

- Daniel, P. M. (1960). Growth and cyclic behaviour in the West Africa lizard *Agama agama africana*. *Copeia*, 94-97.
- Ekundayo, C. A., and Otusanya, L. A. O. (1969). Population estimation of the Agama lizard at the Lagos University Campus. *Nigerian Field*, 34, 83-90.
- Halstead, L. B. (1970). Some observations on the rainbow lizard, *Agama agama* (L.), at the University of Ife. *Nigerian Field*, 35, 86-89.
- Harris, V. A. (1963). *The anatomy of the rainbow lizard, Agama agama* (L.). London: Hutchinson, 104p.
- Harris, V. A. (1964). *The life of the rainbow lizard*. London: Hutchinson, 174p.
- Marshall, A. J., and Hook, R. (1960). The breeding biology of equatorial vertebrates: reproduction of the lizard *Agama agama lionotus* Boulenger at lat. 0° 01'N. *Proceedings of the Zoological Society of London*, 134, 197-205.
- Simpson, G. C., Roe, A., and Lewontin, R. C. (1960). *Quantitative Zoology*. New York: Harcourt, Brace and Co., 440p.
- Steel, R. G. D., and Torrie, J. H. (1980). *Principles and procedures of Statistics*. New York: McGraw Hill Book Co., 645p.
- Tinkle, D. W. (1969). The concept of reproductive effort and its relation to the evolution of life histories of lizards. *American Naturalist*, 103, 501-516.
- Tinkle, D. W., and Durham, A. F. (1983). Demography of the Tree lizard, *Urosaurus ornatus*, in central Arizona. *Copeia*, 585-598.
- Tinkle, D. W., Wilbur, H. M., and Tilley, S. G. (1970). Evolutionary strategies in lizard reproduction. *Evolution* 24, 55-74.

HERPETOLOGICAL JOURNAL, Vol. 1, pp. 392-396 (1989)

IDENTIFICATION OF INDIVIDUAL ADDERS (*VIPERA BERUS*) BY THEIR HEAD MARKINGS

SYLVIA SHELDON AND CHRISTOPHER BRADLEY

Knowles Mill, Dowles Brook, Bewdley, Worcestershire DY12 2LX, U.K.

(Accepted 14.11.88)

ABSTRACT

During a study of adders (*Vipera berus*) in Wyre Forest, a systematic method was developed to identify individuals in the field. It was revealed that no two adders possessed identical head markings. It was shown that a photographic record was a reliable aid to identification. Furthermore it was observed that over the period of study adders retained their individual head markings.

INTRODUCTION

This paper originates from a study of the adder, (*Vipera berus*), in Wyre Forest, Worcester, U.K., which began in 1981 and is now in its 8th year. During the early stages of this work the great diversity of head markings found on the adder became apparent. In attempting to follow the movements and specific seasonal behaviour of a sizeable population of adders, it was preferable if a simple method of identifying adders in the field was available, which allowed for positive identification of individuals without the associated problems of handling and disturbance.

STUDY AREA

The study area was centred upon a plantation of Japanese Larch (*Larix kaempferi*), in which a number of old coppice stools remained from a previous stand of sessile oak (*Quercus petraea*) that occupied the site prior to 1970.

METHOD

During the active period regular visits were made to the main study area. Notes were taken recording time, weather conditions, ambient and ground temperatures.

details of each adder, and significant events observed during that day.

To investigate the possibility of adders possessing an individual head marking, the markings on the head were divided into three basic components, as follows:

- A. *Eye-lines*.
 - B. *Inverted V*.
 - C. *Apex of zig-zag*.
- as illustrated in Fig. 1.

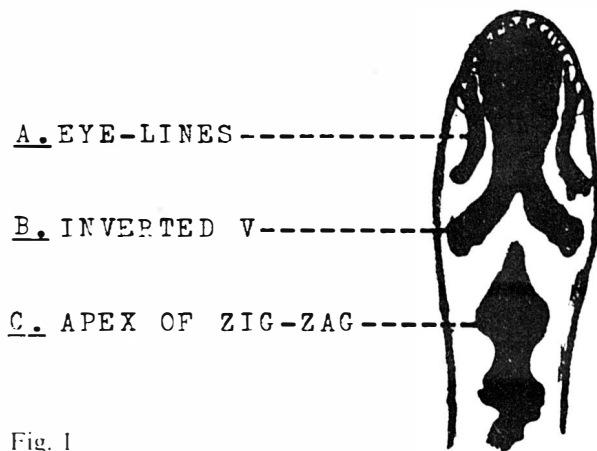


Fig. 1

If A, B or C proved subject to individual variation then this would provide the variables by which individual head patterns could be identified.

Colour photographs of each adder, specifically of the head were obtained, and fixed into a 11 x 13cm mini-file for immediate reference. In conjunction with shed skins (the pigment is retained in the scales and clearly visible when viewed with transmitted light against a white background), this allowed for detailed analysis.

Of the 92 adders photographed, 64 were in the main study area, and the remaining individuals at various locations throughout the Wyre Forest.

RESULTS

It proved possible to resolve the individual scales which comprise each component A, B and C and to place the head marking of each adder into one of two categories.

For the purpose of this study these categories have been labelled:

1. *Visually Identical*. Where the pigmented scales which comprise A, B and C and their respective positions prove impossible to distinguish apart as from one adder to another in a field situation.
2. *Individual*. Where one or more of the components A, B, C, which constitute the head pattern is obviously different.

Further, using the same components A, B, C the head pattern of adders within the study area were compared as they appeared in 1981 when the study first began, or alternatively, when first identified/photographed, and through each successive season until the present, (1988). Colour photographs and, where possible, shed skins were carefully examined for signs of any structural change (changes in shape or position of components A, B, C) over the years.

It was convenient to identify individual adders by name, in addition to each being allocated a number. For example, the two males illustrated in Fig. 2, A and B, and Fig. 3, A and B, were named Pawn and Knight because of the remarkable similarity of component C to the corresponding pieces in a chess set. Fig. 2, C and D, and Fig. 3, C and D, show two other males where component C resembles a Pyramid and a Mushroom. Figs. 2 and 3, E-P illustrate a sample of other head markings.

It was possible to identify individual adders in practically any situation provided that:

- A. A clear view of each head marking was obtained, and
- B. The observer was familiar with the various head markings of individuals within the study area.

As Table 1 shows, in five cases, two adders (set of two) shared a component which was visually identical, each set distinct from the others, significantly, in no two individuals were all three components A, B, C, (which comprise the head pattern) visually identical. Indeed only one adder was found with two components visually identical to the corresponding components on another adder, in this case the third component was the readily identifiable feature.

CHANGES IN HEAD MARKINGS OVER SUCCESSIVE SEASONS

In just one solitary male, (Fig. 2,K and Fig. 3,K) a single pigmented scale to the left of apex appeared in 1984, this was not apparent in 1983. This was the only positive change detected over a period of eight years in a sizeable population of mature adders which have been regularly monitored.

Category of Head Pattern	Component (A) Eyelines	Component (B) Inverted V	Component (C) Apex of Zig-Zag	Components Any Two A, B, C.	
1. Visually Identical	1 Set	2 Sets	2 Sets	1 Set	0
2. Individual	90	88	88	90	92

TABLE 1: Showing number of adders within the study area possessing head markings considered:

1. *Visually identical*.
2. *Individual*, classified according to components A, B, C.

Note: A 'Set' is defined as two individuals who share a component which is visually identical.

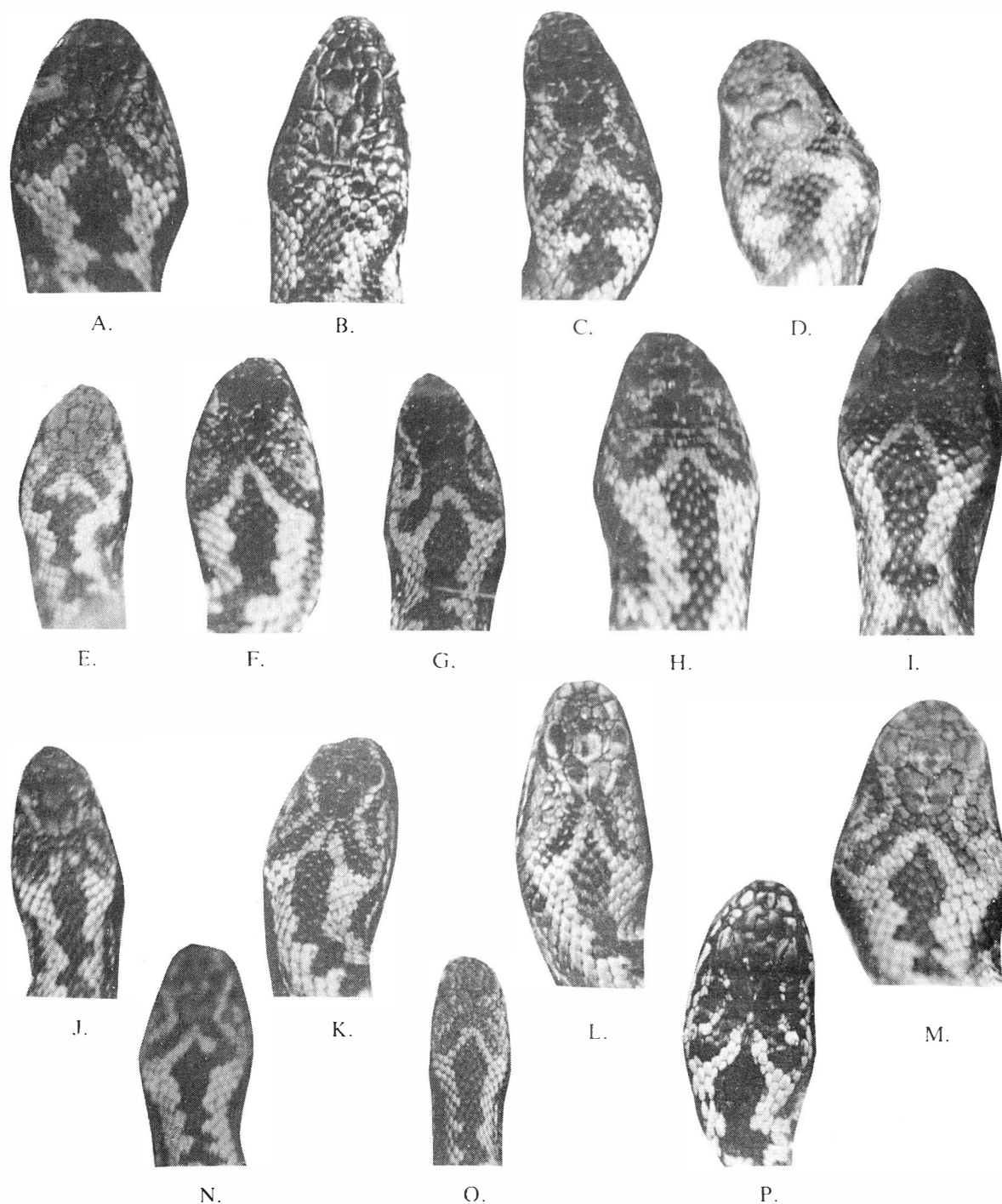


Fig. 2 A-P, showing variations in head markings.

CONCLUSIONS AND DISCUSSION

Leighton (1901) observed the wide variety of head markings in adders, but did not pursue this as a means of identification.

When studying a population of grass snakes *Natrix natrix* in Sweden, Carlstrom and Edelstam (1946) discovered 'the black and white pattern which is found on the underside of the grass snake has an infinite range of variation', and further state 'photographs of the back pattern can be used for *Coronella* and *Vipera* species' to identify individual snakes.

More recently Andren and Nilson, University of Goteborg, used a similar method to identify juvenile *V. berus* and *C. austriaca*, which were too small to mark with ventral scale cuts, but have not published anything specifically on their method.

In Britain the use of head markings for individual recognition has been used for the smooth snake *Coronella austriaca*, Goddard (1984), although details of the work are to be found in his Ph.D. thesis only.

After eight years our research is still continuing with particular attention being paid to juvenile adders, and, if circumstances permit, it is intended to monitor these individuals over many successive seasons to investigate more fully their behaviour in the wild.

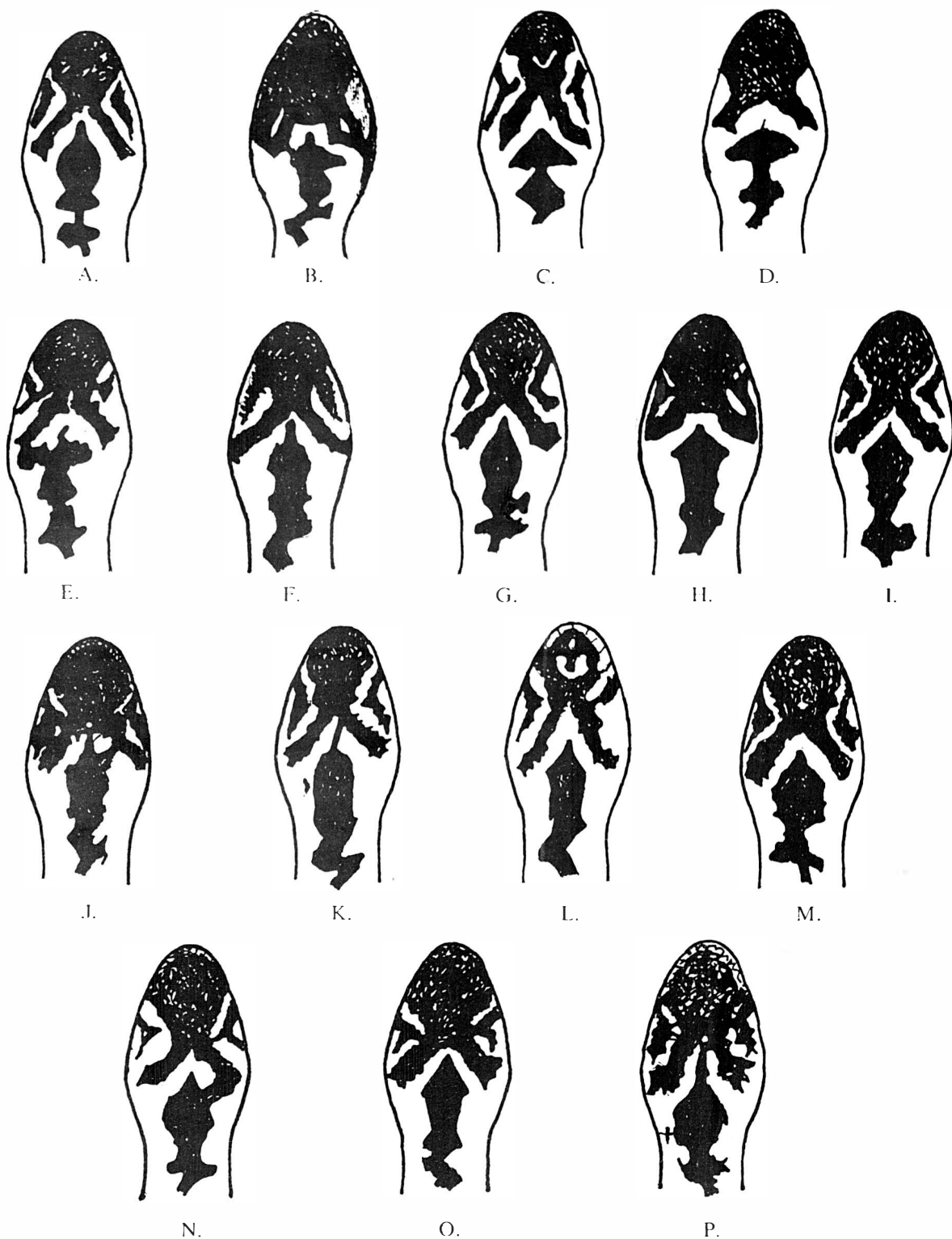


Fig. 3 A-P. Sketches illustrating variations in head markings.

ACKNOWLEDGEMENTS

We would particularly like to thank Mr. and Mrs. Edwin George, Mr. and Mrs. P. Hobson and Mr. and Mrs. J. Bingham for their helpful advice and encouragement given during the preparation of this material for publication. Also to Mr. M. Noble for his interest and suggestions, and to the Nature Conservancy Council and the Forestry Commission on whose land this study was undertaken.

REFERENCES

- Leighton, G. R. (1901). *The Life History of British Serpents and their local distribution in the British Isles*. Edinburgh and London: William Blackwood and Sons.
- Carlstrom, D. and Edelstam, C. (1946). Methods of Marking Reptiles for Identification after Recapture. *Nature*, Vol. 158, No. 4021.
- Goddard, (1984). Morphology growth, food habits and population characteristics of the smooth snake *Coronella austriaca* in Southern Britain. *Journal of Zoology*, **204**, 241-257.