INFLUENCE OF INCUBATION ENVIRONMENT ON THE DEVELOPMENT OF THE FLATBACK TURTLE (*Natator depressus*)

by

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ABSTRACT

During the Australian summers of 1995/1996, 1996/1997 and 1997/1998, the embryonic development of *Natator depressus* was investigated in the laboratory and in natural nests at the major eastern Australian rookery of Peak Island.

Eggs were incubated under different thermal and hydric conditions on vermiculite substrates. No eggs hatched at 25°C, but eggs incubated between 26 -33°C hatched successfully. Within this range, the thermal environment significantly influenced the water exchange of eggs, incubation duration, nutrient mobilisation of embryos, hatching size and energy reserves. The pivotal temperature for sex determination in this population was close to 29.5°C with a possibly narrow transitional temperature range of 1 Celsius degree. Sexually biased differences were observed at hatching; male hatchlings produced at 26°C and 29°C were larger, but had less energy reserves than females which were produced at 32°C. Thermosensitive developmental stages at masculinising temperatures were different to those at feminising temperatures. For the 26 to 32°C temperature shift, the thermosensitive period was confined to a single developmental stage. Determination of ovaries took place at a later stage than that of testes.

The influence of the hydric environment depended greatly on the range of substrate water potentials used in experiments. Nutrient mobilisation of embryos, size and energy reserves of hatchlings were dependent on total egg water exchange over the range of 2% gain to 29% loss (at ~ -180 to -3500 kPa) of initial egg weight, but independent within the narrower range of 6% gain to 19% loss (at ~ -200 to -650 kPa). Hatching was affected only when eggs lost

more than 21% of their initial egg weight (at ~ -1300 kPa). The pivotal temperature for sex determination was not influenced by the hydric environment (~ -180 to -2000 kPa).

A significant effect of clutch on morphological and physiological aspects of developing embryos indicated that genetic/maternal factors influenced these traits. Dietary sources of the female possibly contribute to maternal factors, through processes such as preferential accumulation of specific fatty acids such as oleic acid into the egg yolk. A high proportion of egg yolk lipids (35%) suggests considerable maternal investment. Only 26% of these lipids were used for embryogenesis whereas 74% remained in the form of hatchling fat bodies or residual material in the yolk sac.

Eggs in natural nests incubated over a temperature range of 25.5 to 36.5°C and experienced an average increase in temperature of 7 Celsius degrees during incubation. Water content of sand surrounding nests at the beginning of incubation varied from 2.6 to 7.8%. Hatching and emergence success were not influenced by the position of the nest on the beach, but were positively related to clutch size. Neither clutch size nor hatching and emergence success varied significantly between subsequent clutches of a female. Seasonal changes in the sex ratio of hatchlings are likely to take place at Peak Island, with an overall female biased sex ratio.

A tolerance to high incubation temperatures and severe moisture stress by *N. depressus* eggs may be reflected in the short incubation duration of this species relative to other species of sea turtles.