plans (NMFS and USFWS 1991) [check for updated plan] without removing predators from their important role in the barrier island habitat.

On April 17, 2008, the park initiated patrols on all-terrain vehicles (ATVs) to record sea turtle nest emergences (nest and false crawls) and to screen nests along the twenty four miles of beach. Patrols were expanded to seven days a week on May 10 and continued until August 31, 2008 according to protocol for the state-directed Florida Index Nesting Beach Survey. During September, patrols were conducted on weekdays and sporadically into October. Surveys were preformed by permanent and seasonal Biological Science Technicians and Student Conservation Association (SCA) interns listed on the Florida Fish and Wildlife Conservation Commission (FWC) permit with the assistance of numerous volunteers.

The beach was patrolled from 23:00 to 07:30, with one team beginning at the North District (Apollo Beach) proceeding south, and another team starting at the South District (Playalinda Beach) proceeding north. The beach is divided into quarter mile grids,

A one-axle box trailer was attached to one of the ATV’s to carry necessary equipment.

In addition, daytime patrols were conducted two to three times a week to document any status change to recorded nests. The observations included nest tampers, partial and total depredations, hatches, inundations, nest erosions, or any other notable conditions.

On September 1, 2008 in the North District patrols were adjusted to 04:00 – 12:30. In the South District patrols were switched on September 1, 2008 to 06:00 to 14:30. This was due to a decrease in nesting and to expedite nest excavations and removal of screens from nests that had hatched.

The Visitor's Center was frequently updated on the number of marine turtle nests at the seashore so the numbers could be posted for public view. During June and July, Seashore interpreters conducted "Turtle Watch" programs, allowing visitors to see a loggerhead sea turtle nest, learn about sea turtle conservation issues and recognize the importance of CANA for sea turtle nesting.

As always, certain raccoons learned to tunnel under the screens, resulting in partial or total depredation of a nest. CANA has observed this to be a learned behavior for the raccoons and combated these predators with live trapping. Traps were placed in the backcountry of both districts, baited with canned sardines. CANA managed to trap and relocate 14 raccoons within the park.

Exhibit E – Tropical Storm Effects

Published Saturday, August 23, 2008

For sea turtle watchers, it's now a waiting game

Biologists won't know until after the weekend how nests fared in Fay.

Teresa Stepzinski

BRUNSWICK - Wildlife biologists won't know until Monday at the earliest how many loggerhead sea turtle nests were destroyed on Georgia beaches by extraordinary high tides and storm surge churned up by Tropical Storm Fay.

"It probably will be Sunday before biologists and sea turtle patrol volunteers are able to get onto the beach to begin a thorough assessment," said Mark Dodd, sea turtle program coordinator for the Georgia Department of Natural Resources.

"I wouldn't even want to speculate on how many we've lost. There really is no way to tell until we get out there on the beach," Dodd said.

Dodd said typically about 5 percent to 7 percent of the nests are lost to storms each year in Georgia. Most of what scientists have seen during the past 20 years has resulted from indirect hits and nothing like Fay, Dodd said.

From a third to a half of the state's loggerhead nests had already hatched out. Those that survive the storm should finish hatching by Oct. 15, he said.

But surviving the surge is a long shot, said Terry Norton, a veterinarian and director of the Georgia Sea Turtle Center on Jekyll Island.

"The eggs can tolerate a wash-over as long as the nest isn't filled with water," Norton said.

Dodd said it generally takes hatchlings four days to dig out of the nest once they leave the egg. That makes hatchlings vulnerable to storm surge, Dodd and Norton said.

"The hatchlings will get packed down in there if the nest is filled with water," Norton said.

Until now, it appeared to be a record-breaking year for the loggerheads. A total of 1,544 nests had been documented as of Aug. 1, with biologists predicting a total of 1,600 by the end of the season.

The previous state record was 1,504 nests in 2003.

"Loggerheads have a built-in reproductive mechanism that can account for a large-scale loss of nests in these kinds of disasters," Dodd said. "They produce lots of offspring, of which many may not survive, and they are long-lived animals."

On another positive note, the number of nesting females found dead has been low this season, he said.

Three have been found dead, apparently from trawler or boat collisions. In the past, eight to 10 nesting females have been found dead annually, state records showed.

Exhibit E – Tropical Storm Effects

Five species of sea turtle are found in waters off the Georgia coast: loggerhead, leatherback, green, hawksbill and Kemp's ridley. All are protected by state and federal law.

Loggerheads are the only species to routinely nest on the state's beaches.

teresa.stepzinski@

jacksonville.com, (912) 264-0405

Exhibit F - Management Practices
(PreserveAccess website)

Sea Turtle
Management Practices
in the Southeast Coastal Region

All sea turtles are classified as threatened or endangered and protected by the Endangered Species Act. Two Federal agencies divide jurisdiction over sea turtles. U.S. Fish & Wildlife Service (USFWS) has authority when sea turtles are on the beach. The National Marine Fisheries Service (NMFS) has jurisdiction when sea turtles are in the water.

Section 6 of the Endangered Species Act requires states to show they have an “adequate and active” program for the conservation of endangered sea turtles. The most common sea turtle to nest on the beaches of the southeast coastal region is the threatened Loggerhead seaturtle (Caretta caretta).

Nesting in the United States occurs primarily in four southeastern states as detailed in the USFWS & NMFS species “Recovery Plan”

North Carolina	**1.0 %**	The northernmost area with the fewest nests
South Carolina	**6.5 %**	
Georgia	**1.5 %**	
Florida	**91.0 %**	Primary area where the most nesting occurs

Throughout these southeastern states, there are regional differences in how sea turtles are protected. Some areas make an effort to identify and mark all nests. Others do not.

In the Cape Hatteras National Seashore Recreational Area, nests are marked with stakes and string. As the hatch date approaches, the buffer is expanded closing access between the nest and the ocean, and often prevents access behind the nest as well.

In Florida, where the most sea turtle nesting occurs, it is a different story. Some nests are marked only with a single stake. Others have a small triangular string enclosure, with or without a warning sign. And, some nests are not marked in any way. Most noticeable is the fact that people in Florida are permitted responsible recreational access in close proximity to sea turtle nests buried beneath the sand.

This photo shows Florida beachgoers close to turtle nests

Unlike Florida, people in Cape Hatteras National Seashore Recreational Area are fined $150.00 for even walking in the wet sand in front of a sea turtle nest like the one shown in the above photograph.

According to the Florida Fish & Wildlife Conservation Commission, ***"Not every sea turtle nest needs to be marked"*** and many are not. (Marine Turtle Conservation Guidelines, revised 2007) Each year, Florida has up to 1,000 sea turtle nests per mile compared to a peak level of 1.7 nests per mile in the Cape Hatteras National Seashore Recreational Area.

Florida beach photo showing people and umbrellas near nests

In this photo of a busy Florida beach, the two buried turtle nests shown are only marked with a small triangle of sticks, without a warning sign, while surrounded by nearby beachgoers.

October 23, 2009, the Island Free Press featured an in-depth report on sea turtle nests. The article (attached) contrasted differences in sea turtle management between Florida and North Carolina.

Sea Turtle Nesting Facts –

Sea turtles live in the ocean and come ashore only for the female to lay eggs which are buried in the sand, at night, at a depth of 18 to 22 inches. One female will bury approximately 112 eggs the size of ping-pong balls. The eggs remain buried until hatching, at night, approximately 55 to 80 days later.

> ***Important*** – It is not the number of nests laid, but whether they survive to hatch.

Successful recovery depends on solutions to the real problems – Loss of nests due to high tides from weather events, failure to relocate nests, and predation

Nest Relocation –

The Loggerhead Recovery Plan recognizes that, "***Historically, relocation of sea turtle nests to higher beach elevations or into hatcheries was a regularly recommended conservation management activity throughout the southeast U.S.***" (2009,Second Revision, page 52)

The sea turtle program of the North Carolina Wildlife Resources Commission (NCWRC) currently recommends relocation only as ***"as a last resort."*** As outlined in their protocol, ***"Nests in heavy foot traffic areas should not be relocated. These nests should be fenced off and marked, so that pedestrians will avoid them."***

North Carolina's approach is contrary to the USFWS practice of relocating nests on the Pea Island Wildlife Refuge, located on the north end of Hatteras Island, North Carolina.

The nearby Cape Hatteras National Seashore Recreational Area does not support moving nests and has lost over 46% of the nests laid on Cape Hatteras beaches in the last 11 years.

Meanwhile, South Carolina relocated 40.1% of its nests during 2009 resulting in an incredibly low lost nest rate of only 7.7% making a strong case for the relocation of nests as a tool for species recovery.

Unanswered Questions –

Sea turtle volunteer Larry Hardham who was also a participant in the negotiated rule making proceeding for the Cape Hatteras National Seashore Recreational Area, has repeatedly asked for science-based answers to a series of pertinent questions about sea turtle nests.

USFWS has been asked, in writing, the following questions –

- Do vibrations in the sand affect incubation or hatchlings?
- At what distance can emerging hatchlings hear a passing car?
- At what distance can emerging hatchlings feel a car pass at 15 mph?
- And, does either of these events alter their activity?
- How far away does a stationary light source have to be disorienting (We were told a moving light is not as disorienting as stationary light)

None of these questions have yet been answered

Conducting behavioral observations on spiders and grasshoppers, circa 2007

Brandon Barton

Education
B.S. Wildlife Resources, University of Idaho, 2003
M.S. Biology, University of Central Florida, 2005
PhD Candidate, Forestry and Environmental Studies, Yale University, in progress

I am interested in the direct and indirect effects humans have on food webs within ecological communities. I currently pursue this interest by studying the effects of climate change on New England meadow communities as part of my dissertation research and also through an ongoing project examining intraguild predation among sea turtle predators in Florida.

Climate change in meadow communities

Much of the research that has been conducted on climate change in terrestrial systems has focused on vegetation, thus making the assumption that bottom-up processes are more important than top-down. However, in many systems, such as New England meadows, evidence suggests that top-down processes can have important effects on community dynamics. In the meadows where I work, grasshopper herbivores (*Melanoplus femurrubrum*) can drastically change the plant community by selectively foraging on a single, competitively dominant Goldenrod species (*Solidago rugosa*). Grasshoppers only forage on Goldenrod when exposed to predation risk by spiders (*Pisaurina mira*) because its dense canopy of leaves creates a refuge from predators. Thus, the spider is an indirect keystone species that has a diversity-enhancing effect on the plant community, mediated by a behavioral response by the grasshopper. My dissertation research aims to understand how increasing temperatures due to climate change may affect predator-prey interactions and, consequently, the community as a whole. I am addressing this question by conducting multi-year field experiments and behavioral observations of spider-grasshopper-plant food webs under simulated climate warming.

Intraguild predation on sea turtle nesting beaches

In Florida, raccoons (*Procyon lotor*) are removed from loggerhead (*Caretta caretta*) nesting beaches to decrease egg predation. However, raccoons are also predators of ghost crabs (*Ocypode quadrata*), and ghost crabs also consume a large number of loggerhead eggs annually. Research conducted for my Masters degree demonstrated that intraguild predation by raccoons limited ghost crab populations and that raccoon removal resulted in higher densities of ghost crabs. Areas where raccoons were not abundant because of trapping still had the highest rates of total egg predation because of dense ghost crab populations. I am currently collaborating with researchers at the University of Central Florida to answer a question that arose during this project: why was raccoon predation highest where raccoon abundance was lowest? We believe that raccoons can easily locate sea turtle nests that have been attacked by ghost crabs because chemical cues are transmitted through the ghost crabs burrow and to the beach surface. Thus, as ghost crab density increases following raccoon removal, any remaining raccoons will be more efficient at finding sea turtle nests by following ghost crabs to the eggs. We are also using a long-term dataset to further address the effects of raccoon and ghost crab predation on sea turtle conservation.

Leatherback sea turtle at Archie Carr National Wildlife Refuge, Florida

Peer-reviewed publications

Barton, B. T. and J. D. Roth (*In review*). Implications of intraguild predation for sea turtle nest protection.

Barton, B. T. and J. D. Roth (2007). Raccoon removal on sea turtle nesting beaches. Journal of Wildlife Management 71:1234-1237.

Schmitz, O. J., H. P. Jones and B. T. Barton (2007). Scavengers. Encyclopedia of Ecology. Elsevier, UK.

Exhibit H - Frick memo –pg 1

Michael Frick
<caretta05@AOL.COM
>
Sent by: Sea Turtle Biology and Conservation
<CTURTLE@LISTS.UFL.EDU>

03/13/2010 12:36 PM EST
Please respond to Sea Turtle Biology and Conservation

To: CTURTLE@LISTS.UFL.EDU
cc:
Subject: Proposed Uplisting of Loggerhead Turtles PT 1

Cturtlers,

Wow. I can say that a I'm glad a dialogue has opened up about the consequences of uplisting loggerhead turtles and I'm sorry I singled out Broward County's past malfeasance concerning the conservation of the species (an action which likely has not contributed to any increases in their population). But, let's review, it has now been shown that nest relocation does not significantly alter the hatch rates of nests when done correctly and in a timely fashion. It has also been documented that nest relocation neither skews sex ratios nor does it produce hatchlings that differ from those in insitu nests from the same beach. Given these FACTS, if we are truly concerned about preserving the species, every effort should be made to move any nest in danger of being washed out or any nest situated where hatchlings will ultimately crawl towards artificial lighting. Too many nests to do so is no excuse if in fact we are dealing with an endangered species.

Such was not the mentality chosen when it was decided to protect Kemp's Ridley turtles. Almost every nest was relocated for decades and some turtles were headstarted and we now have a rebounding population in Rancho Nuevo, despite the qualms of past naysayers who now remain silent on the issue. If we call loggerhead turtles endangered than similar measures will have to be taken - including mass nest relocations and rehabilitation. Many facets of what we know as traditional means by which to protect loggerhead turtles will have to change or else the government will be skating the fine line of hypocrisy with regards to their protection of other endangered turtles like Kemp's ridleys. There are no categories like 'a little endangered' or 'really really endangered', it's just 'endangered' And, loggerhead turtles are nowhere close to being endangered with respect to other 'endangered' turtle species. Maybe in Australia but not in the eastern US.

I have seen the data from annual trawler surveys from the Carolinas to Florida where hundreds of subadult loggerhead turtles are tagged annually as neophytes and even had the state coordinators from these regions tell me 'there are a lot of turtles out there'. These turtle will become nesters in another 15-20 years and will likely make up for the declines seen in nesting in Florida from 1998 to the present (and likely even in South Carolina). It just takes time for this 'changing of the guard' to happen. Data from Georgia indicates that the nesting population is stable, or as the state coordinator says 'indiscernibly declining' (whatever that means).

We have yet to learn some of the most elementary aspects of loggerhead natural history. Given this, can you imagine what it will be like to get permits to conduct general natural history studies on loggerheads if they are listed as endangered? Universities will be out of the running left and right to conduct wonderful and illuminating research projects and non-profits will have an even harder time continuing their conservation efforts.Turtle walks that are integral for endearing the general public to loggerheads will be overly regulated or totally forbidden. Research projects that enlist the help of the general public to conduct night-time tagging and conservation will become so highly regulated that only the 'select' will be able to experience the beauty and wonder of working directly with these magnificent animals.

I began work on such a project in high school and this type of opportunity, along with turtle walks on Juno Beach, Florida, inspired me to become a turtle biologist - working now for over 20 years with turtles. Likewise, many general public volunteers I have worked with have since become turtle biologist after having the chance to work directly with loggerhead turtles - a species they were able to become acquainted with because they were listed 'only' as threatened and not 'endangered', had loggerheads been uplisted at the time these people would never have been permitted to be introduced and trained to conduct hands-on research and conservation with sea turtles. Moreover, some of these volunteers were middle-aged and had already spent their earlier years in college becoming lawyers or nurses or whatnot (not biologists); however, through their experience working on our program they have been qualified to be hired elsewhere in the world working with sea turtles (not because they had a degree in biology but because they gained hands on experience in the field). Now they have begun second careers as researchers, field biologists and champions for the preservation of sea turtles. If the resulting restrictions surrounding the status of endangered had been placed on loggerheads during this time, the sea turtle community would be that much smaller and would not include some of the leading experts in the field today.

We also have to consider whether or not marine ecosystems could support the numbers of loggerhead turtles historically observed in some areas. Humans destroy marine livebottoms when trawling and harvest many marine species for consumption that are also consumed by loggerhead turtles. Are the necessary resources there to allow for the continued increase of loggerhead populations? Is this a realistic doable endeavor to re-establish historic loggerhead populations? If it isn't, then loggerhead turtles will be on the endangered species list for eons - because we will never be able to 'replenish' their populations according to the goals and numbers set by the current recovery plan. It seems to me that conservation of a depleted species should aim for stability rather than posting monumental gains for many years in a row. We have stability in loggerhead populations in some areas and to me this means that the populations are planing out with respect to available resources.

I am a proponent for habitat protection, but this is not achieved by placing a single resident in these areas on the endangered species list. If this were the case than the loggerhead turtle uplisting would never have to be considered. There are already dozens of marine species on the endangered species list that frequent the habitats also occupied by loggerheads, and their endangered status has not lead to the protection of these habitats. What makes us think by adding another endangered species (the loggerhead turtle) to the list of other endangered animals in these habitats will make a difference? It hasn't made a difference before. Maybe we should rethink the means by which we propose legislation to protect these habitats other than placing a bullseye on a particular species head to lead the charge to protect these areas. Such was almost detrimental to the spotted owl. There has to be ways to protect loggerheads other than surrounding them with red-tape that will ultimately exclude potential individual workers and future conservationists that are necessary for loggerhead management.

There will be no sympathy offered to my position by some 'well-known' turtle biologists because they will have the privelege of working with 'endangered' loggerheads because they work for the permitting institutions. These individuals are also proponents for the uplisting of loggerheads because they have nothing to lose by doing so. They will always be able to put their hands on a turtle or gain increasing and invaluable experience by doing so. They will not understand what it is like to be an average joe looking to gain experience in order to get an 'in' in the world of sea turtle field biology. But, I am not asking for their sympathy. I am asking for the ears of those who know exactly where I'm coming from.

We should exhaust every means to propagate loggerheads before throwing our hands up and asking for 'federal assistance'. These means have not been exhausted yet and we have yet to prove unequivocally that loggerheads are endangered. As long as there is a shadow of a doubt, which there is, no US court should rule in favor of uplisting loggerheads. And the petitioning organizations should consider the possible deleterious effects of their actions prior to submitting such hubris. We haven't even covered the economic consequences of a loggerhead uplisting that would foment negative attitudes towards the turtles we love by certain individuals in the general public: those who livlihoods will be dramatically altered or terminated as a result of a loggerhead uplisting. This will be covered in PT 2. Believe me, uplisting loggerheads is not a simple straight-forward matter. It could potentially open up a can of worms that may

Exhibit - Frick memo – pg 3

generate the most negative press in the general media that we've ever witnessed. Would this be fair to loggerhead turtles; for us to use them as patsies in order to push political agenda?

Mike Frick

<><><><><><><><><><><><><><><><><><><><><><><><> To leave the CTURTLE list, send a message to: listserv@LISTS.UFL.EDU with the message: signoff CTURTLE

If you experience difficulty, send an email to: CTURTLE-request@LISTS.UFL.EDU
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Exhibit I - Turtle Nests Map - Figure 1- Legend

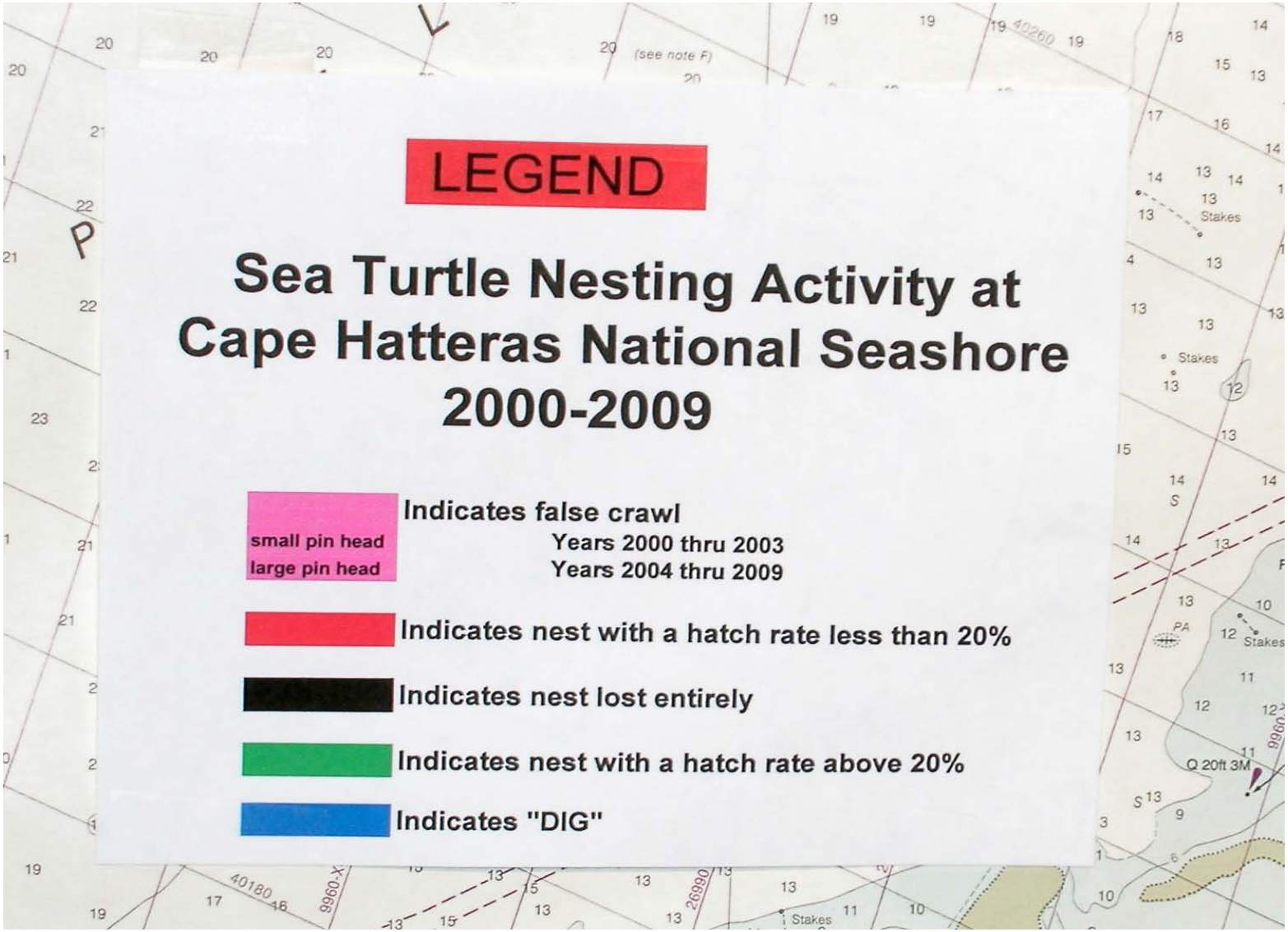

Exhibit I - Turtle Nests Map - Figure 2- Entire Seashore

Exhibit I - Turtle Nests Map - Figure 3 - Avon North

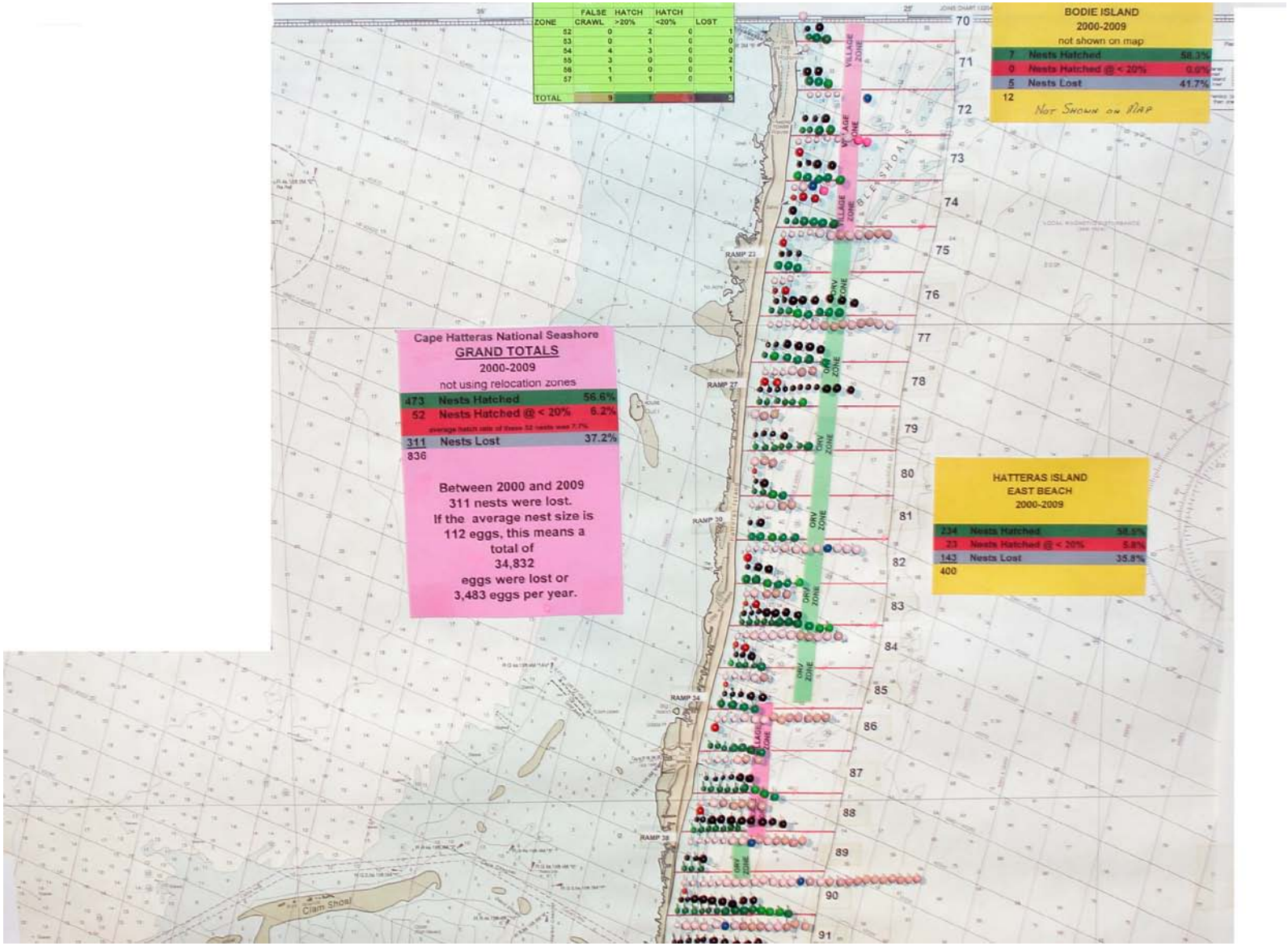

Exhibit I - Turtle Nests Map - Figure 4 - Cape Point

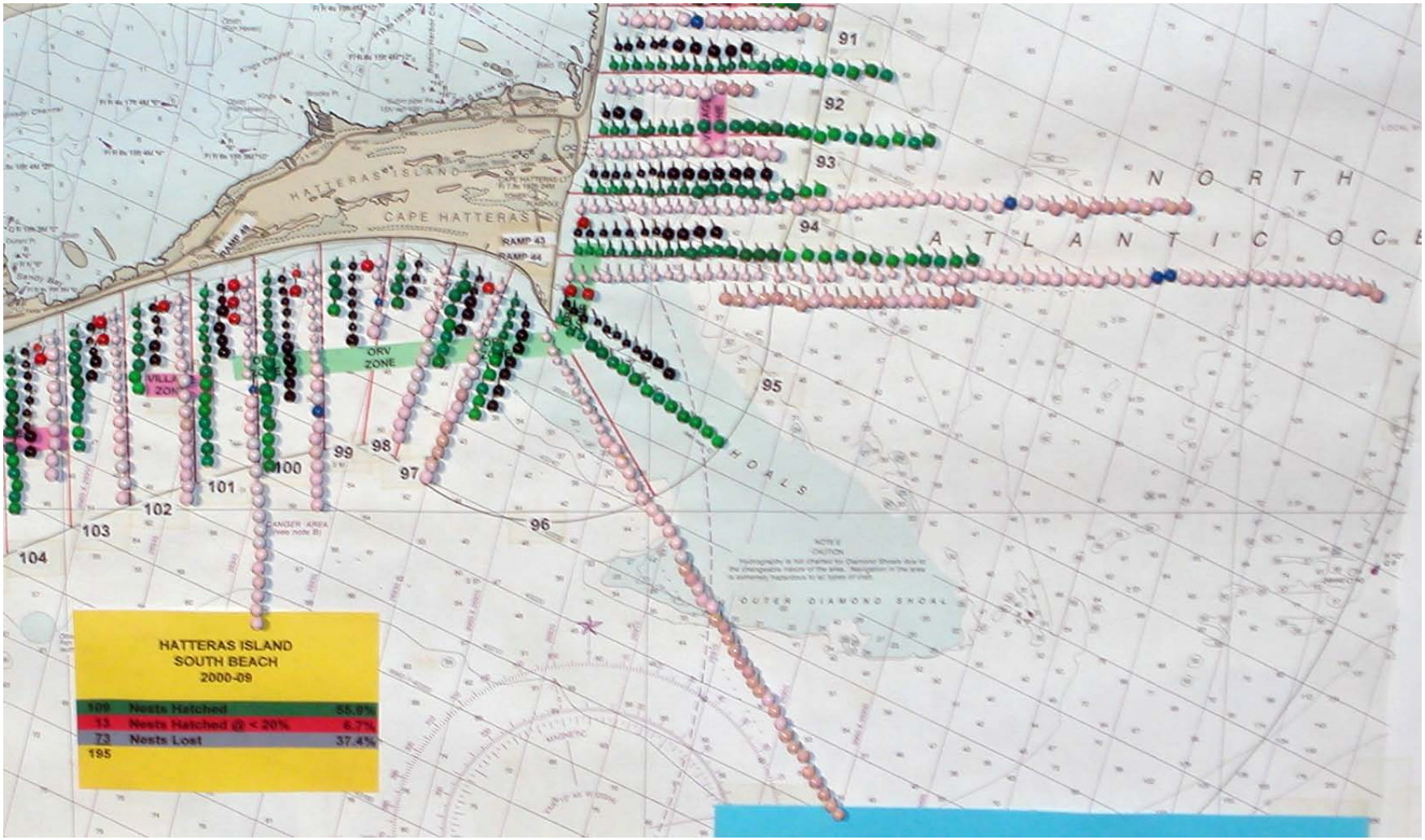

Exhibit I - Turtle Nests Map - Figure 5 - Ocracoke

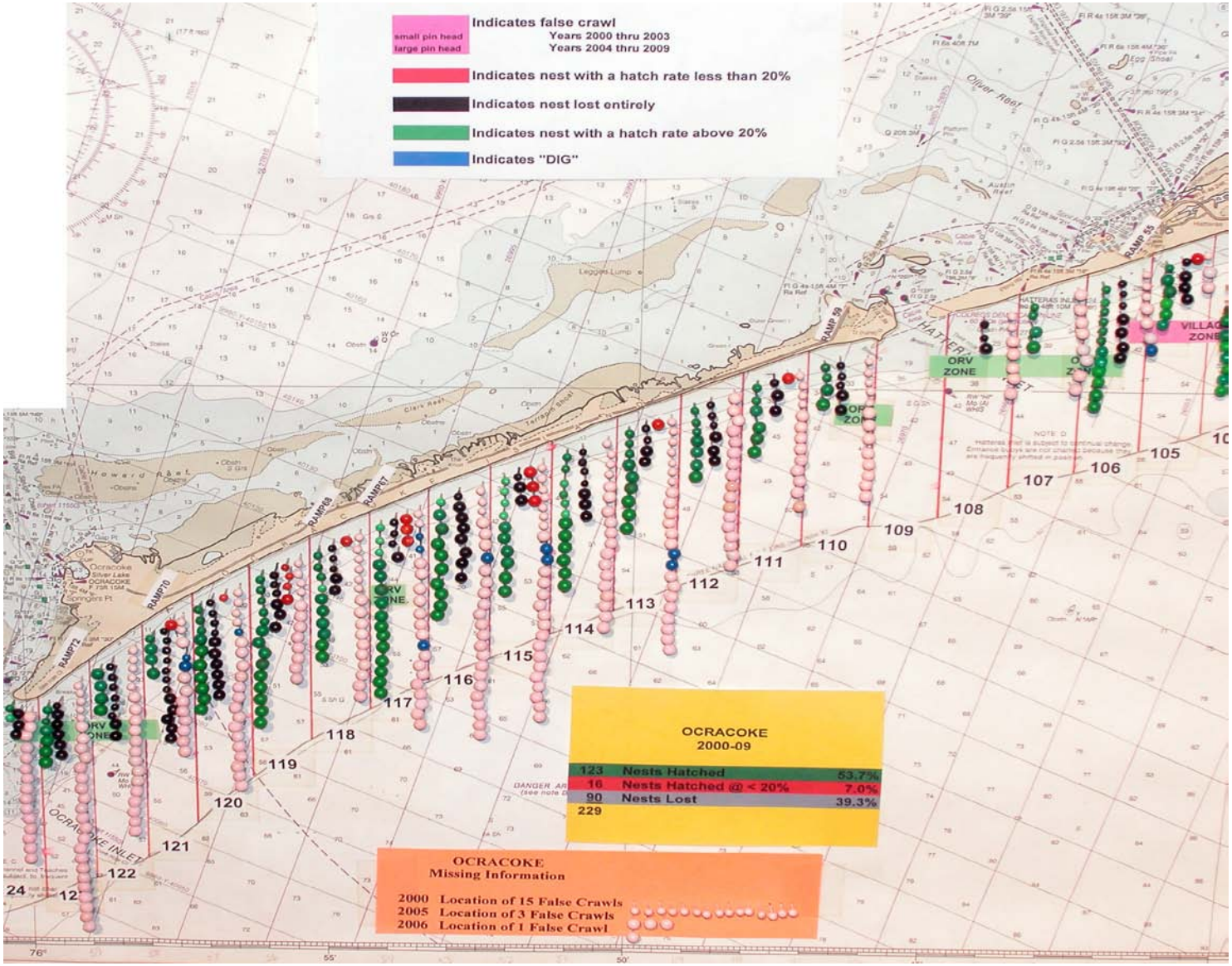

Exhibit J
Highlighted Areas by Larry Hardham

GUIDELINES

FOR

MARINE TURTLE PERMIT HOLDERS

~ Nest Protection Management ~

Wildlife Diversity Section
South Carolina Department of Natural Resources
P.O. Box 12559
Charleston, SC 29422
Phone: 843-953-9015
FAX: 843-953-9353
E-Mail: sccturtle@mrd.dnr.state.sc.us

(Revised 4/2002)

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The video, ''Sea Turtle Nest Protection, a Training Guide'', should be used in conjunction with those topics marked with an asterisk.

INFORMATION FOR MARINE TURTLE PERMIT HOLDERS

The South Carolina Department of Natural Resources (SCDNR) issues permits for activities involving marine turtles in South Carolina under authority granted to the state through Cooperative Agreements with the U.S. Fish and Wildlife Service and National Marine Fisheries Service under Section 6 of the Endangered Species Act (ESA). All activities must be authorized under Now tisChapter 15 of the South Carolina Code of Laws. Each permit consists of a principal permit holder, qualified personnel with Letter of Authorization (LOA), and a list of authorized activities. Permit holders are expected to know the conditions and responsibilities associated with their permit. Principal permit holders are responsible for ensuring that SCDNR staff or an experienced permit holder thoroughly and properly trains all personnel with LOA's listed under their permit. Permit holders are authorized to conduct specific activities depending upon experience, area of investigation and/or demonstrated marine turtle management needs. Only those activities specifically listed on the permit are authorized.

A permit issued by the SCDNR or a letter of authorization (LOA) from the permit holder must be in the possession of each person at all times while conducting authorized activities. You should also carry identification that will verify that you are the named permit holder. Some wildlife or public safety officers or concerned individuals may perceive that your activity is harmful or unlawful. Please ensure that your response to such situations is thoughtful and reflects the special responsibilities associated with your permit.

The permit does not allow you to act as an employee of SCDNR. Please do not represent yourself as a wildlife or conservation officer, especially if you are talking with the media. Distinctive, identifying clothing is encouraged and should display the logo or name of your organization or marine turtle project.

Occasionally, a beach nourishment project may occur in your survey area. All such projects are reviewed by SCDNR, the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers and operate under specific requirements that consider the nature, timing and sequence of beach nourishment activities to provide protection to marine turtles and their nests or hatchlings. If you are approached by a local contractor, individual, or other entity and asked to establish a marine turtle nest relocation or nest protection program in conjunction with a beach construction project (including beach cleaning) contact your Marine Turtle Program Coordinator immediately.

Contact your project coordinator and the SCDNR Hotline number, 1-800-922-5431 if you think unlawful activities are being conducted, such as egg poaching or other disturbances to nests or nesting female turtles. **Do not notify the news media.**

Requests for expansion of authorized activities must be made in advance by phone to the S. C. Marine Turtle Program Coordinator, and an amendment to the application may be required.

The principal permit holder is required to submit the following 3 summaries to SCDNR at the end of each sea turtle season in keeping with the following schedule:

1) **Project Summary Form** …… **due December 31**

2) **Annual Project Report (following the required outline)** ……..... **due January 31**

3) **Nest Data Spreadsheet** ……..…… **due January 31**

Failure to submit reports in a timely manner may delay processing your application for the following year.

* * * * *

NESTING SURVEYS

This activity involves the patrolling of a specific beach area (listed on the permit) to identify, enumerate, and evaluate nesting and non-nesting emergences (false crawls). Nesting surveys should begin **shortly after sunrise**. Because of potential disturbances to nesting females and the difficulty of locating crawls in the dark, nesting surveys may not be conducted during the night unless specifically authorized by SCDNR.

Surveyors should move along the beach at the level of the latest high tide line. Upon discovery of a crawl, surveyors shall determine whether or not the crawl was a nesting or non-nesting emergence. Probing a nest is allowed to determine the exact location of the egg chamber only if SCDNR personnel or another experienced surveyor has trained the surveyor and possesses a current **Letter of Authorization (LOA)** under a principal permit holder. Dig down, **only with hands**, until the top eggs are felt, to verify the exact location of the chamber. Shallow nests may result in some eggs being punctured. If this occurs, remove all broken shells and clean off the albumin and yolk from the adjacent eggs. Once the clutch is found, re-bury it with moist sand and gently pat the sand surface above the eggs with your hand. Replace the dry sand over this area to the depth present before you began.

After each crawl is documented, the track should be marked to avoid duplicate reporting. This may be done by use of flagging, sweeping ones feet across the track or crossing the upper part of the track with a survey vehicle.

All permit holders approved to conduct nesting surveys may also relocate nests laid in poor sites (too low on beach or near dune crossovers), determine hatching success, and evaluate nest depredation without these activities being specifically listed on the permit. Hatcheries or non-self-releasing screens may not be utilized unless specifically stated on the permit.

* * * * *

MARKING NEST LOCATIONS

Marine turtle nests need to be marked so that they can be located for nest inventory or protected from hazardous activities such as vehicle or heavy foot traffic. The type of beach (developed or remote) will determine the best techniques for marking nests. Please keep in mind when driving stakes that some undiscovered clutches might be present on the beach. Use flags or stakes with caution.

To identify a nest area so that activities are directed away from the nest site, delineate with markers the entire disturbed area where the turtle covered. Use three or four stakes to mark an area around the nest. These stakes should extend about 36" above the sand. Be sure that the egg chamber is located in the center of this area. Surveyor's ribbon or rope should be tied from the top of one marker to another to create a perimeter around the nest site. On low density nesting beaches, an official SCDNR sign can be located seaward of the nest site. The nest-identifying number and the date the nest was laid can be printed on the wooden post.

Nests can also be marked by measuring the exact distance from the precise clutch location to two separate marking stakes on the dune, one landward of the other, so that a straight line between them is pointing directly toward the location of the clutch (like sighting down a rifle barrel).

If concealment of nests is desired, measure the exact distance and direction with a compass to two separate marking stakes on the dune, hidden among the vegetation. If one marking stake is discovered and removed there is still one remaining.

Whatever method a particular project decides to use is fine, just as long as it is uniform among all workers. For instance a project may simply choose to place the marking stake 3' seaward of the clutch.

On beaches where removal of marking stakes by the pubic is a potential problem, an additional stake, driven deeply and hidden from view, should be placed a measured distance landward of the others. As added insurance, an aluminum strip can be buried hand-deep and 24" from the clutch location in a standardized direction. This metal marker can be found later with a metal detector.

NEST RELOCATION

Moving marine turtle eggs may create adverse impacts. Movement alone is known to kill developing embryos by rupturing delicate membranes that attach to the top of the egg. We also know that the incubation environment greatly influences the developing embryo and that nest relocation can involve the transfer of eggs from an appropriate environment to an inappropriate one.

Nest relocation must be considered a management technique of last resort and only if the likelihood of the nest surviving to hatch is nil. The most desirable alternative is to eliminate the problems that prompt relocation of the nest. Normally, the only situation that justifies nest relocation is when a nest is laid seaward of the debris line marking spring high tide. If foot traffic is heavy, a nest can be roped off so that pedestrians avoid it. If a nest is laid near a light that may disorient the hatchlings, the light should be kept off or shielded. **Lighting problems are not a valid reason to relocate nests.** If mammalian predators threaten a nest, it should be screened with a self-releasing screen. Use of hatcheries must be approved by SCDNR.

Use the following decision-making protocol when evaluating relocation:

Question 1: Will the nest be destroyed in situ?
If NO: No action required. Leave nest where it was deposited.
If YES: Go to question 2

Question 2: Can the nest be moved **directly** inland to a stable dune?
If YES: Move to new location directly inland.
If NO: Move to next best available site **closest** to original nest location.

If a nest requires relocation, it should be moved as early in the morning following its deposition as possible. After deposition, the potential for movement-induced mortality in marine turtle eggs increases rapidly. **Eggs should be moved no later than 9 AM** (turtles may nest as early as 9 PM the preceding night). To relocate a nest, find the location of the egg chamber by gently probing with a tapered, T-handled dowel. Once the eggs are located, carefully remove the sand from around the top eggs. Individual eggs should be gently lifted from the egg chamber and placed into a rigid container with a 2"-3" layer of moist sand on the bottom. When moving eggs, be sure to maintain each egg's original orientation; do not rotate eggs in any direction and avoid any abrupt movements. As eggs are placed in the container, be sure that they do not roll. When all eggs are in the container, cover them with a layer of moist sand. Note total number of eggs laid and number of eggs found broken during probing.

Find suitable beach habitat nearby that is successfully used by nesting turtles. Avoid relocating nests near inlets, as hatchlings will be swept into the marsh by incoming tides. Be sure that the new nest site is above the spring high tide level and is not in dense vegetation. Prior to removing eggs, dig a new egg chamber to the same depth, size and shape of the original. The shape should resemble an inverted light bulb. (The cockleshell is a good instrument to round out the bottom of the nest if you use posthole diggers). Relocate the eggs into the new egg chamber by transferring them one at a time while continuing to maintain each egg's original orientation. Dry sand should not be allowed to fall into the egg chamber. After all the eggs have been transferred into the

new egg chamber, cover them with the moist sand excavated from the hole and gently pat the sand surface above the eggs with your hand. Replace the dry sand over this area to the depth present before you began. The relocated nest can then be marked and later evaluated for nest success. Nests in danger of being completely eroded away by high tides can be moved to safer areas anytime during incubation, **with prior permission**.

DO NOT:	**Clear dune vegetation** **Restructure the dune profile** **Remove eggs from the beach environment**

* * * * *

NEST SCREENING

When a nest is at risk from mammalian predators (e.g., raccoons, foxes, etc.), the eggs and pre-emergent hatchlings may be protected by placing a self-releasing screen over the nest. The screens used for this purpose are typically 4' X 4' pieces of 2" X 4" mesh welded wire (do not use metal screen with a smaller mesh size as it is likely to trap emerging hatchlings). This type of screen is large enough to keep mammalian predators out, yet it allows hatchlings to escape from the nest unaided. The screen must be centered exactly over the egg chamber to make it less likely that mammalian predators will burrow to the eggs from the side of the screen and to make sure that anchoring stakes placed along the edge of the screen will not enter the egg chamber.

To find the location of the egg chamber within the body pit, use the method described under NESTING SURVEYS. Once the top eggs are located, use moist sand from a similar depth to re-cover the eggs. Dry sand should not be allowed to fall into the nest cavity. Once the egg chamber is re-covered with moist, then dry sand to the original level, mark the center of the egg chamber with a piece of marshgrass. Be sure that this marker is not inserted into the egg chamber. Level the surface of the sand in a 4' X 4' square centered on your temporary marker so that the screen will lay flat. Place the screen on the smoothed sand and work it back and forth until it is not showing. Remove the temporary marker. Using stakes, secure the four corners of the screen. You may use tent stakes or make your own stakes of wood, PVC or some other durable material. The corners of the screen should be well away from the egg chamber. Place about two inches of sand on top of the screen after anchoring so that the wire is well covered. Maintain screens just one to two inches below the surface of sand if sand accumulates. Some mammalian predators will not investigate or attempt to dig into a nest if they do not notice the wire. If predators in your area are very persistent and dislodge screens with only four stakes, try using eight stakes and place the four additional stakes midway between the corners. If stakes are easily dislodged, longer or thicker stakes may be needed.

Plastic screening is recommended, and white is the preferred color.

Sometimes raccoons will dig into the top layers of eggs through the screening. A smaller square, 1'x 1' of hardware cloth can be added on top to prevent this. This additional screening must be removed at 45 days incubation to avoid hatchlings being trapped. Another method involves elevating the original screen approximately 2" above the sand's surface at 45 days incubation. This can be accomplished by putting driftwood under 3 edges of the screen, leaving the seaward edge open.

In some situations, if screened nests are not marked with an appropriate sign, a beach user is likely to discover the screen and think that it should not be on the beach and pull it up. Marking screened nests may also be necessary to prevent people from inadvertently injuring themselves on the screen or on any stakes.

Because stakes and/or screens may become partially or completely dislodged, they should be checked regularly. During the period of anticipated emergence, screens should be checked for sand accumulation. After 45 days of incubation, screens should be checked each morning for signs of hatching activity and just in case hatchlings become trapped by them. All screens shall be removed from the beach after hatchling emergence is completed.

* * * * *

NEST CAGING (SELF-RELEASING)

When a nest is at high risk from predators (e.g., raccoons, foxes etc.), the eggs and pre-emergent hatchlings may be protected by placing a self-releasing cage over the nest. Restraining cages shall provide enough room for all hatchlings to completely emerge from the sand and shall have, on the seaward side of the cage, an area from which hatchlings can readily escape. If hatchlings are to escape through a wire screen, the mesh size shall be no smaller than 2" X 4" (making sure the long edge, 4 inches, is parallel to the sand). If hatchlings are to escape through an opening in the cage, the opening should be 2 inches high and extend along the entire seaward side of the cage. Cages shall be centered exactly over the nest cavity to make it harder for mammalian predators to reach the eggs if they put their paw through the mesh. Make sure that any anchoring stakes places along the edge of the cage will not enter the nest cavity.

The first step in caging a nest is to find the location of the nest cavity within the body pit. Follow the directions under NESTING SURVEYS. Most cages are anchored by burying the outward pointing flanges (see illustration) one half to one foot under the sand's surface. Enough of the cage should be above the sand surface to deter raccoons from reaching eggs through the mesh. Center the cage over the nest cavity and trace the edges of the cage in the sand. The cage should be oriented so that the escape opening is facing the sea. Remove the cage and carefully dig a trench along the tracing of the

edges of the cage. Place the cage into the trench and fill the trench with sand. When completed, the sand around the cage and over the nest cavity should be at the original level. If stakes are used to secure a cage, make sure they will not enter the egg chamber.

Because cages may become partially or completely dislodged, they should be checked regularly. **Self-releasing cages should be checked each morning during the period of anticipated hatching, just in case some hatchlings have become trapped. All cages should be removed from the beach after hatchling emergence is completed and nest success evaluation has been completed.**

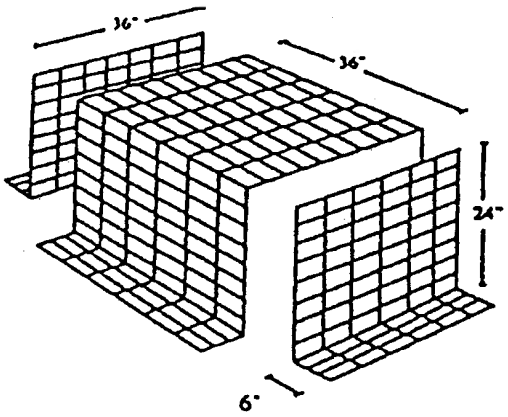

Figure 1. Example of a self-releasing cage. The cage is constructed of 2" x 4" welded utility wire. Hatchlings are able to escape through the mesh of the wire.
(Cage design courtesy of The Conservancy.)

* * * * *

RESCUE OF DISORIENTED HATCHLINGS

This activity involves retrieving disoriented hatchlings and ensuring that they reach the water safely. Due to the short duration of the hatchling frenzy period, hatchlings should be released under the conditions that afford them the best chance of survival. There are two situations of hatchling rescue and release and each will be handled differently in order to best meet this goal.

1. All hatchlings found during darkness **must be released immediately**, the same evening they are found. A flashlight may be used at the water's edge if you come across a disoriented hatching in progress. Keep the light at least 5 feet above the water and turn it off periodically. This will lead the remaining hatchlings in the right direction, while the surrounding area is searched for lost turtles.

2. Hatchlings that are found disoriented during daylight surveys are likely to be dehydrated and weak and will survive better if given a chance to rest in a damp

environment. Small Styrofoam or plastic coolers lined with damp sand work well as temporary holding containers. A damp towel should be placed loosely over the top of the container to provide a dark, moist environment. Once placed in a holding container, hatchlings should not be handled or disturbed until they are ready for release. Activity causes increased expenditure of limited energy stores. Release the hatchlings that night at hard dark about 25 feet from the ocean and monitor their entire trek to the water.

Hatchlings must <u>not</u> be held in water! If disoriented hatchlings require further holding, please contact the Marine Turtle Program Coordinator for transfer to an authorized staff.

DO NOT:	**Build runways without prior permission** **Remove or cut dune vegetation** **Assist hatchlings unless they are deformed** **Remove hatchlings from the beach environment**

LIGHTING VIOLATION REPORTS

Report disorientation events to SCDNR and to US Fish and Wildlife Service Law Enforcement (843-813-8821) as soon as the event is discovered. Follow up by completing a Sea Turtle Disorientation Report form and mailing it to SCDNR as soon as possible. It is very important that SCDNR be informed of all disorientation events as they occur. Include number of hatchlings disoriented and document with photographs if possible.

* * * * *

HATCH SUCCESS EVALUATION

Because marine turtle eggs are subjected to a variety of incubation environments, including many that are affected by human activities, it is very important each nesting season, and on each managed nesting beach, to have some idea of how many eggs actually produced hatchlings. This activity, known as hatch success evaluation, involves the excavation of a nest and a determination of the fate of each egg.

Hatch success evaluations may only be conducted **either 75 days after the nest was deposited or 3 days after the first emergence**, whichever occurs first. These are minimum waiting periods. If a nest has been subjected to cooler temperatures (tidal inundation, rainfall, shading, cool fronts, etc.), nest success evaluations should not be conducted until 80 days or 96 hours after the first emergence. **Digging into a nest before all the hatchlings have emerged exposes them prematurely and is likely to adversely affect their ability to survive. It is vital to allow all hatchlings to emerge**

naturally before excavating the nest.

On higher density nesting beaches (greater than 120 nests per year), nest success evaluations do not have to be conducted on every nest, but a minimum of 25% is required. Useful information may be obtained by evaluating a sample of nests; however, the sampling technique must be devised to best represent the entire nesting season and nesting beach. The easiest way to do this is to mark for evaluation every other nest, or every fourth nest, etc. For this sampling technique to succeed, a sampling plan based on the number of nests expected has to be devised before the nesting season begins. Once a sampling plan is devised, it has to be followed throughout the nesting season. If needed, the SCDNR's marine turtle program staff is available to help develop a valid sampling plan. Beaches with under 120 nests per season should plan to excavate all nests.

When a nest marked for evaluation is completely depredated or destroyed (all eggs lost), record this (no further evaluation is necessary). This nest is a very important part of your sample to accurately determine overall nest success; **do not select another nest as a replacement.** When a nest marked for evaluation is partially depredated, remove the depredated eggs. Cover the nest cavity with moist sand, and return the site to its original condition. Record the nest as partially depredated along with the number of eggs that were depredated. **If the number of eggs laid is unknown, use the clutch size of 120 eggs in your calculations.**

To conduct a nest success evaluation, dig down into the nest chamber with your hands until you reach eggs or eggshells. Do not use shovels or other tools, but you may want rubber gloves. If you encounter live hatchlings **before** reaching any eggs or eggshells quickly cover the nest cavity with moist sand and return the site to its original condition. Wait at least 3 days before excavating again.

Carefully remove the contents of the nest and place them in a pile on the sand or in a tray for easier sorting. Separate the contents into the following **FOUR categories**: hatched eggs (=eggshells), live hatchlings, dead hatchlings, and unhatched eggs. Dead pipped eggs are considered unhatched eggs. An egg is not considered hatched until the hatchling actually leaves its egg. Each item found in the nest should fit into one and only one, category. (Do **not** include live or dead hatchlings that are found on the surface of the beach as they are already emerged from the nest.)

For *in situ* nests determine and record the number of eggs that hatched by carefully counting the eggshells. (The total number of eggs laid should already be known for relocated nests.) Count each eggshell that is more than 50% complete as one hatched egg and disregard the smaller pieces. Be sure that all the eggshells are completely separated from each other. Record the number of live hatchlings, dead hatchlings, unhatched eggs, and egg shells.

Hatchlings found at the bottom of nests during daylight excavation shall be released immediately on the beach a short distance from the water. Someone should monitor the hatchlings to ensure gulls or ghost crabs do not take them. Under natural conditions, (where kind humans do not excavate nests) these hatchlings would not have survived. They are not as fit and may even have genetic defects that prevented them from leaving the nest.

After completing the nest success evaluation, the nest contents should be reburied within the original nest cavity, unless a hatchery is being used. Research has shown that the leftover nest contents contribute to the growth of dune plants. Leave the marker in case raccoons dig up the contents. In this way the unearthed contents will not be confused with a "wild" nest that has been depredated.

If you find live hatchlings in pipped eggs, hatchlings with yolk sacs or any viable looking eggs, do the following. Rebury the contents of the hatched nest at the bottom of the egg chamber. Add a layer of clean moist sand. Place the viable eggs and hatchlings on this layer of sand and then add more clean, moist sand over them. Cover the area with dry sand and keep the nest location marked and screened if necessary. These turtles may never emerge due to unknown genetic or physiological reasons. After a reasonable time (one week), excavate the nest and complete the evaluation.

There are two ways to measure the success of turtle nests. First, is the number of **live hatchlings** that emerge from the nest out of the **total eggs** deposited (hatching success). Second, is number of **nests** that produce hatchlings out of the **total nests** laid (nest success). Calculate each separately for **1) in situ, 2) relocated and 3) total for the season.**

HATCH SUCCESS RATE FORMULA
(Total # **live hatchlings** / Total # **eggs laid**) x 100

NEST SUCCESS RATE FORMULA
(Total # **nests hatched*** / Total # **nests laid**) x 100
[*Nests with 10% or greater hatch success]

Some nests that are laid at the end of the season are subjected to very cool temperatures in the fall, and may never hatch even though the eggs contain live embryos. If these nests incubate over 90 days, record them as unhatched.

DO NOT: Excavate hatchlings prematurely

PUBLIC EDUCATION AND RELATED MATERIALS

This section applies to all information distributed through the media, slide presentations, newsletters, websites, and public posters and signs by projects in regards to sea turtle conservation and the activities carried out under the permit issued by SCDNR.

Sea turtle conservation requires long-term public support over a large geographic area. The public must be factually informed of the issues particularly when conservation measures conflict with human activities such as commercial fisheries, beach development, and public use of nesting beaches. Public education is the foundation upon which a long-term conservation program will succeed or fail.

It is the responsibility of the projects to ensure that information provided to the public in any form is biologically accurate and in keeping with the SCDNR Guidelines.

It is also important to ensure that there is **correct representation** when providing public information. The authorship of any educational materials rests with the respective project. **Do not act as an agent or employee of SCDNR** when providing public information. (See section on INFORMATION FOR MARINE TURTLE PERMIT HOLDERS for more information.)

In an attempt to ensure that material is factual and up to date, SCDNR is willing to review any educational materials developed and distributed by the projects. SCDNR would also like to develop a catalog of all the educational materials produced by the projects, including newsletter and media articles. Include copies of any such materials with the annual report sent to SCDNR at the end of each season.

* * * * *

PUBLIC AWARENESS TURTLE WATCHES

Observing nesting sea turtles and hatchling emergence at night provide valuable opportunities for education and training. However, turtles are sensitive to disturbances, and therefore turtle walks and watches must be conducted with care. The following are the **minimum** guidelines required by SCDNR. Projects can implement more stringent guidelines if they so choose. Advise SCDNR if guidelines other than those listed here are to be used. These guidelines apply only for loggerhead turtles. Other species should be reported immediately the next morning so that SCDNR can verify the tracks.

Turtle watches may not be commercialized (conducted for profit). Fees may only be charged by non-profit organizations to cover legitimate costs incurred in sea turtle conservation efforts.

Observing nesting turtles:

Programs presented prior to walking on the beach are highly recommended and must explain the procedures to be followed during the experience, as well as accurate, updated information on sea turtle conservation and biology. **Group size is not to exceed 10 persons per group. State Parks ONLY will have a limit of 30 persons per group.** Turtle watch tour guides are encouraged to inform persons who are out on their own looking for turtles of the need to be part of a permitted group. This is an opportunity to educate persons who might otherwise disturb nesting turtles. Participants must stay with the group and remain quiet. Tour guides are responsible for maintaining group control at all times.

Flashlights may be used to ensure safety while gaining access to and from the beach. Once on the beach, lights are restricted to tour leaders. The use of red filters on flashlights is recommended. Improper use of flashlights can deter other nesting females.

One guide should find the turtle and determine what stage of nesting she is in. Only if she is dropping eggs or covering can people approach and form a semi-circle around the rear of the turtle at a distance of two meters. A roped off area may be necessary to prevent onlookers from creeping too close. Semi-circles with children sitting in front of adults allow for maximum viewing. When the turtle is dropping eggs, the tour guide can use a low intensity flashlight to illuminate the back of the turtle and move sand so that the eggs are visible. A single egg may be removed from the nest by a staff member to show the participants. The egg must be returned to the nest before egg deposition is completed.

When the turtle is covering, light touching of the turtle's shell is permitted. This must cease if it appears to alter the turtle's activities. A low intensity flashlight can be used to illuminate the back of the turtle in order to observe the covering process. Once the turtle has finished covering and starts towards the water, all lights must be turned off to avoid disorienting her. People must stand behind the turtle once she starts towards the water.

No flash photography is allowed.

A summary of the guidelines used by the project for turtle watch programs, any problems experienced, and the number of excursions must be included in the annual project report to SCDNR at the end of the year.

Observing hatchling emergence:

This activity applies principally to permit holders whose areas are public beaches, such as state parks, or resort areas. Under natural conditions, marine turtle hatchlings emerge in darkness. Although rain or overcast skies can induce daylight emergences, the overwhelming majority of hatchlings emerge in the dark.

Nests are not to be dug into at any time, neither during daylight or dark, to see if hatchlings are "ready" to emerge. Nests may only be dug into under the guidelines described in NEST SUCCESS EVALUATION.

Hatchlings shall emerge naturally and shall be allowed to crawl to the water on their own.

When an emergence is taking place, the public must stand behind the nest forming a V towards the water which is delineated with a roped off area at a minimum of 2 meters from the path of the hatchlings. Hatchlings must be allowed to walk freely to the water without disturbance. The public must be managed in a strict manner so as to avoid hatchlings being trampled. A staff member can stand in the surf with a single low intensity flashlight pointing up the beach to maintain hatchling orientation to the water as well as assist the public in viewing the hatchlings. A quick check of the release area with a small flashlight a short time after release will ensure that all hatchlings have reached the water.

A summary of the guidelines used by the project for hatchling night programs, any problems experienced, and the number of excursions must be included in the annual project report to SCDNR at the end of the year.

Conducting turtle watches, disturbing sea turtles, and handling eggs or hatchlings without a valid permit is unlawful.

Equal Opportunity Agency