Responses of Heat Shock Genes in Loggerhead Turtle Embryos (*Caretta caretta*) Exposed to Thermal Stress

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The survival and viability of sea turtle embryos is dependent upon favourable nest temperatures throughout the incubation period. Consequently, future generations of sea turtles may be at risk from increasing nest temperatures due to climate change, but little is known of how embryos respond to heat stress. Heat shock genes are likely to be important in this process because they code for proteins that prevent cellular damage in response to environmental stressors. This study provides the first evidence of an expression response in the heat shock genes of embryos of loggerhead sea turtles *(Caretta caretta)* exposed to realistic and near-lethal temperatures (34°C and 36°C) for one or three hours. We investigated changes in the expression of *Heat shock protein 60* (*Hsp60)*, *Hsp70*, and *Hsp90* in heart (n=23) and brain tissue (n=23) in reaction to heat stress. Under the most extreme treatment (36°C, 3 h), *Hsp70* increased expression by a factor of 38.8 in heart tissue and 15.7 in brain tissue, while *Hsp90* expression increased by a factor of 98.3 in heart tissue and 14.7 in brain tissue. Our findings indicate that both *Hsp70* and *Hsp90* are useful biomarkers for assessing heat stress in the late-stage embryos of sea turtles. Our results can be used for future studies of variation in the thermo-tolerance response of sea turtles at clutch and population levels.

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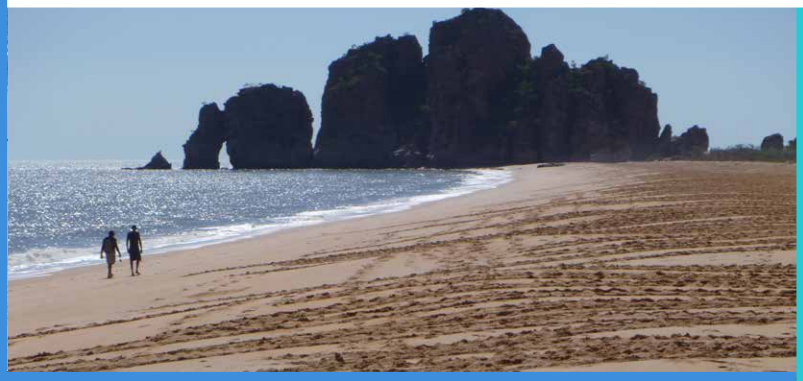
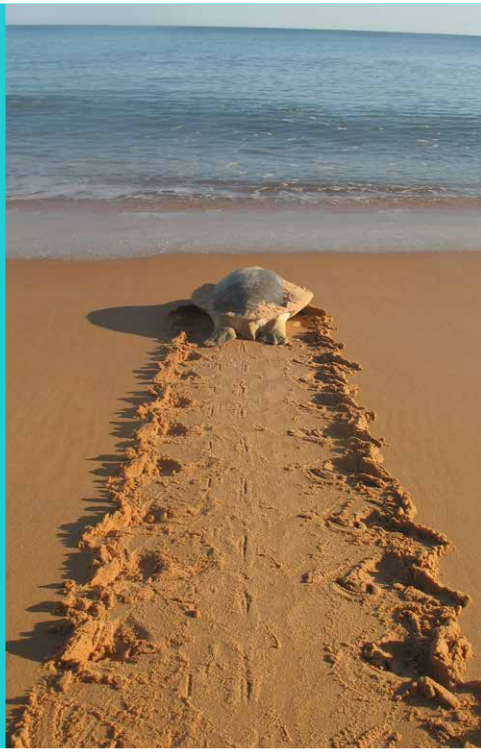


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