

# The ecological distribution of monitor lizards (Reptilia, Varanidae) in Nigeria

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*The ecological distribution of monitor lizards (Reptilia, Varanidae) in Nigeria.*— The ecological distribution of three varanid lizards (*Varanus exanthematicus*, *V. niloticus niloticus*, and *V. niloticus ornatus*) in Nigeria is studied in the present paper, from both literature records and long-term field ecological research. *V. exanthematicus* is present only in central and northern Nigeria, where it seems to be widespread and locally common in the Guinea savanna vegetation zone, but may be found in several spots in the Sudan savanna and even in the Sahel savanna. *V. n. ornatus* is confined to the extreme south of the country, i.e. in the coastal mangrove and deltaic swamp rainforest habitats, and also in the moist lowland rainforest. The distribution of *V. n. niloticus* remains controversial. It is widespread in the Sudan savanna and in the Guinea savanna, but appears only rarely in the derived savanna and moist lowland forest vegetation zones. Despite a few old literature records, it seems to be absent from the rainforest blocks of southern Nigeria. Annual precipitation regimes seem to condition greatly the general distribution patterns of the Nigerian varanids, which are quite generalist in terms of habitat preferences within each major climatic-vegetation zone.

Key words: Varanidae, Distribution, Ecology, Nigeria.

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## Introduction

African varanids have been the subject of a lot of general and specific contributions (e.g. see COWLES, 1930; FITZSIMONS, 1943; VERNET, 1984; DE BUFFRÉNIL, 1992; DE BUFFRÉNIL et al., 1994; DELISLE, 1996), but several aspects of their natural history remain unresolved, including faunistic, taxonomic, and physio-ecological aspects (e.g. see BOEHME & ZIEGLER, 1997). In particular, the ecological and distribution data on Nigerian varanids are still scarce and conflicting (e.g. see DUNGER, 1967; BOEHME & ZIEGLER, 1997; ANGELICI & LUISELLI, 1999; LUISELLI et al., 1999a). This scarcity of data is accounted for by the fact that access to this country has been notoriously difficult for foreign scientists for a long time (due to both internal political instability and presence of organized criminality), and indigenous research has been curtailed by economic constraints. Nevertheless, as Nigeria is a crucial country in terms of biodiversity (SINGH et al., 1995), housing a large part of some of the most endangered biotopes in the world (SINGH et al., 1995), immediate environmental research by worldwide organizations is called for (AKANI et al., 1999).

This paper presents an up-to-date summary of the knowledge concerning the distribution of three varanid taxa of Nigeria (*Varanus exanthematicus*, *V. niloticus niloticus*, and *V. niloticus ornatus*), and relates these data with the major "ecological regions" of this crucial country of western Africa, in an attempt to provide additional materials for a proper understanding of the confused and partially unresolved natural history of sub-Saharan Africa varanids.

## Materials and methods

### Study area

The territory of the Federal Republic of Nigeria, extending for over 920,000 km<sup>2</sup> and inhabited by over 100,000,000 people (according to the 1997 census) is exceptionally important in terms of biological diversity because of the wide variety of vegetation zones (fig. 1). According to SINGH et al. (1995), the major vegetation areas in Nigeria are (from south to north): 1. Coastal mangrove (dominated by *Avicennia*

*marina* and *Rhizophora racemosa*, with local parts invaded by introduced *Nypa* palms); 2. Deltaic swamp forest (dominated by *Phoenix*, *Marantocloa*, *Elaeis*, *Raphia vinifera*, *Raphia hookeri*, *Mitragyna*, *Calamus*); 3. Moist lowland forest (*Elaeis*, *Pseudospondias*, *Terminalia superba*, *Piptadeniastrum africanum*, *Lophira alata*); 4. Derived savanna (formerly moist lowland forest, now deforested due to extensive human activities, with oil palms, cocoa farms, *Terminalia* sp., *Brachystegia* woodlands); 5. Guinea savanna (*Commiphora*, *Combretum*, *Terminalia*, *Acacia*, *Teclea*, *Maba*); 6. Sudan savanna (*Themeda*, *Acacia*, *Combretum*); 7. Sahel savanna (*Themeda*, *Acacia*, *Borassus*), and 8. Montane grassland and forest (*Podocarpus*, *Cyathea*, *Ocotea*, *Aningeria*) (fig. 1). For more details concerning climatic and vegetation characteristics of Nigeria, see SINGH et al. (1995).

### Methods

This study is based on both literature and original field data. Distribution data on Nigerian monitor lizards was collated following detailed bibliographic research including more than 1,800 varanid-related literature entries. In addition, all the monitor lizard sightings obtained during long-term field ecological research in Nigeria (years 1996-1999, for a total of over 450 field days, e.g. see LUISELLI et al., 1998, in press; LUISELLI & ANGELICI, 2000) were compared for analysis in this paper. Although we surveyed every major vegetation zone in Nigeria, it should be stressed that we focused our research especially in the southernmost part of the country, where mosaics of coastal mangrove, deltaic swamp forest, moist lowland forest, and derived savanna are found.

All the distribution records, both those originating from literature sources and those from original field data, were plotted onto a map of the Federal Republic of Nigeria, and compared with the distribution of the Nigerian major climatic-vegetation zones, in an attempt to ascertain the ecological correlates of distribution of the various varanid taxa.

In several cases relative to *V. niloticus* complex, the original literature sources did not specify whether the observed specimens were in fact attributable to ssp. *niloticus* or to

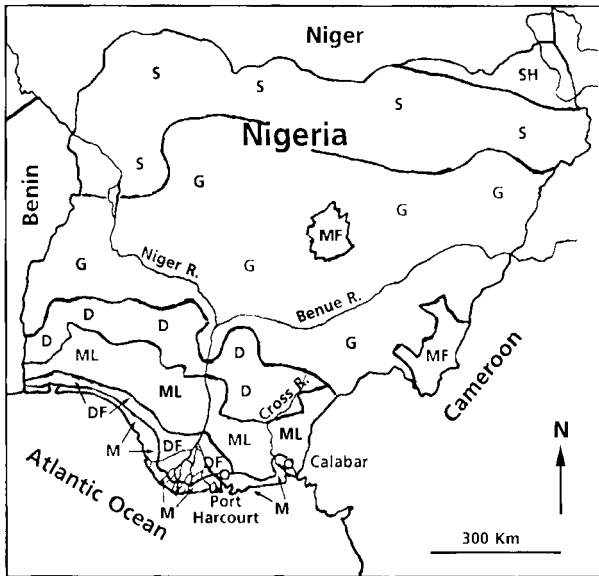


Fig. 1. Map of Nigeria showing the country's major vegetation zones: SH. Sahel savanna; S. Sudan savanna; MF. Montane grassland and forest; G. Guinea savanna; D. Derived savanna (formerly moist lowland forest); ML. Moist lowland forest; DF. Deltaic freshwater swamp-forest; M. Coastal mangrove.

*Mapa de Nigeria mostrando las zonas de mayor vegetación de las provincias: SH. Sabana de Sahel; S. Sabana del Sudan; MF. Praderas y bosques de Montana; G. Sabana de Guinea; D. Sabana derivada (inicialmente bosques bajos húmedos); ML. Bosques bajos húmedos; DF. Bosque pantanoso en aguas dulces deltaicas; M. Manglar costero.*

*ornatus*. These data were not therefore considered in our analysis, although in some cases the identity of the given specimens would have been easily understood on the basis of the geographic position of the site of capture (e.g. in the case of JOGER, 1981, the only Nigerian specimen cited - page 329 - was no doubt *V. n. niloticus*).

The list of references reporting distribution data of Nigerian monitors is as follows:

*Varanus niloticus ornatus*: BOETTGER, 1888; TOFFHOR, 1908; MERTENS, 1942; DUNGER, 1967; REID, 1986; POWELL, 1993; SINGH et al., 1995; LUISSELLI & POLITANO, 1998; AKANI et al., 1999; ANGELICI & LUISSELLI, 1999; LUISELLI et al., 1999a.

*Varanus niloticus niloticus*: BOETTGER, 1888; MERTENS, 1942; DUNGER, 1967; NORMAN, 1968; DE BUFFRÉNIL, 1993; BOEHME & ZIEGLER, 1997; ANGELICI & LUISELLI, 1999; C. Smeenk (unpublished).

*Varanus exanthematicus*: SOUTHWELL, 1913; BAYLIS & DAUBNEY, 1923; DUNGER, 1967; NORMAN, 1968; PAPENFUSS, 1969; AVERY, 1971.

A recent taxonomic review has suggested that *V. n. niloticus* and *V. n. ornatus* could be a separate species rather than a simple subspecies (BOEHME & ZIEGLER, 1997). Awaiting definitive conclusions on this issue, in this paper the conservative view of these two taxa as simple subspecies is maintained.

## Results and discussion

Many of the locality records for the three varanid taxa are relative to museum specimens, often collected a long time ago. This fact is important, as the macrohabitat characteristics of the various Nigerian regions would have

been very different from those of the present day, given that this country is one of the most developed on the whole continent in terms of landscape and soil utilization (DE MONTCLOS, 1994). These literature records, together with the original field records collected during recent years, are entered in figure 2. Although more detailed surveys throughout the country are necessary to reliably depict the distribution of the three varanid taxa, the general characteristics of the distribution of the three taxa can be addressed quite satisfactorily from the present study. Moreover, comparisons of the species-specific distribution patterns (fig. 2) with the distribution of the major vegetation zones in Nigeria (fig. 1) gave a reliable indication of the ecological correlates of distribution of these varanid species.

*V. exanthematicus* appeared to be present only in central and northern Nigeria, where it seems to be widespread and locally common (Luiselli et al., unpublished data). In general, this species is typical of the Guinea savanna vegetation zone, where most of its known localities of presence fell. However, it may be found in several spots of Sudan savanna and even in the very dry Sahel savanna (fig. 2A). More specifically, the typical Nigerian microhabitat for *V. exanthematicus* is the wide scrublands dominated by *Acacia* trees. Although the general distribution pattern of this species in Nigeria is well understood, more research is necessary to establish the southernmost limits of its presence in this country, i.e. the extent to which it can penetrate into forested and moist vegetated areas.

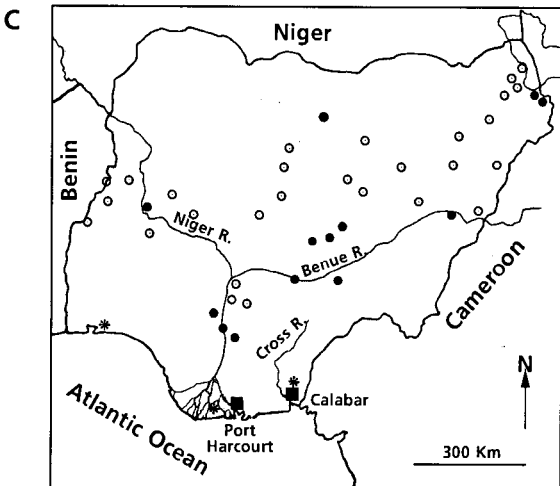
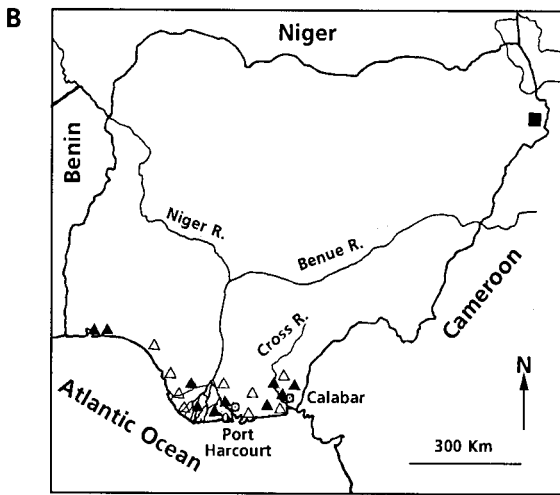
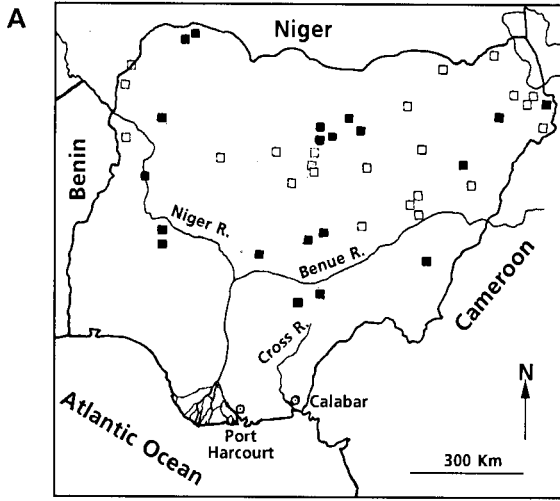
*V. niloticus ornatus* is present only in the coastal mangrove and deltaic swamp forest habitats, also entering in the moist lowland forest of the extreme southeast of Nigeria (fig. 2B). In practice, continuous populations are found only in the southeastern part of the country, from the forested region bordering Cameroon in the east (Cross River State) to the western axis of the Niger Delta (Edo and Delta States) in the west, and with scattered populations along the remnant forested patches of the coastal lagoons of southwestern Nigeria (e.g. Lekki Lagoon, and Lagos State), where, however, it is only rarely found. Within the forested block of Nigeria this taxon is still common and widespread, and tends to be quite generalist in terms of microhabitat selection (ANGELICI & LUISELLI, 1999; LUISELLI et al., 1999a). It is extensively hunted by local tribes (Igbos, Ijaw, Ikwerre, Calabari, Efiks, Ogoni, etc.), both for domestic consumption and for the skin (AKANI et al., 1998). Its pattern of distribution in Nigeria is very well understood, and several aspects of its field biology have already been studied in detail (cf. ANGELICI & LUISELLI, 1999; LUISELLI et al., 1999a). A single literature record for north-east Nigeria is available (see fig. 2B), but is likely unreliable given (i) the completely different environmental characteristics of this spot (Sudan savanna) from the rainforest region inhabited by this taxon (BAYLESS, 1997), and (ii) the enormous gap existing between the known range of this taxon and this supposed distribution record (about 800 km of arid and semi-arid

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Fig. 2. Map of Nigeria showing the distribution records of the three varanid taxa examined in the present paper: A. *V. exanthematicus* (black squares, literature records; white squares, original field records); B. *V. niloticus ornatus* (black triangles, literature records; white triangles, original field records; black square, unreliable record); C. *V. niloticus niloticus* (black circles, literature records; white circles, original field records; asterisks, doubtful records).

*Mapa de Nigeria mostrando la distribución de los tres taxones de varánidos examinados en este trabajo: A. V. exanthematicus (cuadros negros, citas bibliográficas; cuadros blancos, citas propias); B. V. niloticus ornatus (triángulos negros, citas bibliográficas; triángulos blancos, citas originales; Cuadros negros, citas poco fiables); C. V. niloticus niloticus (círculos negros, citas bibliográficas; círculos blancos, citas propias; asterisco, citas dudosas).*

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territories).

*V. niloticus niloticus* is the most problematic taxon in terms of ecological distribution. According to bibliographic records, it should be widely present in Nigeria from the arid northern regions (e.g. Kano and Lake Tchad) to the wet rainforests in the south (Calabar and Niger Delta). Indeed, it is likely that these bibliographic records are not sufficiently accurate, and that the true distribution of this taxon is less extensive (cf. also ANGELICI & LUISELLI, 1999). No doubt the species is widespread in the Sudan savanna and especially in the Guinea savanna vegetation zones (fig. 2C), where it inhabits mainly vegetated spots and gallery forests in the vicinities of rivers and water bodies (Luiselli et al., unpublished data). However, there are surprisingly few records of *V. n. niloticus* in the derived savanna and moist lowland forest vegetation zones, where, in fact, it has never been observed during careful research in recent years (1996-1999). In practice, only two records are available from these vegetation zones: Lagos (BMNH 93.1.11.10-11, see BOETTGER, 1888; DUNGER, 1967), and Umuahia (BMNH 1948.1.2.70, see DUNGER, 1967), both relative to specimens captured a long time ago. With regard to the rainforest zone in the extreme south of Nigeria, the situation is even more intriguing. Sightings of *V. n. niloticus* inside this latter vegetation zone are relative to old records from Calabar (Cross River State, see DUNGER, 1967) and from an unspecified Niger Delta locality (BOEHME & ZIEGLER, 1997), both these areas being no doubt inhabited by *V. n. ornatus* (fig. 2B). This supposed coexistence of *niloticus* with *ornatus* was considered clear evidence of the specific status attained by these two taxa (BOEHME & ZIEGLER, 1997), in addition to convincing morphological characteristics and less convincing physio-ecological attributes (cf. ANGELICI & LUISELLI, 1999). All this forested region has been intensively sampled by Luiselli and associates since 1996, but no *V. n. niloticus* has been observed, whereas more than hundred *V. n. ornatus* have been sighted. Therefore, its presence in this region has been questioned by LUISELLI & POLITANO (1998), AKANI et al. (1999) and ANGELICI & LUISELLI (1999). So, what about these few old records? It is likely that they are unreliable, due possibly to mislabelling

of museum specimens (a common event in old collections of African reptiles, see also OHLER, 1999) and/or the eventuality that they were obtained by the collector in a market place at some distance from where the captures really occurred. In fact, it is interesting to mention that the only records of *V. n. niloticus* in coastal Nigeria came from the three main commercial centres of this part of Africa: Lagos (the most important commercial city of west Africa for a long time), Niger Delta (another crucial commercial area in Nigeria, especially as a result of the migrations of Igbos from the north), and Calabar (formerly the capital city of the country and still one of the most important centres in southeastern Nigeria, DE MONTCLOS, 1994). Along similar lines, it should be noted that in the markets of Port Harcourt (Niger Delta) it was possible to find crocodiles skins from Kano (LUISELLI et al., 1999b), and even servals and Tanzanian lions! (ANGELICI, 1997). Such arguments therefore lead us to think that *V. n. niloticus* is absent from the forested blocks of southeastern Nigeria, where it is replaced by *V. n. ornatus*. With regard to the *niloticus* records from Lagos, we also doubt their reliability, but the sample of wild varanids examined by us from this area is much smaller than that relative to the southeastern regions of Nigeria (ANGELICI & LUISELLI, 1999).

In general terms, the present study on Nigerian monitors widely confirms the major ecological distribution correlates highlighted for each of the three taxa studied by BAYLESS (1997). In particular, the distribution in Nigeria of the three monitors fits very well with the predicted levels of precipitation (in mm) that were considered by BAYLESS (1997) as fundamental limits in the potential distribution of these animals. On the contrary, the type of habitat appears less important, as the monitors tend to inhabit a wide range of habitats within each major climatic-vegetation zone (e.g. see ANGELICI & LUISELLI, 1999). All these ecological aspects should be taken into consideration to convincingly solve the problematic taxonomy of this crucial vertebrate group. The apparent discrepancies between the results from the present study and some literature data or vouchers (*V. n. ornatus*, and, especially, *V. n. niloticus*) could not be explained by the

strong habitat transformations that large areas of Nigeria have experienced throughout the last fifty years. Indeed, given their relative habitat preferences, an expansion of the range of *V. niloticus niloticus* deep inside the nowadays widely deforested areas of southern Nigeria would have been predicted, to the detriment of the forest form *ornatus*. A similar phenomenon is in fact currently occurring in cobras, with the savanna form (*Naja nigricollis*) that is actually colonizing the formerly forested regions to the detriment of the forest species (*Naja melanoleuca*) (LUISELLI & ANGELICI, 2000). Nevertheless, the few doubtful records of *niloticus* from the forested part of Nigeria are relative to an age where the forest was much more extended and better preserved than it is today, and thus ideally much more suitable for *ornatus*.

## Resumen

### *Distribución ecológica del lagarto (Reptilia, Varanidae) en Nigeria*

En este trabajo se estudia la distribución ecológica de tres lagartos varánidos de Nigeria (*Varanus exanthematicus*, *V. niloticus niloticus* y *V. niloticus ornatus*) a partir de datos bibliográficos y de los obtenidos tras los estudios ecológicos de campo. *V. exanthematicus* se encuentra sólo en el norte y centro de Nigeria, donde parece estar extendido y ser localmente común en zonas con vegetación de la sabana de Guinea, pero también puede ser encontrado en algunos puntos de la sabana de Sudán y en la sabana de Sahel (fig. 2). *V. n. ornatus* está confinado al extremo sur de la región, i.e. los manglares costeros y hábitats de bosques deltaicos inundados, y entra también en la mayoría de bosques de las tierras bajas (fig. 2). La distribución de *V. n. niloticus* sigue siendo discutible. Está ampliamente extendido por la sabana de Sudán y por la sabana de Guinea, y sólo se encuentra raramente en las sabanas derivadas y en la mayoría de zonas con vegetación de los bosques de tierras bajas. Pese a los pocos registros antiguos que se conocen, parece no habitar las zonas de bosques húmedos del sur de Nigeria (fig. 2). El régimen de precipi-

tación anual parece condicionar en gran manera el patrón de distribución general de los varánidos de Nigeria, que son completamente generalistas en lo referente a la preferencia de hábitat dentro de cada región climática (fig. 1).

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