26th Sea Turtle Symposium
Island of Crete, Greece, 3 - 8 April 2006

IN-SITU NEST INCUBATION TEMPERATURE STUDY IN A SEA TURTLE NEST WITH INTERNET-BASED DATA ACQUISITION TECHNOLOGY: POTENTIAL FOR CONCURRENT ANALYSIS OF GLOBALLY COORDINATED RESEARCH ACROSS MULTIPLE SITES BY MULTIPLE RESEARCHERS

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Abstract

Sea turtle biologists have been intrigued by temperature effects in sea turtle nests for decades. Incubation temperatures influence incubation duration, hatchling sex ratio, emergence, embryonic growth, phenotype and recruitment into a population. Conventional dataloggers are typically deployed to study nest temperatures that are later downloaded for offline analysis. We report here our experiment with one turtle nest using an Internet-based data acquisition system that offers researchers a method of investigation previously unavailable – real time collaborative investigation of sea turtle nests at multiple sites by multiple researchers on a global scale.

The study was conducted on Talang-Talang Besar Island nesting beach at Talang-Satang National Marine Park, Sarawak, Malaysia. We placed five platinum PT 100 RTD sensors (Minco Products Inc, USA) at the nest-bottom, nest middle-center, nest middle-side, nest-top, and sand at 15 cm below the surface, in a Chelonia mydas nest (1º44´N, 109º46°E). Sensors were factory calibrated to ± 0.1°C (N.I.S.T., USA) from 15.6 to 43.3 °C. Air temperature and humidity were measured with two other sensors (model HS-200V, Precon, USA) placed 1m above the nest. All seven sensors were wired to a weatherproof solar-powered data acquisition system comprising a datalogger with built-in embedded Internet gateway, a global system mobile modem, and a GSM signal booster. We subscribed to iSCADA hosted data acquisition service (www.devicesworld.net, Cyberjaya, Malaysia) for the duration of this study.

In the 51-day experiment from 22 Jul to 12 Sep 05, we received, and discussed on-line, real time temperature data as incubation events unfolded and remotely altered our pre-set temperature threshold alerts and sampling frequency to study incubation events. Temperatures at nest middle-center averaged 32.53 ± 1.19 °C, with a 4.95°C range from 30.17 to 35.13°C (n=1303); air temperatures averaged 29.68 ± 3.54°C, with a 19.49°C range from 23.30 to 42.79°C (n=1303). Sand temperature leads, and not lags, nest top temperature. The nest was well insulated against temperature fluctuations arising from conduction.

The end-to-end Internet-based system described here opens unique opportunities for biologists to conduct coordinated studies on nest temperatures on a global scale. A research team normally invests equipment and resources for a localized study using conventional methods. However, when several research groups collaborate on a regionally or globally coordinated experiment using a web-based data acquisition system, each research group's project investment in one site enables the group access to real time data from the total number of sites. Thus, multiple researchers from multiple sites are able to conduct nest temperature studies of the population with minimum costs. The advantages of regionally or globally coordinated real time study include: simultaneous access to data with avenues for on-line analysis and collaboration, standardization of research equipment and methodology, greater transparency, lower risk of experimental failure, flexible sampling rate and incubation event threshold settings and timely intervention.

The study was supported in part by the university AcRF grant 02/05 to the first author. We thank Sarawak Forestry Corporation for its support and the Talang-Satang National Marine Park staff for assistance.