

Effects of warmer than normal incubation temperature upon the behavioral function of the hatchling freshwater turtles

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The Mary River turtle (*Elusor macrurus*) is listed as the 20th most endangered freshwater turtle in the world. The population has undergone significant decline over the last three decades and the present population is located within a single river system in Eastern Australia. Archival meteorological data shows that the local ambient temperature has undergone a 0.7°C increase since 1980, and the present study aimed to quantify if slight alterations in nest temperature during incubation affect the physiological and behavioral traits of the hatchlings. We recorded the average temperature from wild *E. macrurus* nests during the 2009/2010 nesting season, and mean nest temperature ranged between 26 to 31°C. Freshly laid *E. macrurus* eggs were collected and incubated at three constant thermal regimes, from the lowest to 1°C above the mean nest temperature recorded in the wild (26, 29 and 32°C). Embryos incubated at the warmest regime had the shortest incubation period, but upon hatching their growth rate was significantly less than those incubated at the lower temperatures. The warmer the incubation temperature the lower stroke force exhibited by the hatchlings whilst swimming and the lesser the amount of time they spent swimming during a trial. The implications of this reduced swimming performance could be observed in the behavioral function, as turtles incubated at 32°C spent most of their time in shallow water, whilst turtles with the better swimming performance (incubated at 26°C) preferred to remain in deeper water. The food supply of hatchlings *E. macrurus* and their refuges from predators are located on the river substratum and we hypothesize that the eggs incubated at 32°C would have an impaired survivorship in the wild because of a reduced prey consumption and exposure to predators. Although other factors may have been significant in the decline of the *E. macrurus* population, the present study shows that hatchlings incubated at warmer temperatures have a reduced ability to carry out the necessary behaviors for survival. Climate models predict a 1.6 to 3.0°C rise in ambient temperature for this locality by 2070, and therefore, we argue that the survival of hatchling *E. macrurus* may be further compromised.