Loggerhead Turtles Shifting to the Northern Beaches for Nesting in Turkey: Can It Be the Evidence of Global Warming?

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PROCEEDINGS OF THE THIRTY-FOURTH ANNUAL SYMPOSIUM ON SEA TURTLE BIOLOGY AND CONSERVATION

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the occurrence of climatic events like "El Niño" and "La Niña". 2010 was a La Niña year, meaning colder temperatures, consistent with a sex ratio closer to 50%, while from August 2011 to date, an El Niño event has been occurring, producing warmer temperatures and therefore, a skewed sex ratio favoring females. This is a three year study, and we plan to continue sampling over several years to collect sufficient data to estimate the real impact of climatic events. So far our results show how subtle (0.9°C) temperature changes affect sex ratios in this species, highlighting the vulnerability of sea turtle populations to the contemporary climate change.

NEST SITE SELECTION AND ITS IMPLICATIONS FOR CONSERVATION FOR THREE SPECIES OF MARINE TURTLES NESTING ON PLAYA NORTE, COSTA RICA*

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All sea turtles today are currently listed as threatened to critically endangered due to interactions with anthropogenic activities during all life stages. Particularly true in the Caribbean; the warm sandy beaches that marine turtles utilize as rookeries are under increasing developmental pressure to satisfy increasing tourism demands and population growth. Various factors such as vegetation, slope/elevation and distances from dunes or water lines have been identified as factors for nest site selection. However, there are both inter- and intra-specific differences both geographically and temporally and it is still relatively unknown why turtles nest where they do. Playa Norte is a small nesting beach located in the Tortuguero Lowlands on the northern Atlantic coast of Costa Rica in the Caribbean Sea. It is used predominantly by Greens (*Chelonia mydas*); however, it also supports considerable numbers of critically endangered Leatherback (*Dermochelys coriacea*) and Hawksbill (*Eretmochelys imbricata*) turtles. As the three species have demonstrated different nest-site selection factors yet are still nesting on the same beach, this study aimed to identify a possible underlying nest site selection factor that all three species utilize. Spatial distribution of percent nesting along Playa Norte was significantly correlated (Spearman Rank, p= 0.0054) for Greens and Hawksbills whilst Leatherbacks were strongly related to Hawksbills (p=0.0924). The use of vegetation by Hawksbills and Greens varied annually whereas Leatherbacks consistently nested in open (exposed) zones. Percent nesting did not change due to removal or change of vegetation. This suggests that vegetation type and location are unimportant factors for nest site selection for Greens and Hawksbills. Contrastingly, for the conservation of Leatherback nesting, it is vital to maintain open areas of beach as Leatherbacks consistently nest in open or exposed areas of beach. This is the first study to use percent nesting as a preliminary indicator for nest site selection for any species of marine turtles. Results of this study are discussed in an evolutionary context as well as providing recommended measures for conservation.

LOGGERHEAD TURTLES SHIFTING TO THE NORTHERN BEACHES FOR NESTING IN TURKEY: CAN IT BE THE EVIDENCE OF GLOBAL WARMING?

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Loggerhead sea turtles are isolated from the Atlantic population, colonized in the Mediterranean and their nesting population seems to be around 2000 females. Nearly half of these populations are nesting on the South Mediterranean beaches of Turkey. Their nests have been recorded on the most north-western beaches of Ekincik and Dalyan. During the last two years a single nest, on Kusadası public beach, in each season were recorded nearly 200 km north of these

present nesting beaches. The first one was recorded on 08.06.2012 and relocated to further open beaches due to closer location of the sea. The relocation of 81 eggs took place 44 hours after being laid. The incubation period was 55 days and hatching continued for 7 days. A total of 74 hatchlings were emerged from this nest. There were 3 dead-in-shell embryo and 4 unfertilized eggs also recorded. The other nest was recorded on 30.06.2013 and protected in situ. The clutch size was 98 eggs. The hatching started on the 57th day of incubation and continued for 8 days. A total of 91 (91%) hatchlings emerged and the nest contained 4 dead-in-shell embryos and three unfertilized eggs. These two nests were protected and watched by local authorities and volunteers on the beaches and attracted almost 20,000 visitors during the entire incubation period. Our genetic analysis of the dead in-shell embryos will show the haplotype of the nests. From the incubation period, by comparing the results with nearby beach of Dalyan, we can assume that nearly equal sex ratios of hatchlings are produced. The results were discussed under the possible shifting behavior of loggerhead turtles as a possible result of global warming.

EMERGENCE OF LEATHERBACK (*DERMOCHELYS CORIACEA*) HATCHLINGS FROM THE NEST AT PLAYA GRANDE, COSTA RICA

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We investigated emergence rate of leatherback turtle hatchlings from in situ clutches over the course of three nesting seasons (October-December) during 2008-9, 2011-12 and 2012-13 at Playa Grande, Parque Nacional Marino Las Baulas, Guanacaste, Costa Rica. We focused on hatchlings, which emerged from their eggshell yet failed to emerge from the nest during the two-day period between the first hatchlings emerging and the nest excavation being performed. We measured the distance from the head of the hatchling to the surface of the sand to determine whether measured variables had an impact on where in the sand column above the nest hatchlings were found at the time of excavation. These variables included: temperature in the week prior to emergence, depth of dry sand above the nest (dry front), hatching success of the individual clutch, number of eggs in the clutch, and total depth of nest. Emergence rate (hatchlings that emerge from a nest related to total number of eggs that hatched) of hatchlings significantly declines as the season progressed in all years of this study. The depth of the dry front significantly increased during the course of all three seasons, and the temperatures in the centre of each clutch also increased through the season; this indicates that the nest environment may become less suitable for emergence as the season advances. This conclusion was supported by results from 2008-9 and 2011-12 seasons where the depth of the dry front had the strongest correlation with emergence rate respectively, and in 2012-13 both dry front depth and temperature were significantly correlated to emergence rate. There was also a significant effect of weeks into the hatching season on the number of dead hatchlings found in the dry front, which also supports this conclusion. Seasonal progression had an impact on the number of hatchlings found in the nests during excavations, and the proportion of these hatchlings that were still alive. The depth of the dry front was significantly correlated to number of hatchlings failing to emerge in all years investigated; this suggests that water content of the sand or sand consistency may be contributing factors to lowering leatherback hatchling emergence rate. By identifying factors responsible for reduced emergence rate we could potentially implement conservation strategies to alter environmental conditions within the nest, therefore increasing hatchling production. We would like to thank all the field biologists and Earthwatch volunteers responsible for collecting the data used in this investigation, the Park rangers at Parque Nacional Marino Las Baulas, the Leatherback Trust, and the Goldring-Gund Marine biology station. Also we would like to thank the International Sea Turtle Society, U.S. Fish and Wildlife Service, National Fish and Wildlife Foundation, U.S. National Marine Fisheries Service, Sea Grant-Texas, Shell, International Seafood Sustainability Foundation, Wildlife Computers, Environmental Business Specialists LCC, Sea Turtle Conservancy, Florida TURTLE license plate program, SIRTRACK, CLS America, Ecological Associates Inc., Desert Star Systems LLC, Loggerhead Marinelife Center. Janet Hochella, Kiki Jenkins, Sea Turtle Project-Bangladesh, Marinelife Alliance, Matthew Nash, Mission: Clean Beaches, Sandy Sly, ProFaunaBaja – ASUPMATOMA, Usagi Family and Debbie Sobel and the International Sea Turtle Symposium for providing the travel grant which enabled participation in this symposium.