

Ecological Sampling Design and Observer Bias: An Example from Toad-Headed Agama (*Phrynocephalus versicolor*) in the Southern Gobi, Mongolia

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Abstract

Currently Mongolia faces great challenges in ecological research, with ecological studies relatively neglected during Soviet administration. The development of ecological studies requires an appreciation of sampling bias and how this can be avoided. Here we present a case where observer biases are impossible to disentangle from site effects because sample site data are confounded with observer sampling activity. Three volunteers were collected simple body mass and length measures of toad-headed agama, *Phrynocephalus versicolor*, as part of a wider ecological survey programme in Borzongiin Gobi, South Mongolia. Field data potentially reveal a difference in morphological size in toad-headed agama inhabiting different habitats, but this can only be ascertained through further sampling effort. We give recommendations for future studies.

Key words: *Phrynocephalus versicolor*, ecological field techniques, sampling, observer bias, Borzongiin Gobi, Mongolia.

Introduction

Throughout Soviet dominance until 1990, the biology education system in Mongolia focused on systematics and taxonomy, with very little ecological research. Consequently, although a wealth of systematic knowledge has been gathered for Mongolian species, little is known about dynamic processes occurring in Mongolian ecosystems, population sizes and interactive processes between species (Anonymous, 1998). Studies of ecosystem functioning are developing, but resources for such research are scarce and frequently involve untrained individuals in the collection of data. Furthermore, the scale of the ecological work required over such a large, ecologically diverse and unstudied country often necessitates a large workforce to carry out biological sampling.

Techniques for ecological censusing, either for pure biological study or habitat management and conservation purposes, require unbiased estimates to be collected (e.g. Bibby *et al.*, 1992; Sutherland 1996; Begon *et al.*, 1996), involving for example random sampling and sampling replication (Greenwood, 1996). One possibility for the

introduction of bias into ecological data is the use of a number of observers to measure the same factor. Variation in data is generated by observer differences rather than representing true biological variation (e.g. Sauer *et al.*, 1994, Robinson *et al.*, 2000, Spaulding *et al.*, 2000).

We document a case of difficulty encountered in disentangling a potential biological phenomenon from a biased sampling effect during a Mongolian field study of toad-headed agama, *Phrynocephalus versicolor*. Field work was intended to compare ecological parameters at two sites in the Little Gobi Strictly Protected Area A. Species richness, abundance and population distributions in this area are little known and simple inventory work as well as more complex ecological and behavioural studies is urgently needed. Three volunteers from Mongolia and overseas were involved with agama data collection as part of a larger survey programme by international non-governmental organisation (NGO) volunteers. Data were collected as a simple training exercise, but demonstrate well the problems encountered with inadequate experimental sampling design and serve as a lesson for future studies.