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**Proposal Cover Sheet**

**Term: Fall\_X\_ Spring \_\_\_\_\_ Year \_2011\_**

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Have you identified a research mentor for a senior thesis (if applicable)?

\_\_\_\_\_ Yes \_\_X\_ No.

If yes, please identify.

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Title of Proposal:**

\_\_\_\_\_\_Effects of Hurricanes on Loggerhead Sea Turtle (*Caretta caretta)* Nesting on Florida

Beaches\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Keywords (3-5) \_\_\_\_*Caretta caretta,* hurricanes, nesting\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Checklist:**

All required portions of the first submission are included \_\_\_X\_\_ Yes \_\_\_\_\_ No

I had an external reviewer read the proposal \_\_\_\_\_ Yes \_\_X\_\_ No

If Yes, who \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ When \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

I authorize the use of this proposal as an example in future courses \_\_\_\_\_ Yes \_\_X\_\_\_ No

**EFFECTS OF HURRICANES ON LOGGERHEAD SEA TURTLE (***Caretta caretta)* ***NESTING ON FLORIDA BEACHES***

**Abstract**

There is close overlap of hurricane season (June-November) and sea turtle nesting season (March-November), hurricanes are a potential cause of damage to sea turtle populations. Hurricane Andrew, which struck South Florida on 24 August 1992, provided an opportunity to quantify the impact of a category 4 hurricane on six Florida nesting beaches. We compared the reproductive seasonality of sea turtles nesting in areas vulnerable to hurricanes. Storm surges significantly decreased reproductive output by lowering the number of nests that hatched and number of hatchlings that emerged from nests. Hurricane Andrew affected turtle nests over a total of 80 miles of beaches on the east and west coasts of Florida. The storm surge associated with the hurricane produced the greatest mortality through nest flooding. The greatest surge effect was felt on beaches closest to the "eye" of the hurricane, where egg mortality was 100%. In areas farther away from the "eye," the surge was lower and mortality was correspondingly decreased. Data on post-hurricane hatching success, mortality, and cause of death was gathered. Sixty- nine percent of the eggs did not hatch after Hurricane Andrew and appeared to have drowned during the storm. Further mortality occurred when surviving turtles suffocated in nests situated in the beach zone where sand had increased.

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**Introduction**

Loggerhead sea turtles (*Caretta caretta)* are a common species in the oceans around Florida. The state of Florida is know for its miles and miles of diverse beaches, 90 percent of all loggerhead nesting occurs in Florida (FWC, 2011). Loggerheads tend to lay their eggs on beaches with high energy, relatively narrow, steeply sloped, coarse-grained sand (NOAA, 2011). The nesting season is from March-November, laying eggs at night with up to seven nests in a 14 day period (U.S. Fish and Wildlife Service,2011).

Threats to these nests include natural disasters like hurricanes, tropical cyclones, and heavy rain from the hurricanes. The nesting season and hurricane season overlap causing many nests to be destroyed. A missing link in the literature and research of the destruction of nests is the long-term effects. The main question is how do hurricanes affect the nests, for instance, how many of the eggs survive, the mortality rate, and how it impacts the surviving eggs.

Loggerheads need to be protected, one of the ways to accomplish this is through research and hands on learning to determine why the population may be declining and what threats are causing it. So far it has been found that storm surges associated with the hurricane produces the greatest mortality through nest flooding (Lutz, 1994). Entire nests exposed to seawater can be lost due to inhibited oxygen exchange between eggs and the surrounding substrate or rapid water loss to highly saline waters. Sea turtles in general have flexible-shelled eggs, which lose and gain water quickly depending on conditions surrounding the nest (Pike, 2007). Sea turtles are threatened mainly because of their inability to quickly recover from population declines due to their slow rates of population growth (Pike, 2007). This later mortality may be substantially reduced if beach topography is returned to normal and beach debris removed after a hurricane (Lutz, 1994).

**Project Summary**

Loggerhead nesting is greatly affected by the winds and storm surges on beaches throughout Florida. To be able to determine what the actual mortality rate and the survival of the eggs are we will conduct a survey sent to various counties along the east and west coast of Florida, look at data from past years and specifically on the effects of Hurricane Andrew.

**Problem Statement**

As stated earlier Loggerheads nesting season and Florida’s hurricane season have a period of overlap. One of the problems for loggerheads is when a hurricane hits any where near the beach either rain or intense wind can destroy the beach therein destroying the turtle nests buried in the sand. Not many turtles make it in the first place once they hatch due to predation, but hurricane force winds and intense rain just decrease the survival rate even more during these 6 months. Research will be done to find out the impact and percentage of loggerhead sea turtle nests that hurricanes have affected in the state of Florida.

**Methods**

***Experimental Design****:*

The focus will be on central and south Florida. The main question being addressed is how do hurricanes affect the nests, eggs survival rate, mortality rate, and the impact on surviving eggs.

Surveys will be conducted from May 15,2011 until August 15, 2011, twice a week for each beach. A total of 236 loggerhead nests will be used in the analysis of nest-site selection. Data will be collected from each nest site. (Garmestani, 1997).

***Data collection****:*

Nest Survey *–To* assess the general impact of Hurricane Andrew a questionnaire will be mailed to local organizations in charge of monitoring nesting activity. Telephone contacts will also made to clarify answers. Information is included from Juno Beach in Palm Beach County, Deerfield Beach in Broward County, Key Biscayne and Virginia Key in Dade County, and Sarasota Beach on the west coast in Sarasota County. The data requested included: 1) Number of nests laid after the hurricane compared to previous years, 2) Number of nests remaining (unhatched) when the hurricane struck, 3) Hatching success of the nests which hatched after the hurricane vs. success at the same time in previous years, and 4) total hatching success as compared to previous years (Lutz, 2004).

Following the hurricane, the nests will be located and changes in beach profile noted. The eggs will be left in place and monitored through the normal period of incubation. After 70 days the nests will be excavated and the contents categorized into four groups: dead hatchlings (hatched, unable to escape the nest), emerged hatchlings (empty shells unaccounted for in 1st group), and unhatched fertile eggs in either early (no visible embryo) or late (large, well developed embryo) development (Lutz, 2004).

***Study site:***

The study will be done on an uninhabited, 38.3-km stretch of beach along the Atlantic coast of central Florida, USA (Canaveral National Seashore; 28°4347.06”N, 80°4117.17W). We will conduct nightly beach surveys for loggerhead turtle nests beginning in April and ending in late September. Each night during this period we will survey the beach for turtles emerging to lay eggs, or for tracks of turtles that had already deposited eggs. Turtle tracks will then be followed to the nest site, and will covered each nest with a wire screen to deter predators. The holes in the screen will be large enough to allow hatchling turtles to exit the nest and disperse to the ocean naturally. We also will mark the location of each nest with a numbered wooden stake (1m tall) for future identification. (Pike, 2007).

We will excavate a subset of nests post-hatching to determine clutch size, whether any eggs in the nest hatched (nesting success), and the proportion of eggs that hatched (hatching success). If we are unable to find nests marked for excavation (i.e., both the nest marker and predator-exclusion screen were either washed away or entombed under >1m of sand), we will consider them to have failed, and presumably no hatchlings emerged from such nests. We used Kolmogorov–Smirnov tests for normality to determine whether each loggerhead nested in a normally distributed pattern throughout the nesting season. When these results are significant we visually inspect the distribution of the data to identify whether nesting occurred early or late in the season. (Pike, 2007).

We define the sea turtle nesting season as the period from when the first nest was laid until the last nest was laid, whereas the incubation season is the period of time when the first nest was laid until the last nest hatched; thus the incubation season is of longer duration than the nesting season (Pike , 2007).

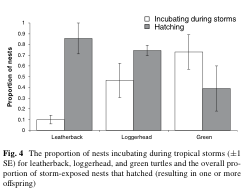
**Data Analysis**

**Nest Survey***:* The turtle nests in Juno Beach (Palm Beach County) located about 90 miles from the eye were not adversely affected by Hurricane Andrew since nests that hatched after the hurricane had an average of 80% emergence success, equal to previous years. Deerfield Beach (Broward County), located approximately 45 miles from the eye, experienced surges of up to 1.8 m. Of the 2,221 total loggerhead nests for 1992, 24.5% were lost or destroyed by Hurricane Andrew. The 107 hatched loggerhead nests that were evaluated after the hurricane had 69.0% hatching success compared to the 1991 rate of 69.7% indicating that they were not affected by Hurricane Andrew. In Virginia Key, located south of Miami and north of Key Biscayne, the storm surge from the hurricane was 1.8-2.4 m, and washed out 10 unhatched nests (Lutz, 1994).

There was no evidence of survival, and the most likely cause of mortality was drowning. The eye of the hurricane passed 10 miles south of Key Biscayne, where the beach is monitored from the northern tip of the key to the northern tip of Cape Florida State Recreation Area. At the time of the hurricane, 18 monitored nests had not yet hatched and all, as well as any remaining unmarked nests, were inundated with a 1.8-2.4 m storm surge. Erosion in some parts of the survey area and notable increase of sand in others, as well as restricted access to the beach following the storm, prevented search and excavation (Lutz, 1994).

No nests were observed to hatch after the hurricane, and, like Virginia Key, the most likely cause of mortality was drowning. Hurricane Andrew predictably did not have as much effect on west coast beaches, because of the distance from the eye and because the beaches were leeward from the storm track. However, storm surges still occurred on Sarasota Beach. Out of the 1992 total of 2,762 known and possible loggerhead nests on 42.4 miles of monitored beach, 22.4% were partially or completely destroyed by Hurricane Andrew. Hatching success in nests that were not directly affected was comparable to previous years (Lutz, 1994).

We analyzed the number of nests incubating in each month, each nests incubates for more than 1 month, and may be exposed to storm surges during the entire period of development. In all cases where a nest did not produce any hatchlings, the nest was either inundated with seawater at some point during development or the nest was completely washed away due to storm surges. Nest failure was 74% of all nests hatched (Pike, 2007). Loggerheads can differ markedly in nest placement and nests placed closer to the shore generally have a higher likelihood of failing due to seawater inundation. For example, loggerhead nests placed further from the ocean (closer to the dunes) have a higher likelihood of hatching than those placed closer to the high-tide line. (Pike, 2007).



**Broader Implications**

Published literature suggests loggerhead turtles are nesting earlier in the season and shortening their nesting seasons in response to increasing sea surface temperatures. This may cause loggerhead reproductive success to improve in the future because more nests will hatch before the onset of hurricanes (Pike, 2007).

**References**

1. Florida Fish & Wildlife Conservation Commision. Loggerhead Nesting in Florida. Sep. 25, 2011. <http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead/>.

2. Garmestani, AS. , HF. Percival, K.G. Rice and K.M. Portier. 1997. Sea turtle nesting in the Ten Thousand Islands o f Florida. Fla. Coop. *Fish and Wildl. Res. Unit, USGS-Biological Resources Division Tech.* Rep. 56. 96 pp.

3. Lutz, P.L. 1994. Effects of Hurricane Andrew on the Sea Turtle Nesting Beaches of South Florida. *Bulletin of Marine Science*. 54. 978-981.

4. NOAA Fisheries. Loggerhead Turtle (*Caretta caretta).* Office of Protected Resources. Sep. 25, 2011. http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.htm.

5. Pike, D. A. , Stiner, J.C. 2007. Sea turtle species Vary in the Susceptibility to Tropical Cyclones. *Oecologia*. 153. 471-478.

6. U.S. Fish and Wildlife Service. Loggerhead Sea Turtle. North Florida Ecological Services Office. Sep. 25, 2011. <http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/loggerhead-sea-turtle.htm>.

**Biographical Sketch**

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**EDUCATION**

* **Florida Gulf Coast University,** Fort Myers, FL Expected Fall 2012
* Relevant course work: Scientific Process, Conservation Strategies for a Sustainable Future, North American Environment, Ecology

**Southeastern University,** Lakeland, FL

* Completed 35 hours of General Education coursework and 12 hours of General Biology courses along with other miscellaneous courses
* Dean’s List 2008

**OTHER WORK EXPERIENCE**

**Planet Beach Contempo Spa,** Spa Consultant , Sarasota, FL June - July 2011

* Seasonal
* Entered clients into the computer and rang up purchases
* Sales
* Sanitized Machines
* Instructed clients on spa processes

**CAMPUS AND COMMUNITY INVOLVEMENT**

* Fundraising to buy plants
* Volunteered at C.R.O.W- Clinic for Rehabilitation of Wildlife
* Naples Botanical Gardens
* Organized canned foods on Thanksgiving
* Missions trip to Grenada
* Missions trip to New York