NEST TEMPERATURES OF THE WATER DRAGON *PHYSIGNATHUS LESUEURII* IN SOUTHEAST AUSTRALIA

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ALTHOUGH the egg stage is a critical period in the life cycles of reptiles, details of the incubation conditions inside natural egg chambers are limited; information usually concerns species with environmental sex determination, mainly crocodilians and chelonians (e.g. Bull, 1982; Magnusson et. al. 1985; Moll, 1994). Conditions within lizard nests have also been reported, but much less frequently (e.g. Leiberman, 1979; Phelps, 2000). Part of the problem apparently involves the location of natural nests, since in comparison to many crocodiles and chelonians, lizards are often much smaller and their nesting behaviour less obvious (Perry & Dmi'el, 1994).

During November and December 2000 we had the opportunity to make observations on the temperatures inside the egg chambers of the Australian water dragon *Physignathus lesueurii* at the Australian Botanical Gardens, Canberra, ACT (350 15'S; 1490 8'E). We were alerted to the presence of the nest sites on the morning of 30/11/00 when two dragon eggs were found above ground in an area of sandy soil, which was not a natural feature of the gardens having been used for the construction of pathways. Presumably a dragon had disturbed an earlier egg clutch whilst in the process of laying her eggs. Soil moisture levels were high throughout the observation period and were particularly high on the morning the eggs were discovered as a result heavy rain the previous evening. This depressed the loose soil at the nest entrances and showed up clearly against the surrounding impacted soil. Further investigation revealed at least eight nest sites.

The nests were situated on short embankments, at approximately 50^0 inclines, generally facing a direction of northwest with the egg tunnels at approximate right angles to the surface. All were situated in open areas and did not receive any shade until late in the day (around 1700 hrs). The top rows of eggs were buried 20 cm or so into the soil. To avoid undue disturbance of the egg clusters we did not make detailed counts of the eggs within each nest but numbers in excess of 15 - 20 eggs were present in at least two nest chambers. Over six days between 30/11/00 and 16/12/00, consisting of two overcast and four sunny days, temperatures inside the nests were recorded at approximately 15 minute intervals using an alcohol thermometer with the bulb placed immediately above the egg clutches.

Date	Mean	±Standard Deviation	Range	*n*
31/11/00	24.3	1.04	22-25	30
07/12/00	23.7	0.06	23-25	17
01/12/00	26.6	1.91	24.29	29
06/12/00	29.2	1.94	25-32	35
11/12/00	25.7	2.81	23-31	33
16/12/00	25.2	1.57	24-28	29

Table 1. Summary statistics of daily recorded temperatures (^{o}C) inside the nest chambers of *Physignathus lesueurii.* The days with overcast weather were 31/11/00 and 7/12/00; the others generally had clear sunny skies. The number of daily measurements *n* on which the calculations are based are also given.

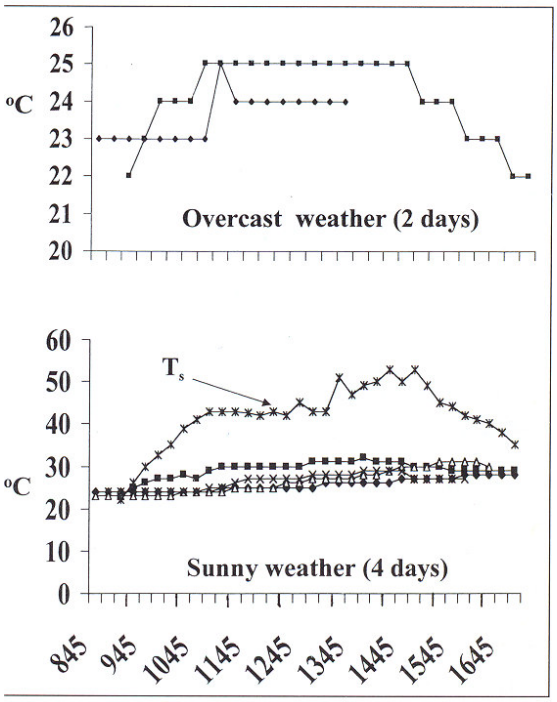

Figure 1. Daily changes in temperature inside the nests of *P. lesueurii* during overcast (top graph) and sunny weather. Corresponding changes in sand surface temperature (T_s) and nest temperatures (solid squares) on the warmest sunny day (6 December 2000) are shown for comparative purposes. Crosses, solid diamonds and open triangles show nest temperature records on sunny days when comparative sand surface temperatures were not recorded.

Temperatures recorded from the nests are summarised in Table I with the quarter-hourly changes in temperature for each day shown in Figure I. The highest nest and outside sand surface temperatures were observed on December 6 (Fig.I) when sand surface temperatures exceeded temperatures inside the nest by up to 23°C with the mean difference between nest and sand temperature 13.4°C (S.D. = 5.32, *n* =32). During the two overcast days maximum nest temperatures did not exceed 25°C.

One interesting aspect revealed by these data was the relatively constant temperatures inside the nests, despite frequent high and variable external temperatures - it is of course important that reptile eggs do not overheat. The nest temperatures of *P. lesueurii* were in general lower than those recorded from similar sized tropical lizards (e.g. *Basiliscus basiliscus,* Lieberman, 1980; *Iguana iguana,* Rand, 1972; Drummond & Burghardt, 1983). As in the *P. lesueurii* nests some degree of variation in nest temperature in these species was also reported. It should be noted however, that in the present study no hatching period was observed, although when the nests were inspected on 28/12/00 the clutches were still apparently healthy.

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