

## CHAPTER 1 INTRODUCTION

The present study commenced in May 1975 as part of the first phase of the Savanna Ecosystem Project. The Ecosystem Project was initiated to investigate the structure and functioning of a Savanna Ecosystem with the eventual aim of being able to predict changes in the vegetation structure, composition and its inherent animal component, and monitor changes induced by management practices.

The Savannas are widespread in Africa and were formed under varying degrees of aridity, temperature and edaphic conditions. As with most semi-arid regions, they are very fragile and easily disturbed by overgrazing, overburning or by changes in the animal component. They become degraded, resulting in erosion and the spread of desert. There are several types of savanna in southern Africa, which can broadly be divided into broad-leaved deciduous and microphyllous savannas. The ecosystem study at Nylsvley is located in an area of savanna dominated by Burkea africana trees with Eragostis pallens as the main grass species. Interspersed in the Burkea africana savanna are areas of microphyllous vegetation usually located on disturbed areas.

The reptile and amphibian population study was part of the overall plan to identify major components and pathways within the ecosystem and therefore formed part of the consumer component.

The objectives of this study were basically three fold:

1. To determine the species diversity and distribution of reptiles and amphibians on the Nylsvley Nature Reserve and the Ecosystem study area in particular. Chapter 4.
2. To determine population size and biomass of reptiles and amphibians in the Ecosystem study area. Chapter 4.
3. To determine the inter-relationship between the reptiles and amphibians and their physical and biotic environment. This included an understanding of food and feeding movement, reproduction, growth and biomass. Chapters 4, 5, 6 and 7.

A checklist of the vertebrate fauna, excluding the avifauna, was completed in 1977 (Jacobsen 1977) and served to indicate the diversity of animal life on the Nylsvley Nature Reserve. A total of 29 snakes, 24 lizard, 17 amphibian, 4 chelonian and 62 mammal species was described. This represents an estimated 95% of the terrestrial vertebrate species likely to be found. Of this total, 11 amphibian, 41 reptile and 43 mammal species are to be found in the Burkea africana - Eragrostis pallens savanna. This made estimates of populations exceedingly difficult. From the initial survey it was apparent that only a relatively small number of species dominated the herpetofaunal community. These included two snake species, four lizard species and three amphibian species. The most abundant snakes in this instance were Thelotornis capensis (vine snake) and Psammophis sibilans brevirostris (short-snouted sand snake). The lizards included Ichnotropis capensis (Cape rough-scaled lizard), Lygodactylus capensis (Cape dwarf gecko), Mabuya varia (variable skink) and Panaspis wahlbergi (snake-eyed skink). Of the amphibians the most abundant were Bufo garmani (northern mottled toad), Kassina senegalensis (bubbling kassina) and Breviceps adspersus (common short-headed frog) (Figure 1).

Population estimates from mark-recapture samples with which this study was involved have several inherent drawbacks or assumptions which question the reliability of results, particularly if a low recapture rate is experienced. Previous investigations in the Study Area showed all forms of animal life to be depauperate and other methods of population estimation not practical. Total sampling as used by Barbault (1971, 1973, 1974a) at Lamto was not possible due to inadequate labour and finance. The use of line transects to estimate populations, Western (1974), Eberhardt (1978) was also not feasible owing to the paucity of animals. Mark-recapture methods were resorted to as the only method available under the conditions pertaining at Nylsvley. The drawbacks to this are mainly concerned with three basic assumptions which had to be made:

That no emigration or immigration occurred during the period of study.

Mortality and natality are assumed to have balanced out during the period of study.

The chance of capturing marked and unmarked animals was equal.

Figure 1 The main reptile and amphibian species of the Burkea africana - Eragrostis pallens Savanna Study Area

- (a) Ichnotropis capensis
- (b) Mabuya varia
- (c) Panaspis wahlbergi
- (d) Lygodactylus capensis
- (e) Psammophis sibilans brevirostris
- (f) Thelotornis capensis
- (g) Bufo garmani
- (h) Breviceps a adspersus
- (i) Kassina senegalensis

A



B



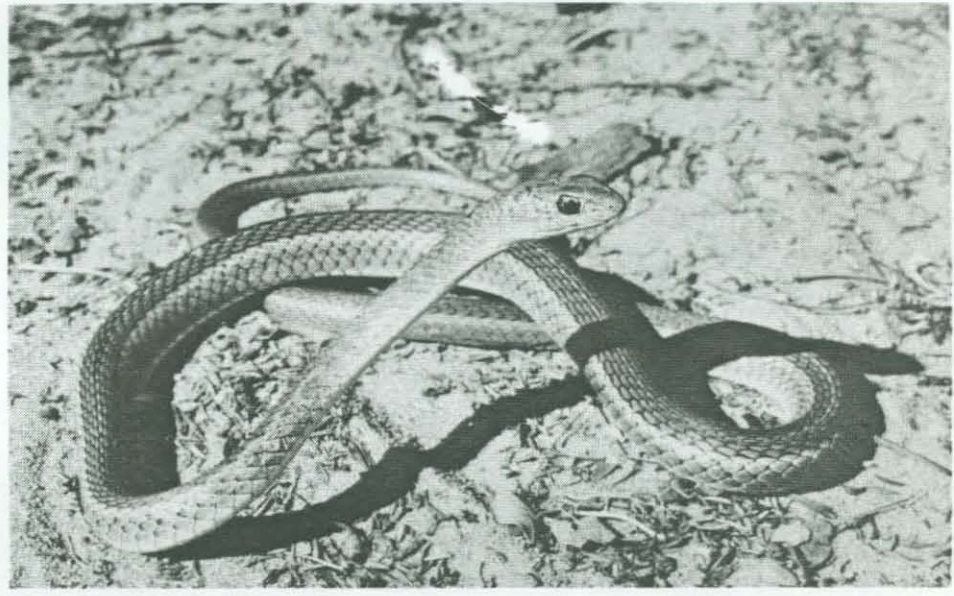
C



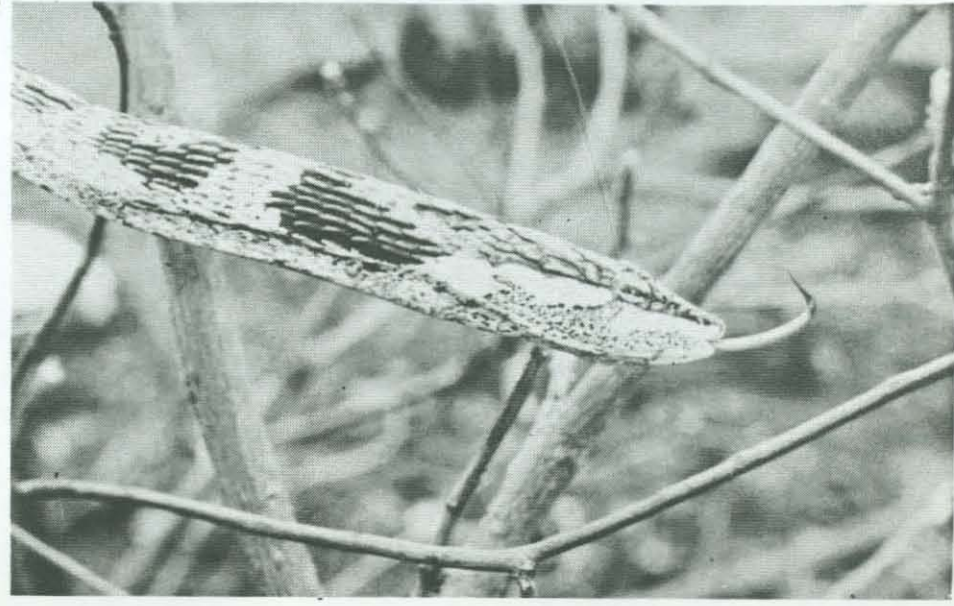
D



E



F



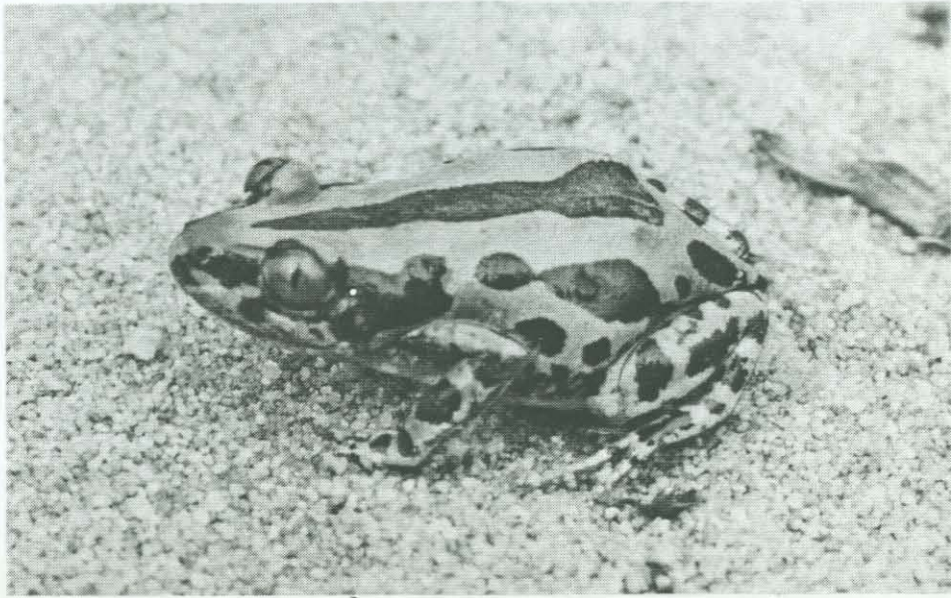
G



H



I



Various authors, De Lury (1951), Schaefer (1951) and Jolly (1963), have used the mark-recapture technique to determine population size. However, usually these have been used for estimating fish populations where it is possible to net a number, mark and release and, on a subsequent date, net again and determine the percentage of marked to unmarked individuals in the population.

The most simple formulas are those derived by Petersen and Lincoln and known as the Petersen and Lincoln Indices. The formula is simply as follows:-

$$N = \frac{Mn}{m}$$

where N = population size  
M = total number of marked individuals in the population  
n = sample captured  
m = number of marked individuals in sample n.

This method was suitable for short periods of time but did not compensate adequately for longer intervals. This induced modifications to the existing method. One of the first was the Schnabel method which was closely followed by the Schumacher-Eschmeyer technique. The Schnabel Index is simply a summation of the existing Peterson Index as follows:-

$$N = \frac{\sum (M)(n)}{\sum m}$$

It is assumed that the number of recaptures follows a Poisson distribution. One of the problems of this method is that the variances are difficult to estimate. Therefore, simple straightforward tests of differences in population level, as well as confidence limits for the population estimate, are possible by using the knowledge that the number recaptured approximate a Poisson distribution, Chapman (1954).

Chapman (loc.cit) also determined that a modification of the Schnabel Index presented a nearly unbiased estimate of the total number of animals present. He therefore proposed the following equation:-

$$N = \frac{\sum (M)(n)}{\sum m + 1}$$

Confidence limits can then be calculated using the method of Chapman and Overton (1966). Eberhardt (1969) mentions that the usual capture - recapture methods may seriously underestimate population density, particularly



as they all assume probability of capture is the same for all members of the populations. However, trapping results and estimates based thereon during this present study indicate the contrary.

The population study took place over an area of 64 ha of a section of the area demarcated for the ecosystem study and one which would remain relatively undisturbed by other researchers. The preliminary survey of the number and distribution of species involved indicated that the animals were divided into different strata within defined habitats. Thus, there were arboreal, terrestrial, rupicolous and fossorial species.

Very little research has been done on total populations within a specific area. The one most comparable and to which repeated reference is made, is that of R. Barbault under the auspices of the Laboratoire de Zoologie de l'Ecole Normale Supérieure, Paris at Lamto on the Ivory Coast, Barbault (1971, 1973, 1974a, b, 1975, 1976a, b, c, d). This is an area of tropical humid savanna subjected to annual fires except where protected under experimental conditions and it is with this section in particular that some comparison will be made.

Other authors, Dargan & Stickel (1949), Degenhardt (1966), Alcalá and Brown (1967), Bauerle (1971) and Western (loc.cit.,) used various sampling techniques to determine population sizes but most were difficult to apply to local conditions. The method finally decided on approximated closely that of Dargan and Stickel (loc.cit.) and Bauerle (loc.cit.)

As there are few reptiles which show sexual dimorphism, the sexing of captured reptiles followed the method of Szidat (1968). Various papers deal with the marking of individuals for later recognition. Among these methods are scale clipping, Blanchard and Finster (1933), Spellenberg (1977); tattooing, Woodbury (1948, 1956); toe clipping, Woodbury (1956); notching the carapace of chelonians, Woodbury (1956). An improved method of marking snakes involved the use of an electric soldering iron with a fine point to cut through the scales at their base, Weary (1969). This effectively produced a permanent identifiable mark. Other methods of marking which are often used during fish studies include injecting dye under the skin or into the dermis, which allows the colour to show through, Dunn and Coker (1951), Al-Hamid (1954) and Kelly (1967).





This has the advantage of recognizing animals without handling them. Finally, Radiotelemetry was used by Fitch & Shirer (1971), and snakes were made to swallow packages containing transmitters which worked with varying success and for different lengths of time. This method opens up many possibilities, particularly for relatively short-term studies.

Few population or detailed autecological studies have been carried out on African reptiles. Such studies are still largely in their infancy with most research being taxonomical, Broadley (1976). This makes any detailed study so much more important and at the same time increases our knowledge of a hitherto largely neglected group of lower vertebrates. The present study is, therefore, a contribution to our understanding of African reptiles and amphibians and their interaction with the environment, both physical and faunistic.