GROWTH DYNAMICS OF JUVENILE SLOW-WORMS *(ANGUIS FRAGILIS)* IN CAPTIVITY

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INTRODUCTION AND METHODS

Since virtually nothing is known about the growth of Slow-Worms *(Anguis fragilis* L.) the following data may be of some interest. The measurements were made on four juvenile lizards from a litter born in captivity in August 1986. These juveniles were kept with their litter mates and their mother in an indoor vivarium measuring 76 x 38 x 30 cm. Each of the four was marked with a spot of different coloured quick-drying lacquer paint to enable it to be recognised; each spot was replaced weekly. The lizards were fed small grey slugs *(Deroceras reticulatum)* at frequent but irregular intervals. Each slug was weighed to an accuracy of about ±0.2 mg and presented to a Slow-Worm individually using forceps, so the food intake of each marked lizard could be measured. Growth rates were determined by weighing the lizards at intervals.

RESULTS

The experiment commenced on 17 October 1987. The growth of the four marked juveniles

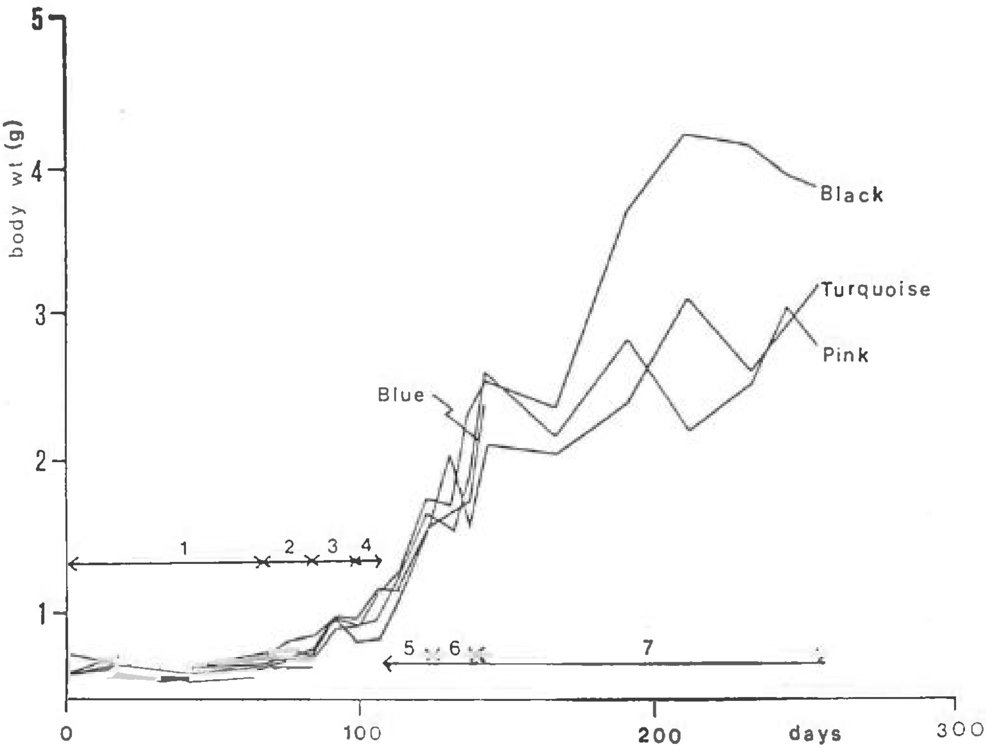

Fig. 1 Growth of the four Slow-Worms. Day 0 = 17 October 1987. Phases 1-7 are referred to in the text.

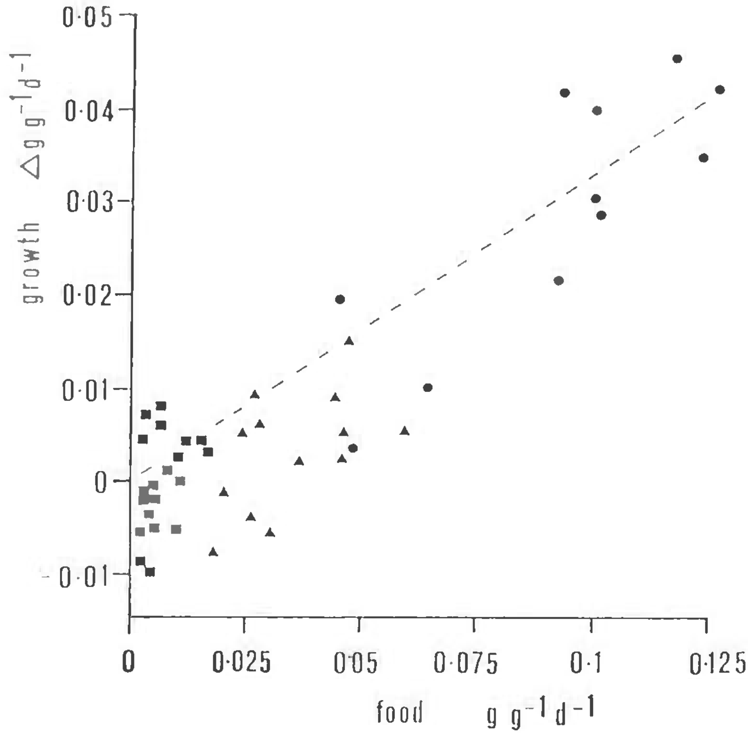

Fig. 2 Relationship between growth and food consumption. Squares represent phase 1, triangles phase 7 and circles phases 3 and 5.

(labelled 'blue', 'black', 'turquoise' and 'pink') is shown in Fig. 1. For the first 73 days the vivarium was unheated (phase 1), but from this point onwards the lizards were given a 100 W tungsten bulb suspended 24 cm above the soil in the vivarium and switched on for a variable time each day, beneath which they could bask. This increased food consumption and growth rates, although there were three periods associated with sloughing when feeding and growth were sporadic (phases 2, 4 and 6). At the end of phase 6 growth continued at a slower rate until 8 June 1988 (phase 7: total time = 242 days) when the experiment was terminated and all of the Slow-Worms released into the wild. Observations on juvenile 'blue' ceased on day 139 because the paint spot was lost and this was noticed too late to distinguish it from the unmarked lizards in the cage.

The lizards were weighed at varying intervals which averaged about 14 days. For comparative purposes, growth within each interval has been calculated on a daily basis, using the relative unit change in mass (g) per g per day (ΔW g^{-1} d^{-1}). Food consumption was converted to equivalent units, i.e. F g^{-1} d^{-1} (the lizard body mass used in the calculations was the mean of the body masses at the beginning and the end of the time interval). There was a clear correlation between growth and food consumption (Fig. 2: r = 0.92, d.f. = 43, $P<0.001$); because of the variability due to sporadic feeding, some of the data in phases 2, 4 and 6 have not been used in plotting this Figure). The mean gross growth conversion efficiency (growth x 100 / food) at relatively high levels of feeding ($F>0.1$ g g^{-1} d^{-1}) was 33%. At lower levels of feeding the efficiency fell: the linear regression of growth on food consumption is $G = 0.35F - 0.0046$ (the dashed line in Fig. 2 shows the expected relationship if growth conversion efficiency remained constant at 33%). This regression shows that growth efficiency is 20% at F = 0.03 g g^{-1} d^{-1} and that growth is negative (i.e. slow-worms will lose weight) at levels below 0.015 g g^{-1} d^{-1}.

DISCUSSION

The data presented here show that the growth dynamics of Slow-Worms are essentially similar to those of the diurnal Common Lizard *(Lacerta vivipara)* and the Wall Lizard *(Podarcis muralis)*, which are lacertids and in which gross growth conversion efficiency is 35% when the animals are able to thermoregulate for appreciable periods. Reduced food intake in these species results in a reduction in conversion efficiency (Avery, 1984; Perkins & Avery, 1989). There was no *a priori* reason for expecting this similarity; Slow-Worms are anguid lizards, which have lower metabolic rates (Hailey, 1984) and may differ also in other physiological respects from Lacertidae (Hailey & Theophilidis, 1987), and they are secretive and largely crepuscular.

In captive *L. vivipara* the rate of food consumption by an individual lizard, which in turn largely controls its growth rate, is affected by ambient temperature and by the period for which the animal can thermoregulate (Avery, 1984). The data shown in Fig. 1 suggest that this is also the case for Slow-Worms: low rates of food consumption and growth occurred during phase 1, when there was no bulb for thermoregulation; higher rates during phases 3 and 5. The reasons for the later reductions in growth seen during phase 7 are not known. They probably reflect the fact that by then the animals were long-term captives, which furthermore had been kept active during the winter period when they would normally have been hibernating. These animals may have been stressed in some way, and this would result in reduced appetite, food intake and growth. However, all the Slow-Worms were active and apparently healthy at the end of the experiment; 'turquoise' and 'pink' were still growing (Fig. 2).

It would be most interesting to compare the rates of growth recorded here with those which occur in the field; the fact that the necessary data was not available highlights the need for further research on Slow-Worms. It has been assumed in the interpretation of the data offered above that Slow-Worms in this study thermoregulated during phases 3 - 7 at times when the bulbs were switched on. We did not have the facilities to investigate this. There are no detailed studies in the literature which address this question, although there is plenty of evidence that Slow-Worms may bask and otherwise thermoregulate under some circumstances in both the field and the laboratory (Simms, 1970; Spellerberg, 1976; Gregory, 1980; Frazer, 1983).

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