
HERPETOLOGICAL SURVEYS OF SOUTH-WESTERN AND SOUTH-EASTERN REGIONS OF NIGERIA

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Abstract

The herpetofauna of part of the south-western (Lagos, Ogun and Oyo States) and south-eastern (Cross River State) regions were investigated. Specimens were located opportunistically during visual surveys. Both regions fall in the tropical zone, and the south-western region surveyed, was mostly lowland, degraded forests (mostly secondary) and savanna. The south-eastern regions surveyed were of primary forests, montane, sub-montane and plateau habitats. A total of 35-38 amphibian species were recorded in south-western Nigeria and over 49 species in the south-eastern region. Higher amphibian diversity was observed in the south-eastern region due to the diversity of habitat types. The difference in species diversity was due to the presence of *Werneria mertensiana*, *Didynamipus sjoskedti*, *Cardioglossa gracilis*, *C. leucomystax*, *Astylosternus batesi*, *A. djedematus*, *A. montanus*, *Amietophrynus superciliaris*, *Petropedetes johnstoni*, *Leptodactylodon bicolor*, *L. polycanthus* among others, regarded as forest and montane species. A few farm-bush and savanna species were also observed and they include *Haplobatrachus occipitalis*, *Amietophrynus maculatus*, *Phrynobatrachus accraensis*, *Arthroleptis variabilis* and *Silurana tropicalis* which may indicate that the primary forests are being degraded, hence the emergence of these invasive species. The lower amphibian diversity observed in the south-western region is believed to have resulted from the high amount of degradation and conversion of the natural forests into the impoverished faunal region. Future intensive surveys of both regions especially the degraded areas of the southeastern region would undoubtedly reveal existing species not encountered in this study or even undescribed species.

Keywords: herpetofauna, amphibian diversity, south-western region, south-eastern region, invasive species.

Introduction

Anurans occupy an enigmatic position in the public consciousness, especially among the environmentally aware. They have existed for a very long time, and may have evolved before the reign of the dinosaurs and have thrived for about 300 million years. Scientists have tallied over 6,000 species of anurans around the world, about the same as the number of mammals and more than half the number of birds (Young *et al* 2004).

Anurans occupy wide ranges of temporal and spatial niches to maximize their resource utilization and to reduce interspecific competition. These niches differ among species and are expressed by differences in their temporal appearance and or spatial distribution (Begon *et al* 1990). Their distribution is worldwide with the highest population

and diversity occurring in the tropical region of which Nigeria is situated. Nigeria has a great variety of ecosystems, ranging from mangrove swamps and rainforests along the coasts, various types of savannas further north, to the Jos plateau in central Nigeria and finally the south-east regions towards Cameroun offering mountainous habitats and protected primary forests. So far about 103 amphibian species have been recorded from within Nigeria's border (IUCN *et al* 2008).

As expected, Nigeria being a tropical country has climatic and vegetation conditions which favour the thriving of the amphibians in terms of diversity and population increase. However, the biology and ecology of amphibians have not been well documented and there is still paucity of information about the prevailing diversity



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of almost all these species. Few works and contributions to the knowledge on the country's herpetofauna are dated back to early 1960's. Reports of Schioltz (1963, 1966 and 1967) and that of Walker (1966, 1967, 1968 and 1969) were earlier contributions followed by those of Akintola (1976), Reid (1987) and Bohme and Nikolaus (1989). Recent contributions were those of Akani *et al* (2004) who investigated the anuran species in forest swamps of the Niger Delta and Lea *et al* (2005) that reported on the herpetofauna composition of the Obudu area of south-east Nigeria. Also Luiseli *et al* (1999, 2004 and 2007) have carried out ecological studies on the herpetofauna (especially reptiles) of the Niger Delta.

Most recently, Onadeko and Rodel (2009) observed from surveys in south-western Nigeria that the occurrence of species such as *Leptopelis macrotis* and *Phrynobatrachus liberiensis* showed closer relationship between the region and the Upper Guinea Forests where they also occur; and species such as *Phlyctimantis boulengeri* and *Nectophryne afra* indicated herpetological relationship to the eastern region of the country. Lately, few survey works have been carried out in the far south-eastern region of the country by the same authors (Onadeko and Rodel) and others. The aim of this paper is to compare observed species occurring in these two regions and to establish possible reasons for taxa differences.

Materials and methods

Study areas

South-western Nigeria

The selected states for this study were Oyo, Ogun and Lagos States in south-western Nigeria. Lagos State is situated between Latitude 6.4° and 6.67° N and Longitude 2.7° and 4.43° E; Ogun State between Latitude 6.3° and 7.75° N and Longitude 2.7° and 4.6° E; and Oyo State between Latitude 7.08° and 9.2° N and Longitude 2.7° and 4.55° E (Figure 1). These states are characterized by a south-north gradient of precipitation which is mirrored by a gradient of vegetation zones naturally from tropical evergreen forests in the south, gradually transforming into dry savanna towards the north (Udo, 1970). A total of thirty six survey sites were selected and sampled between July 2003 and December 2004. The sites chosen were representative of the geographical zones within the study area (forest to the savanna zones).

South-eastern Nigeria

The selected state for the study was Cross River State which is situated between Latitude 5.45° and 5.75° N and Longitude 8.30° and 8.50° E. It is the farthest south-eastern state bordering the nation of Cameroun (Figure 1) (Geography Dept., University of Lagos). Regions served as study areas were; the Mbe Mountains,

Oban Hills Division of the Cross River National Park and Obudu Plateau.

The Mbe Mountains are located roughly 160 km from Calabar and about 50 km north-east of Ikom. The mountain top is usually shrouded in clouds with wet mist and rain. Eleven survey sites (MBE 01-MBE 11) each of about 100m² were surveyed within the montane zone and at the base of the mountains including the Base Camp located at 06° 15' 268'' N and 09° 04' 685'' E at an elevation of about 830 m (Professor Oates pers. comm.). Surveys were carried out between the 27th of June and the 8th of July, 2005.

The Oban Hills Division of the Cross River National Park is located about 36 km north-east of Calabar consisting of lowland forests and submontane regions. At Oban Hills eleven survey sites (OHD 01-OHD 11) each of about 100m² including the Base Camp (05° 32' 785N 08° 36' 173' E) were sampled between the 14th and 24th of October, 2005. Survey efforts were concentrated around the tributaries of the Akaram, Calabar (05° 33'662'' 08° 36' 017''E) and Kwa (05° 31' 832''N 08° 034' 57''E) Rivers.

Obudu Plateau is situated in the north-east (06° 37'021'' N 09° 20' 087' E) of Cross River National Park which is wet and mountainous with a height of 1,500-1,700 m. It comprises of a large area of montane grassland having mountain streams flowing through valleys supporting patches of montane forests (www.obuducattleranch.info). Surveys were carried out along these forest streams from the 18th to 21st of January, 2007.

Sampling methods and techniques

Specimens were mainly located opportunistically, during visual surveys of all habitats. There were careful examinations of suspected refuges and hiding places such as under stones, fallen wood, panels, plastics and amongst leaf litters (Rodel and Branch, 2002). Vegetation surrounding and overhanging aquatic environments were searched thoroughly. Surveys were undertaken during the early morning (6-9 am), afternoon (2-5 pm) and at night (7-10 pm). Specimens collected by hand or sweep nets were recorded systematically, identified, classified and then photographed before release. Unidentified specimens were photographed and those photographs were sent for identification (Schioltz, A. pers.comm.). Voucher specimens were collected and preserved in either 10% formalin or 70% alcohol. Each of these sites had their positions taken with the Global Positioning System (G.P.S.) receiver (Garmin Extrex). Nomenclature follows Frost *et al* (2006) and Frost (2007).

Results

A total of 18 amphibian species from 9 families were

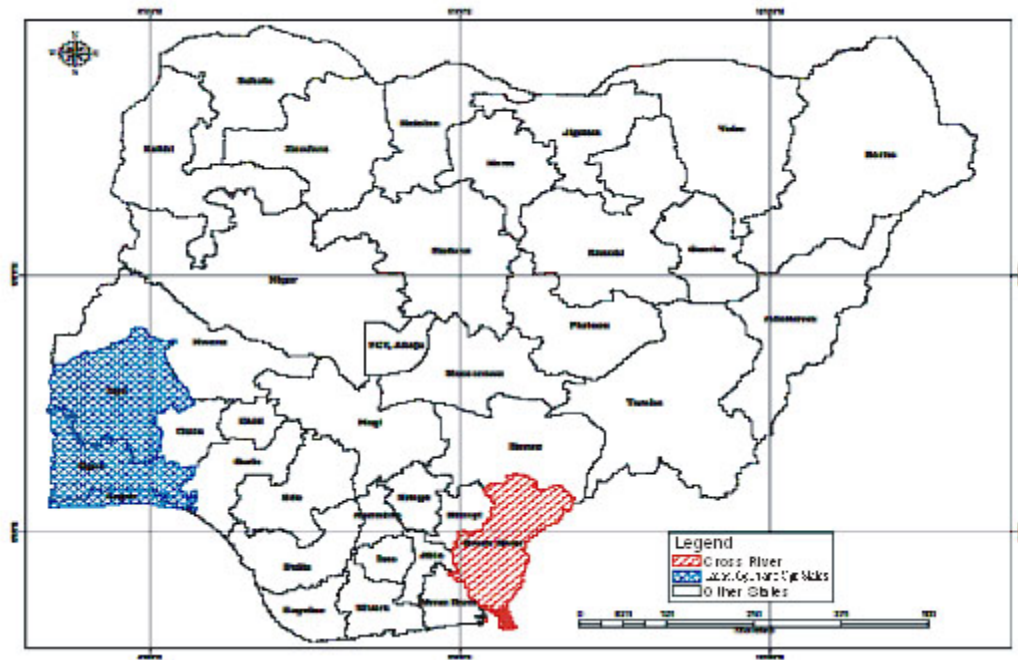


Figure 1: Nigeria showing states of Lagos, Ogun and Oyo (in blue) and Cross River (in red) (LABCARS, Geography Department, University of Lagos, 2010).

recorded at Mbe Mountains. Of these, 12 were identified to species level, 5 to genus level and one could not be identified. Single species was recorded for each of the family of Dicroglossidae, Hyperoliidae and Pipidae made up of *Haplobatrachus occipitalis*, *Hyperolius riggenbachi* and *Silurana tropicalis* respectively. The rest of the families had 2-4 species recorded. The cumulative total of different amphibian species was plotted for each day of the survey (Figure 2) and the list of species are shown on Table 1.

Table 1: Amphibian species recorded during preliminary survey of the Mbe Mountains.

Families	Species
Pipidae	<i>Silurana tropicalis</i>
Phrynobatrachidae	<i>Phrynobatrachus auritus</i>
	<i>P. accraensis</i>
	<i>Phrynobatrachus variabilis</i>
Arthroleptidae	<i>Arthroleptis/Schoutedenella</i>
	<i>Arthroleptis variabilis</i>
	<i>Arthroleptis</i> sp.
	<i>Arthroleptis</i> sp.
Astylosternidae	<i>Scotobleps gabonicus</i>
	<i>Astylosternus</i> sp.
Bufonidae	<i>Amietophrynus maculatus</i>
	<i>A. latifrons</i>
Petropedetidae	<i>Petropedetes johnstoni</i>
	<i>P. newtoni</i> or <i>parkeri</i>
	<i>Leptopelis boulengeri</i>
	<i>Leptodactylodon</i> sp.
Hyperoliidae	<i>Hyperolius riggenbachi</i>
Dicroglossidae	<i>Haplobatrachus occipitalis</i>
Unidentified species	

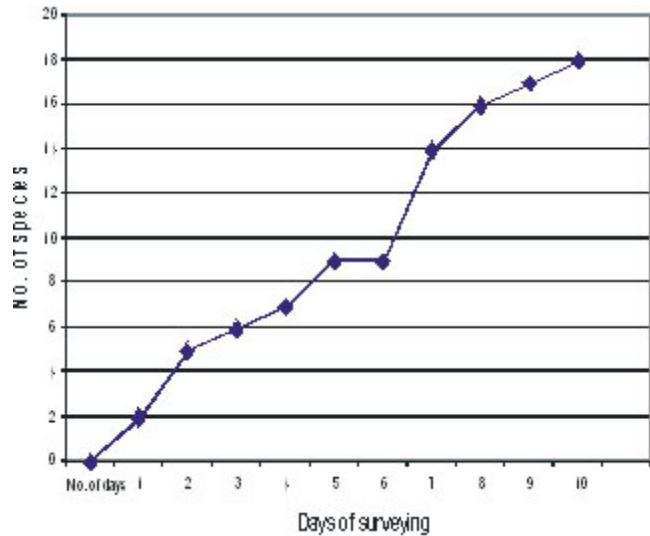


Figure 2: Species accumulation curve of amphibians registered at Mbe Mountain.

A total of 29 amphibian species from 7 families were recorded at the Oban Hills Division of the Cross River National Park. Of these, 24 were identified to species level and 5 to genus level (Table 2). The families of Arthroleptidae and Petropedetes had 7 species each followed by Astylosternidae and Bufonidae that had 6 species each recorded. One amphibian species each was observed for the families of Ranidae, Dicroglossidae and Hyperoliidae which were *Hydrophylax albolabris*, *Haplobatrachus occipitalis* and *Hyperolius guttulatus* respectively. The cumulative total of different amphibian species plotted for each day of the survey is shown in Figure 3.

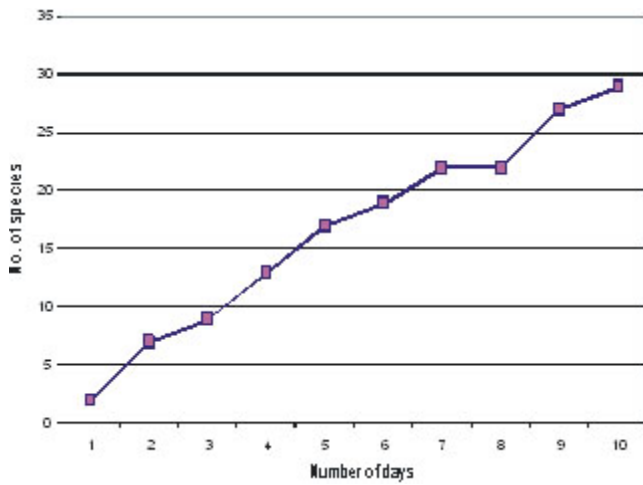


Figure 3: Species accumulation curve of amphibians registered at Oban Hills.

Table 2: Families and species of amphibian recorded at Oban Hills.

Families	Species
Ranidae	<i>Hydrophylax albolaris</i>
Dicroglossidae	<i>Haplobatrachus occipitalis</i>
Arthroleptidae	<i>Arthroleptis variabilis</i>
	<i>A. taeniatus</i>
	<i>Arthroleptis sp</i>
	<i>Arthroleptis sp</i>
	<i>Cardioglossa gracilis</i>
	<i>C. leucomystax</i>
	<i>C. elegans</i>
Astylosternidae	<i>Astylosternus batesi</i>
	<i>A. montanus</i>
	<i>A. djadematus</i>
	<i>Astylosternus sp</i>
	<i>Trichobatrachus robustus</i>
Bufonidae	<i>Scotobleps gabonicus</i>
	<i>Amietophrynus tuberosus</i>
	<i>A. latifrons</i>
	<i>A. superciliaris</i>
	<i>A. cameronensis</i>
	<i>Werneria mertensiana</i>
Petropedetidae	<i>Didynamipus sjoskedti</i>
	<i>Phrynobatrachus auritus</i>
	<i>Phrynobatrachus sp</i>
	<i>Leptodactylodon polycanthus</i>
	<i>Leptodactylondon sp</i>
	<i>Petropedetes carmeronensis</i>
	<i>P. neutoni</i>
Hyperoliidae	<i>Dimorphognathus africanus</i>
	<i>Hyperolius guttulatus</i>

Fifteen amphibian species were recorded on Obudu Plateau of which 13 were identified to species' level and 2 to genus' level. There were a total of 4 families having 1-5 species each. Also, one species (*Geotrypetes seraphini*) of the order Gymnophiona was recorded.

The cumulative total of different amphibian species was plotted for each day of the survey (Figure 4) and the list of species are shown on Table 3. Cumulatively, in all the regions studied in south-eastern Nigeria, there was a total of 49 anuran species observed.

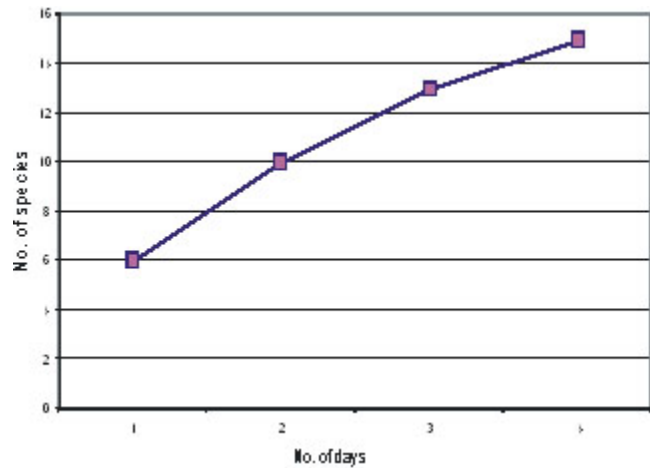


Figure 4: Species accumulation curve of amphibians registered on Obudu Plateau.

Table 3: Families and species of amphibians recorded on Obudu Plateau.

Families	Species
Arthroleptidae	<i>Arthroleptis sp.</i>
	<i>Arthroleptis sp.</i>
	<i>Cardioglossa pulchra</i>
	<i>C. melanogaster</i>
	<i>Leptopelis modestus</i>
Astylosternidae	<i>Astylosternus</i>
<i>diadernatus</i>	<i>A. montanus</i>
	<i>Phrynobatrachus hylaios</i>
	<i>P. werneri</i>
	<i>P. steindachneri</i>
Petropedetidae	<i>Leptodactylodon bicolor</i>
	<i>L. boulengeri</i>
	<i>L. polycanthus</i>
Hyperoliidae	<i>Hyperolius riggenbachi</i>
Gymnophiona (Order)	<i>Geotrypetes seraphini</i>

Species' difference of south-western and south-eastern regions

The various amphibian species observed in the two regions of Nigeria exhibited peculiar distribution patterns.

There were some species observed only in one region i.e. either found only in the south-east or south-west of Nigeria (Appendix). Twenty species observed in south-west Nigeria were not recorded in the south-eastern region and similarly 32 species observed in south-east Nigeria not recorded in south-western region. Species that were only observed in south-west Nigeria are listed on Table 4 while those only seen in south-east Nigeria are listed on Table 5.

Table 4: Amphibian species observed in surveys in south-west Nigeria (Lagos, Ogun and Oyo States) but not seen in the south-eastern region.

Families	Species
Pipidae	<i>Xenopus muelleri</i>
Hemisotidae	<i>Hemisis marmoratus</i> <i>H. guineensis</i>
Bufonidae	<i>Nectophryne afra</i>
Ranidae	<i>Hydrophylax galamensis</i> <i>Aubria subsigillata</i>
Ptychadenidae	<i>Ptychadena pumilio</i> <i>P. oxyrhynchus</i> <i>P. bibroni</i> <i>P. muscareniensis</i> <i>P. longirostris</i>
Phrynobatrachidae	<i>Phrynobatrachus francisci</i>
Arthroleptidae	<i>Leptopelis viridis</i> <i>L. macrotis</i>
Hyperoliidae	<i>Africalus dorsalis</i> <i>Hyperolius nasutus</i> <i>H. fusciventris</i> <i>H. nitidulus</i> <i>H. concolor</i> <i>Kassina senegalensis</i>

Table 5: Amphibian species observed in surveys in south-eastern Nigeria (Oban Hills, Mbe Mountains and Obudu Plateau) but not seen in the south-western region.

Families	Species
Phrynobatrachidae	<i>Phrynobatrachus auritus</i> <i>P. hylaios</i> <i>P. werneri</i> <i>P. steindachneri</i>
Arthroleptidae	<i>Arthroleptis/Schoutedenella</i> <i>Arthroleptis variabilis</i> <i>Arthroleptis</i> sp. <i>Arthroleptis</i> sp. <i>A. taeniatus</i> <i>Cardioglossa pulchra</i> <i>C. melanogaster</i>

Astylosternidae	<i>Scotobleps gabonicus</i> <i>Astylosternus diadernatus</i> <i>A. montanus</i> <i>Astylosternus</i> sp.
Bufonidae	<i>Amietophrynus maculatus</i> <i>A. latifrons</i> <i>A. tuberosus</i> <i>A. superciliaris</i> <i>A. cameronensis</i> <i>Werneria mertensiana</i> <i>Didynamipus sdjoskedti</i>
Petropedetidae	<i>Petropedetes johnstoni</i> <i>P. carmeronensis</i> <i>P. newtoni</i> or <i>parkeri</i> <i>Leptodactylodon bicolor</i> <i>L. boulengeri</i> <i>L. polycanthus</i> <i>Leptodactylodon</i> sp. <i>Dimorphognathus africanus</i>
Hyperoliidae	<i>Hyperolius riggenbachi</i>
Gymnophiona (Order)	<i>Geotrypetes seraphini</i>

External morphology and distribution of some selected species

Brief description of the physical features (e.g. size, colour etc.), distribution and location of the amphibian species sampled in this study are as follows.



Plate 1: *Cardioglossa gracilis* (south-east).

Snout-vent length (SVL): 4.26 cm. Interorbital (eye to eye) length: 1.04 cm.

A medium-sized frog with prominent tympanum. Has a dull pointed snout. Eyes are bulging. The dorsum has a brown colour at the vertebral region and the colour gets lighter towards the flanks. At the flanks the colour is deep brown. There is marble-like colouration on the extremities, and it has long fingers. They were seen mostly on rocky shores of fast flowing streams in south-eastern region of Nigeria.



Plate 2: *Cardioglossa leucomystax* in the south-east. Snout-vent length (SVL): 4.12 cm. Interorbital (eye to eye) length: 1.08 cm.

Cardioglossa leucomystax possess similar colour patterns to that of *C. gracilis*. The major difference is in the snout which is not as pointed as that of *C. gracilis*. It has a long third finger and found mostly on rocky surfaces of shallow streams.

This is a large toad with bright colours. The dorsal region is bright yellow with red flanks and the colour gets lighter towards the ventrum. The extremities are bluish in colour with occasional yellow stripes and there are no webbings. The specimens caught were mostly found on dead tree trunks lying above the ground on other trees. They were quite sluggish and were not difficult to catch.

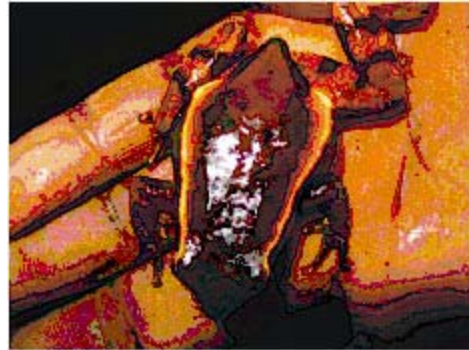


Plate 5: *Werneria mertensiana* in the south-east.

Snout-vent length (SVL): 3.56 cm. Interorbital (eye to eye) length: 1.20 cm.

This is a medium-sized beautiful toad with fine coloration. The snout is blunt and the eyes are bulging. The tips of the finger and toes are slightly enlarged. The dorsum is dark brown with yellow stripes along the junction between the dorsum and flanks. The legs are lighter in colour with a few dark bars. Specimens were located mostly at night on leaf litters on the forest floor.



Plate 3: *Amietophrynus tuberosus* in the south-east.

Snout-vent length (SVL): 4.64 cm. Interorbital (eye to eye) length: 1.16 cm.

A medium sized toad with very prominent warts. Possess a purple-brownish colour on the dorsal region. The ventral region is pale white possessing some dark spots. The snout is blunt and the tympanum visible. Specimens were observed mostly under rocks and roots of large trees.



Plate 6: *Petropedetes cf. johnstoni* in the south-east.

Snout-vent length (SVL): 6.73 cm. Interorbital (eye to eye) length: 1.64 cm.

This large frog bears some resemblance to a tree-frog with the tips of the toes and fingers having enlarged discs as adaptations for rocky substrates. They possess very large tympanum and bulging eyes. The colour of the dorsal region is olive green with dark mottled colour



Plate 4: *Amietophrynus superciliaris* in the south-east.

Snout-vent length (SVL): 10.39 cm. Interorbital (eye to eye) length: 2.28 cm.

found irregularly on the entire dorsal surface and also extends to the forelimbs and hindlimbs. The ventral region is pale white. Specimens were observed mostly at night along the banks of swift-flowing streams with rocky substrates.



Plate 7: Amplexant pair of *Astylosternus* sp. in the south-east.

Snout-vent length (SVL): 6.16 cm. Interorbital (eye to eye) length: 1.52 cm.

A fairly large species found in similar habitats with *P. johnstoni* usually among dry leaves, under tree roots or among fallen branches. Some were also caught from rock crevices. The dorsum was mainly brownish in colour with irregular dark shaped spots on the entire body. Notable amongst most specimens caught was a broad brown stripe located between the eyes. There was some degree of webbing on the toes.

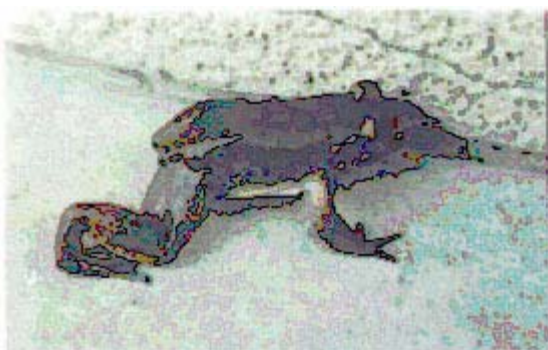


Plate 8: *Aubria subsigillata* in the south-west.

Snout-vent length (SVL): 6.28 cm. interorbital (eye to eye) length: 1.44 cm.

The basic colour observed on these large specimens during this study was light olive brown to dark reddish brown on the dorsal region with pale yellow spots on the flanks and dorsal regions including the ventral regions of the thighs. The preference of the species for emergent

vegetation around bodies of water suggests that the species inhabits watery environments in the forest.



Plate 9: *Hydrophylax galamensis* in the south-west.

Snout-vent length (SVL): 6.89 cm. Interorbital (eye to eye) length: 1.66 cm.

The dorsal region of *H. galamensis* varies from light greenish brown to dark greenish brown. The lateral region adjoining the ventrum is mottled brown with light spots. These spots are also present on the thighs and anal region. A light-yellow stripe starts from the snout runs above the eyes caudally on the dorsal lateral ridge toward the posterior region of this fairly large animal. The specimens were among the collections made close to streams. This species is probably solitary because it is rarely seen with other species of anurans.



Plate 10: *Hyperolius guttulatus* in the south-west.

Snout-vent length (SVL): 3.31 cm. interorbital (eye to eye) length: 1.09 cm.

This is a medium-sized tree frog with a relatively broad head with large eyes. The specimens of *Hyperolius guttulatus* collected were very variable in colouration. The colours varied from light green to black with orange-yellow spots of various sizes. Most of these specimens

were collected in swamps with large stagnant ponds with heavy growth of *Pistia sp.*

Discussion

Although herpetological investigations in West Africa started in the 19th Century, very few areas are well known (Rodel and Branch, 2002). Only in the 1960's were nearly complete amphibian inventories presented for a number of West African localities, e.g. Mt. Nimba (Guibe and Lamotte, 1963), Lamto (Lamotte, 1967) and Mts. Loma (Lamotte, 1971). Schiötz (1963, 1966 and 1967) also surveyed several other West African localities including Nigeria.

Recently, Onadeko and Rodel (2009) recorded a total of 38 amphibian species in south-western Nigeria (Lagos, Ogun and Oyo States) while brief visits to areas of south-eastern Nigeria (Cross River State) had over 49 species recorded. The topography of south-western Nigeria is mainly lowland (Udo, 1970) with the vegetation mostly degraded by anthropogenic activities. The south-east region surveyed had diverse habitat types. The Mbe Mountains and Obudu Plateau have montane environment while Oban Hills is composed mainly of primary rain-forests. Rodel and Branch (2002) observed that areas that naturally comprise diverse habitat types (e.g. mountains, different forest types, different savanna types) showed the highest species diversity.

In south-western Nigeria, majority of the amphibian species recorded were savanna specialists. Such species include *Hemisis marmoratus*, *Ptychadena bibroni*, *P. longirostris*, *P. muscareniensis*, *Hyperolius concolor*, *Leptopelis viridi* and *Xenopus muelleri*. Onadeko and Rodel (2009) observed that 53.4% of species in Ogun State were savanna species; while 79.2% and 68.4% in Oyo and Lagos were savanna species respectively. The rest were forest species found mainly in degraded forests of various vegetation growths eg. secondary and tertiary vegetations, and abandoned farmlands.

The south-eastern region had greater species richness than the south-western region due to its diversity of habitats and probably climatic preference of some of the species. The Obudu Plateau due to its high elevation and temperate climate (www.africansunhotels.com) has unique species such as *Cardioglossa pulchra* and *Phrynobatrachus hylaios*. A caecilian (*Geotrypetes seraphini*) reported by Lea *et al* (2005) was also collected. The Oban Hills Division of the Cross River National Park being a primary rain-forest environment had many forest species such as *Werneria mertensiana*, *Didynamipus sjoestedti*, *Cardioglossa gracilis*, *C. leucomystax*, *C. elegans*, *Astylosternus batesi*, *A. djedematus*, *Amietophrynus superciliaris* and *A. tuberosus* among others. This region has a high diversity

of amphibian species owing to the fact that its vegetation was of primary status supporting greater diversity of organisms. This supports the fact that Nigeria has lost over 90% of its tropical lowland rainforests and more than half of the remaining 10% is found in Cross River State, particularly the Cross River National Park. It is one of the richest forests on the African continent and is of worldwide importance as one of Africa's five biodiversity hot-spots. Over 60% of Nigeria's endangered plants and animals species are found within this forest and nowhere else in Nigeria (www.library.thinkquest.org).

Some similar montane species such as *Petropedetes spp*, *Leptodactylodon spp* and *Astylosternus sp* were observed at Oban Hills and the Mbe Mountains. According to Gatshore (2005), *Didynamipus sjoestedti* also represents a submontane or montane species which was also observed also at Oban Hills. This revealed the similarity of the topography of Oban Hills (montane environments) to that of the Mbe Mountains which supported the thriving conditions of these species. At lower altitudes on the mountain, farmbrush and savanna species such as *Haplobatrachus occipitalis*, *Amietophrynus maculatus*, *Phrynobatrachus accraensis*, *Arthroleptis variabilis* and *Silurana tropicalis* were seen. This indicates that this region is gradually being invaded by these species due to anthropogenic activities such as farming. This poses a threat to the remaining primary vegetation. Hence these species are able to colonize such habitats from other environments that are not of primary forest vegetation.

The species' accumulation curves of the various studied-regions shows that an average of 2-3 previously unobserved species were seen each day of the survey. During the last days of the survey, one unobserved species each was seen at the Mbe Mountains and Oban Hills while two were observed at Obudu Plateau. These indicate that if the duration of the survey time is increased, there is a high possibility that additional species would be observed. This clearly shows that the region has a rich diversity of anuran species and probably several species yet undescribed may still exist in that region, hence the need of more surveys.

From the result of surveys, there were about 20 amphibian species observed in south-western Nigeria not encountered in the eastern region. There were also about 32 species observed in the south-east not encountered in the western region. Possible reasons of taxa difference may be due to climatic, topographic or vegetation difference. Species such as *Phrynobatrachus plicatus*, *P. liberiensis*, *Phlyctimantis boulengeri* and *Ptychadena aequiplicata* observed in the western region were also observed in the eastern region in places not surveyed.

Continuous and discontinuous distribution of species may also be responsible for this observation. There is a high possibility more species would be revealed if degraded regions are surveyed.

High species' richness was observed in the intact primary vegetation of the Oban Hills. There is a strong possibility that species existing in this region may have once been thriving efficiently in south-western Nigeria, but due to anthropogenic factors such as shifting agricultural practices, the vegetation has been destroyed thereby making amphibian living conditions uncondusive. This may have resulted into the lower number of species seen in the southwestern region. Therefore effective sustainable forest management practices are required to conserve the declining bio-diversity.

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Appendix: A checklist of the anurans collected in the three states of south-western Nigeria (Onadeko and Rodel, 2009).

Families	Species
Pipidae	<i>Silurana tropicalis</i> <i>Xenopus muelleri</i>
Hemisotidae	<i>Hemisis marmoratus</i> <i>H. guineensis</i>
Bufonidae	<i>Amietophrynus regularis</i> <i>A. maculatus</i> <i>Nectophryne afra</i>
Dicroglossidae	<i>Haplobatrachus occipitalis</i>
Ranidae	<i>Hydrophylax albolabris</i> <i>H. galamensis</i> <i>Aubria subsigillata</i>
Ptychadenidae	<i>Ptychadena pumilio</i> <i>P. oxyrhynchus</i> <i>P. bibroni</i> <i>P. muscareniensis</i> <i>P. longirostris</i> <i>P. aequiplicata</i>
Phrynobatrachidae	<i>Phrynobatrachus accraensis</i> <i>P. francisci</i> <i>P. plicatus</i> <i>P. liberiensis</i> <i>Phrynobatrachus</i> sp
Arthroleptidae	<i>Arthroleptis</i> spp (2-4 species) <i>Leptopelis viridis</i> <i>L. macrotis</i> <i>L. occidentalis/boulengeri</i> <i>Leptopelis</i> sp
Hyperoliidae	<i>Afrixalus dorsalis</i> <i>Hyperolius nasutus</i> <i>H.-fusciventris</i> <i>H. nitidulus</i> <i>H. guttulatus</i> <i>H. concolor</i> <i>Kassina senegalensis</i> <i>Phlyctimantis boulengeri</i>



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