4-2011

The Effect of Air Temperature on the Incubation Period and Hatching Success of In Situ Loggerhead Sea Turtle (Caretta caretta) Clutches in Broward County, Florida

Lucy Teal Kawana
Nova Southeastern University

Curtis M. Burney
Nova Southeastern University, burney@nova.edu

Louis Fisher
Broward County Environmental Protection Department

PILOT STUDY SHOWS SUCCESS IN RELOCATION OF LEATHERBACK SEA TURTLE (*DERMOCHELYS CORIACEA*) NESTS ABOVE THE BACKSHORE BEACH AT SPNWR

Paul Jobsis[1], Clayton Pollock[1], and Claudia Lumbard[2]

[1] University of the Virgin Islands
[2] US Fish and Wildlife Service

Through conservation, strict enforcement, and the hard work of many dedicated managers and volunteers the number of Leatherback sea turtles nesting at Sandy Point National Wildlife Reserve has increased over the past 30 years. Starting with 20 nesting turtles in 1981 the nesting population has increased dramatically with 208 turtles nesting in 2009. Dynamic erosion patterns coupled with increasing nesting densities may require innovative strategies to maintain this increasing population. Sea level rise and global climate change could also severely limit available nesting and relocation areas further acerbating management. Expanding relocation areas to include the backshore beach within the seaward vegetation would greatly increase the area available for the relocation of imperiled leatherback nests. However, previous studies have shown that relocation into vegetated areas decreases hatch success significantly due to root invasion and hatchling entrapment. Tilling these sandy areas may mitigate these and other soil conditions detrimental to hatch success and have the added benefit of easing the management, oversight and protection of these nests. In a pilot study we tested the effect of tilling the relocation area (1m x 1m x 1m per nest) to remove roots, rocks and other large debris. We compared the hatch success of tilled experimental plots to both natural in situ nests and standard protocol relocated nests on the open (non-vegetated) portions of the beach. In situ nests had a hatch success of 45.4 % ± 5.8 se, n=8; relocated nests using the standard protocol had a hatch success of 52.1 ± 7.9 se, n=8; nests relocated into tilled plots had a hatch success of 52.0% ± 4.2, n=9. None of the nest types showed any statistically significant difference in hatch success. Temperature profiles of the nests in the tilled plots showed a normal temperature profile throughout the nesting period and did not exceed 35 °C. These results support a larger trial of relocation into tilled areas. If future data continues to support these conclusions, then utilizing the backshore beach areas would greatly increase the area suitable for relocation and improve the management oversight and protection of these nests.

THE EFFECT OF AIR TEMPERATURE ON THE INCUBATION PERIOD AND HATCHING SUCCESS OF LOGGERHEAD SEA TURTLE (*CARETTA CARETTA*) CLUTCHES IN BROWARD COUNTY, FLORIDA

L. Teal Kawana[1], Curtis M. Burney[1], and Lou Fisher[2]

[1] Nova Southeastern University Oceanographic Center, Dania Beach, Florida, USA
[2] Broward County Environmental Protection Department, Plantation, Florida, USA

The survival rates of pre-emergent sea turtle hatchlings are critically dependent upon temperature. This study aims to determine if changes in air temperature have influenced the incubation time and/or the survivorship of the pre-emergent loggerhead sea turtle (*Caretta caretta*) hatchlings for past sea turtle nesting seasons in Broward County. Air temperature data within the hatching seasons of 1999 to 2009 was obtained from the NOAA National Climatic Data Center's Fort Lauderdale beach station. The loggerhead sea turtle hatching data collected by the Broward County Sea Turtle Conservation Program from the same time period was examined to assess the potential effects of air temperature on the hatching success and the incubation duration. This was performed primarily to determine if any trends or significance exist in the relationships among the aforementioned parameters. More specifically an analysis of trends in mean yearly sea turtle incubation durations was assessed and any correlations between incubation times and hatching success were also examined. Furthermore the relationship between incubation durations and mean seasonal and intra-seasonal air temperature fluctuations was tested for significance. Preliminary results for this study have shown a significant upward trend in the seasonal average incubation durations from 2003 to 2009 (t-test, $p < 0.05$). The mean incubation period for this study was 50.78 + 1.2 (mean + SD). Over the seasons the mean daily air temperature

fluctuated between yearly averages of 23.3 and 26.9 °C and had an overall mean of 25.98 + 1.9 °C (mean + SD). Statistical analyses indicate a significant negative association between the incubation duration and the average daily air temperature (t-test, $p << 0.001$). Further work pertaining to intra-seasonal analysis continues to be in progress. In Broward County alone, there was a continuous reduction in the number of loggerhead nests deposited each year throughout this study period. Determining if the effects of air temperature have significantly influenced loggerhead sea turtle clutches in Broward County might provide future insights for sustaining the survival rates of sea turtles in this area.

VARIATIONS OF SAND TEMPERATURES AND OF THE PERIODS OF MALE AND FEMALE HATCHLING FLATBACK AND GREEN TURTLE PRODUCTION AT NESTING BEACHES ON BARROW ISLAND AND MUNDABULLANGANA STATION FROM 2004 TO 2008

Gerald Kuchling

Chelonia Enterprises, Subiaco, Western Australia

Temperature data loggers buried at 50cm sand depth at sea turtle nesting beaches on Barrow Island and at Mundabullangana Station in the Pilbara of Western Australia logged sand temperatures from the 2004/05 to the 2007/08 nesting seasons to estimate and compare the periods of male and female hatchling production for Flatback turtles (*Natator depressus*) and Green Turtles (*Chelonia mydas*). The annual proportion of weeks estimated to produce male hatchlings at the monitored beach sites ranged from approximately 50-70% in Flatback turtles and from 30-40% in Green turtles. However, Flatback turtles have a narrower and better defined nesting season than Green turtles. During the thermo-sensitive period of egg incubation of Flatback turtles from early December to mid-March, only 11.2% of weeks showed sand temperatures at nest depth below the pivotal temperature. Since male hatchlings are mainly produced at temperatures below the pivotal temperature it appears that the sex ratio at those nesting beaches is generally heavily skewed towards females. Mundabullangana beach had higher sand temperatures than the Barrow Island beaches. Throughout the monitoring period 70% of all male-producing incubation weeks for Flatback turtles occurred at Bivalve Beach and Terminal Beach on the east coast of Barrow Island. These two beaches are directly adjacent to the development of the Gorgon gas liquefying plant and loading facility. Should nesting turtles avoid these beaches in future due to this development, the Flatback turtle hatchling sex ratio on Barrow Island may shift towards females which already appears to be the dominant hatchling sex. This possible shift will occur parallel and in addition to generally predicted hatchling sex ratio changes towards females due to climate change, which may aggravate an imbalance of the hatchling sex ratio in the future.

MULTIPLE PATERNITY WITHIN THE NORTHERN SUBPOPULATION OF LOGGERHEAD SEA TURTLE (*CARETTA CARETTA*)

Jacob Lasala[1], Kris Williams[2], J. Scott Harrison[1], Mike Frick[2], and David C. Rostal[1]

[1] Georgia Southern University, Statesboro, GA
[2] Caretta Research Project, Savannah, GA

Comprehension of a species mating system is not only important within conservation efforts, but the knowledge is also essential in understanding how populations differ from one another. Specifically, patterns of paternal contributions can skew effective population size and alter genetic variability. Recent studies have suggested that multiple paternity occurs in most species of reptiles but within the Testudines there is a high degree of variation. (Uller & Olsson 2008) Previous studies on the loggerhead turtle (*Caretta caretta*) have shown that within large rookeries (Florida, Australia and Greece) multiple paternity occurs in more than 30% of nests, but what of smaller nesting beaches? The primary objectives of this study are to determine if 1) multiple paternity occurs in Georgia's nesting population, 2) does it differ from previous studies, and 3) if present, to what degree. Secondary objectives are to compare the incidence of multiple paternity over multiple years, instead of the average and determine if the incidence varies over the course of the nesting season (Early, Middle and Late nests). Mothers and offspring were sampled from over 30 nests in 2009 spanning the