Protecting Beaches and Sea Turtles:
Beach Nourishment, Loggerhead Sea Turtles, and Sea Level Rise in North Carolina

Kimberly Hernandez | Master of Environmental Management | Duke University

North Carolina Coastal Resources Law, Planning and Policy Center

Introduction

With sea levels rising and beachfront development continuing, barrier island beaches will be increasingly squeezed between the rising tides/storm surges and coastal development. Because of the economic value of coastal property and the current ban on seawalls, groins, and other hard structures on North Carolina beaches, beach nourishment is often the accepted engineering solution utilized to combat eroding shorelines.

With North Carolina prioritizing nourishment as a viable and effective option, it is important that species that rely on certain beach characteristics are considered during the nourishment permitting process. Given the recent critical habitat designations for the Northwest Atlantic Ocean Distinct Population Segment of the Loggerhead Sea Turtle (*Caretta caretta*), the impact of nourishment on sea turtles warrants further attention.

Each beach selected for this study is:

I. A known loggerhead sea turtle nesting beach;
II. Within the proposed terrestrial critical habitat;
III. Vulnerable to sea level rise;
IV. On a developed barrier island.

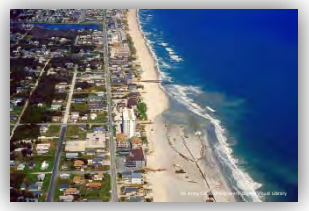
Critical Habitat Designation

On July 9, 2014 the National Marine Fisheries Service and the U.S. Fish and Wildlife Service announced two final rules that designated marine and terrestrial critical habitat for the Northwest Atlantic Ocean Distinct Population Segment of the Loggerhead Sea Turtle. This study focused exclusively on the final terrestrial critical habitat ruling (see maps).

The critical habitat covers 96.1 miles of North Carolina ocean-side beaches, including the five islands in my study area:

- Bogue Banks
- Pleasure Island
- Bald Head Island
- Oak Island
- Holden Beach

Methods



Carteret County
New Hanover County
Brunswick County

148 projects
$535,148,645
Since 1955

At least
4,810 nests
Since 1998

Historic Nourishment Data

Historic Sea Turtle Data

Literature Review

USGS Coastal Vulnerability Index Maps

Economically & Environmentally Viable Solutions

Problem	Solution?
Construction	Environmental Windows
Sand Quality	Sediment Criteria Rules
Compatibility	Sediment Samples
Toxicity	Not Mentioned in SCR
Sand Color	Not Mentioned in SCR
Design Profile	"Turtle Friendly Design"

Recommendations

1. Maintain the environmental windows for dredging and nourishment.	2. Incorporate sand color into the Technical Standards for Beach Fill.	3. Account for sea level rise in future nourishment projects.	4. Continue to ban hard structures on ocean-side beaches.	5. Continue monitoring beaches for any changes post-nourishment.
In North Carolina, "environmental windows" regulate when nourishment can take place in order to avoid negative impact to sea turtles in the water and on land. However, there is a movement by Governor McCrory and dredging companies to have these windows extended into nesting season in order to drive down project costs. From 1992 to 2006, only one sea turtle was killed by a hopper dredge in the Morehead City vicinity during the January 1 to March 31 window, while 20 sea turtles were killed while dredging outside of this window.	The current rules governing the quality of sediment placed on a North Carolina beach – also known as the Sediment Criteria Rules – do not specify sediment color. Sea turtles exhibit temperature-dependent sex determination, with cooler sand tending to yield males and warmer sand tending to yield females. Because sand color can dictate sand temperature nests incubated on darker (warmer) beaches will produce almost exclusively females, while nests incubated on lighter (cooler) beaches tend to have a mix of males and females.	A Coastal Resources Commission directive approved on May 15, 2014 limits the CRC Science Panel to only project sea level rise for the next 30 years, with an update every five years. This short-term horizon will make it difficult for county and municipal governments to develop long-term economically and ecologically responsible policies. A longer planning horizon would allow planners to incorporate the increased need for sand into future nourishment projects and more accurately represent the total lifetime cost of any multi-decadal projects.	For nearly thirty years North Carolina has banned permanent hard structures on beaches (e.g., seawalls, jetties, or groins). However, in 2011 Senate Bill 110 was signed into law, allowing up to four trial terminal groins to be considered for construction, one each at Holden Beach, Ocean Isle Beach, Bald Head Island, and Figure Eight Island. Bald Head Island just received a permit from the state. Any proposed projects should not only include sea level rise in the plans, but groin construction, if permitted, should avoid sea turtle nesting season (May-October).	Now that the critical habitats for loggerhead sea turtles have been legally designated, the US Fish & Wildlife Service and National Marine Fisheries Service must continue to coordinate with the North Carolina Wildlife Resources Commission and local sea turtle volunteer groups. From 2011-2012, volunteers contributed 40,660 hours to monitor nesting beaches. This is equivalent to $626,589 in volunteer labor that is at no cost to the state or federal governments. These efforts are crucial for the effective management of the loggerhead sea turtle.

Sea Level Rise

Contention has been brewing in the state over the rate at which sea-levels are rising ever since the 2010 CRC Science Panel released the "North Carolina Sea-Level Rise Assessment Report", which recommended planning for 1 meter of sea-level rise. As a result of this controversy, House Bill 819/ Session Law 2012-202 (HB 819) prohibited any "rule, policy, or planning guideline that defines a rate of sea-level change" and states that "the General Assembly does not intend to mandate the development of sea-level policy" and that "the Commission shall be the only State agency authorized to define rates of sea-level change for regulatory purposes" (HB 819 Section 2(a)). Therefore, at the state-level, sea-level rise planning is neither required nor allowed. The State cannot define rates of sea level rise for policy or planning purposes until July 1, 2016, but it instructs the Coastal Resources Commission (CRC) Science Panel to create a follow-up "North Carolina Sea Level Rise Assessment Report" by March 31, 2015. The Panel met for the first time to discuss the new report in July 2014 and a draft is expected on time.

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Historic sea turtle data was obtained from the North Carolina Wildlife Resources Commission. Historic nourishment data was obtained from the Program for the Study of Development Shorelines at Western Carolina University and cross-referenced with data from North Carolina Division of Coastal Management. To focus the study areas, analyzed US Geological Survey Coastal Vulnerability Index maps overlaid with sea turtle nesting density were obtained and used with permission from Dr. Betsy Von Holle.

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