INDIVIDUAL MARKINGS ARE A RELIABLE NON-INVASIVE MEANS OF IDENTIFICATION OVER TIME IN BLOTCHED BLUE-TONGUED LIZARDS, *TILIQUA NIGROLUTEA*

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INTRODUCTION

Pattern is often studied by zoologists who wish to re-identify an individual animal within a population. For pattern to prove a reliable method of identification, it must be unique between individuals and constant throughout time, as has been demonstrated in species such as badgers (Dixon, 2003), polar bears (Anderson and Waterman, 2007) and grey nurse sharks (Bansemer and Bennett, 2008). However, little work has been undertaken on reptiles, which are often identified by injecting or surgically implanting PIT tags (Jemison *et al*., 1995; Hilterman *et al*., 2007) or toe-clipped (Sacchi *et al.,* 2007). Pattern is a less intrusive and more potentially reliable method of distinguishing individuals.

There is currently no information available on pattern stability in the blotched blue tongue lizard (*Tiliqua nigrolutea*). Markings displayed by blue tongue lizards are a combination of very dark blotches and bands on a paler background, and differences in these patterns between individuals are immediately distinguishable. However, it is not enough simply to state that these patterns *appear* unchanged over time, they must be quantified and scored in some way to confirm that this is so. This project has investigated whether pattern remains sufficiently constant over time to be used as a reliable method of individual identification in *T. nigrolutea*.

METHODS

We created a key of ten characters, each with multiple possible character states, focusing on features such as the colour shades of the paler regions (e.g. grey/gold/salmon), the arrangement of individual blotches into connected bands (e.g. Figure 1), and particular regions of the body such as neck, pelvis and tail (e.g. Figure 2) (dorsal pattern only). This key allowed a more objective assessment of digital photographs taken over a period of four years as individuals (N=29) from five litters grew in captivity from neonatal (snout to vent (SVL) length ≈10 cm to adult body length (SVL > 24 cm in males, SVL > 26 cm in females). Digital images of the dorsal surface of individual lizards taken at 12 and 18 months and 4 years were scored using the key and compared. Not all photos displayed all 10 characters clearly, so only characters that were visible in the photos were scored. Only characters where a score was

available for at least two of the sample periods dates were considered. The proportion of characters scored for which each individual achieved an identical character state over time was calculated as a percentage for each litter, and overall.

RESULTS AND DISCUSSION

Analysis of pattern characteristics showed a high mean similarity of characters over time. Table 1 shows mean percentage pattern similarity for each litter. Mean pattern similarity over time for all 29 individuals was 93 %. While pattern *structure* did not change over time, pattern *colour* did vary. The pale regions of markings changed over time between character states (e.g. grey/gold/salmon) in seven individuals during juvenile development, suggesting that colour is not as reliable an identifier as pattern structure: this was the reason that mean pattern similarity over time was 93 %, rather than 100 %. However, for all characters measured (8-10 depending on digital image quality), no individual scored an altered state on more than 1 character. This demonstrates that, as suggested by the Australian Society of Herpetologists (ASH Inc., position paper No. 1), pattern in *T. nigrolutea* is highly stable over time, and therefore provides a reliable, non-invasive means for re-identification of individuals. With a photograph, either in black and white *or* colour, it should always be possible to recognise an individual, even if it has not been encountered in the wild for a period of years. In fact, in the captive colony on which this study was done, there are individuals which have been identifiable by their unchanging pattern structure for more than 14 years to date.

REFERENCES

Anderson, C.J.R., Roth, J.D., & Waterman, J.M. 2007. Can whisker spot patterns be used to identify individual polar bears? Journal of Zoology 273: 333-339.

Australian Society of Herpetologists (ASH) Inc. Position paper No. 1: Toe clipping of lizards. Accessed online 25 June 2009. http://www.flinders.edu.au/shadomx/apps/fms/fmsdownload.cfm?file_uuid=E49BD3A7-97BE-68EB-4CDE-26E908385FCD&siteName=flinders

Bansemer, C.S., & Bennett, M.B. 2008. Multi-year validation of photographic identification of grey nurse sharks, *Carcharias taurus*, and applications for non-invasive conservation research. Marine and Freshwater Research 59: 322-331.

Dixon, D.R. 2003. A non-invasive technique for identifying individual badgers *Meles meles*. Mammal Review 33: 92-94.

Sacchi, R., Scali, S., Fasola, M., & Galeotti, P. 2007. The numerical encoding of scale morphology highly improves photographic identification in lizards. Acta Herpetologica 2: 27-35.

Jemison S.C., Bishop L.A., May P.G. & Farrell T.M. 1995. The impact of PIT-tags on growth and movement of the rattlesnake, *Sistrurus miliarius*. Journal of Herpetology 29: 129-132

Hilterman M.L. & Goverse E. 2007. Nesting and nest success of the leatherback turtle (*Dermochelys coriacea*) in Suriname, 1999-2005. Chelonian Conservation and Biology 6: 87-100.

Figure 1. Character 10 in the pattern key distinguished individual *Tiliqua nigrolutea* pattern on the basis of overall dorsal surface markings: Blotches can be random, offset, symmetrical or arranged into bands.

Figure 2. Character 6 in the pattern key distinguishes individual *Tiliqua nigrolutea* pattern on the basis of tail banding: bands can be continuous, broken or a combination of these down the length of the tail.

Figure 1

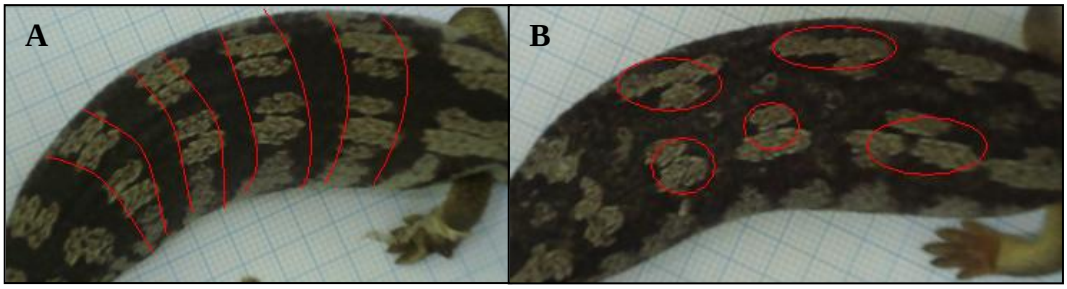

Figure 2

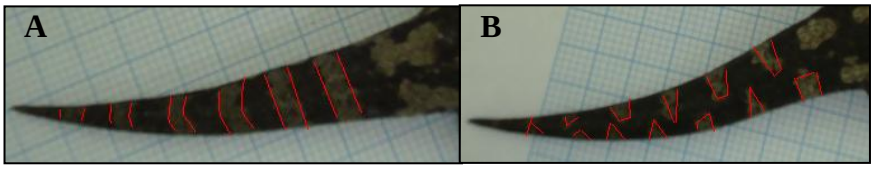

Table 1. Mean pattern similarity over time for each of five litters of *Tiliqua nigrolutea*.

Litter number	Mean character Similarity (%)
1	96
2	88
3	93
4	93
5	95