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Short communication

A preliminary survey of amphibians from the Idanre Forest Ecosystem, southwestern Nigeria

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Abstract

This study was conducted to provide a checklist of amphibian species in the Idanre forest ecosystem (lowland - Idanre Forest Reserve, and highland - Idanre Hills) based on field surveys carried out during June - July 2018. A total of 218 individuals, comprising 11 species from six genera belonging to five families, were observed. A high number of individuals and species were observed in the lowland (Idanre Forest Reserve) compared to the highland (Idanre Hills) region. All species recorded from the study sites are categorized as Least Concern in the IUCN Red List, except for the critically endangered and endemic Sclerophys perreti. We acknowledge that this study is preliminary; thus, we offer recommendations for a comprehensive survey to unveil the amphibian species richness and abundance as well as patterns of species' adaptation.

Keywords: Diversity, species richness; conservation; amphibian; Nigeria

Introduction

Amphibians include the highest number of threatened species than other vertebrate groups in the world (Howard & Bickford, 2014). Currently, the International Union for Conservation of Nature (IUCN) reported that approximately one-third of the world's amphibian species are threatened. Among these threats, habitat alteration has been opined as a leading cause of amphibian decline globally (Stuart et al., 2004; Wake & Vredenburg, 2008; Hof et al., 2011). Other threats include invasive species, disease, and climate change (Cheng et al., 2011; Hof et al., 2011)

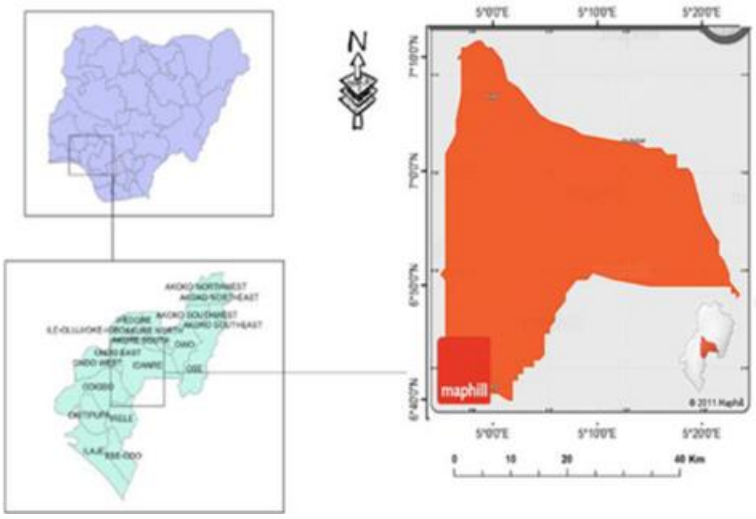

Figure 1. Map of Nigeria, showing the Idanre forest ecosystem, Ondo State, southwestern Nigeria.

Owing to the global decline of amphibians, there is a need for improved conservation of amphibians and their associated habitats (Nneji *et al*., 2019a).

Studies on amphibians of Nigeria dates to the 1950s (Romer, 1953; Schiøtz, 1963, 1966; Walker, 1966, 1967, 1968, 1969). In recent times, there has been an increase in amphibian surveys across the country (Akani & Luiselli, 2009; Onadeko & Rödel 2009; Akani et al., 2014; Nneji et al., 2019a, b, c & d, and others). Such studies have continued to give deep insights into the distribution, diversity, and conservation status of amphibians in Nigeria. Extensive herpetological surveys will help understand the amphibian diversity and enable the design of sustainable conservation plans for amphibians and their associated habitats in Nigeria.

Idanre forest ecosystem, consisting of Idanre Forest Reserve and Idanre Hills in its lowland and highland regions respectively, contains a sizeable amount of plant and animal species, some of which are endemic. For instance, previous studies of Onadeko and Rodel (2014) and Nneji et al. (2019d) reported an endemic and critically endangered toad – *Sclerophrys perreti* (Schiøtz, 1963) from the Idanre Hills. To date, there is still no comprehensive information on the amphibian species richness in the lowland Idanre forest reserve and its adjacent Idanre Hills. The recent study of Awoku and Ogunjemite (2019) reported a reduction of Nigerian forest reserves' landmass due to the demand for forest land for agriculture, fuelwood, timbers, etc. The apparent human-induced activities in the forest ecosystem in Nigeria, such as hunting, slash-and-burn agriculture, urbanization, etc., pose severe threats to wildlife and its habitats (Ikemeh, 2013; Nneji et al., 2019a). These conservation challenges heighten the need for the documentation of amphibians associated with the Idanre forest ecosystem. Herein, we present the results of our preliminary surveys of amphibians in the Idanre forest ecosystem. The objectives of our study are to (1) create a checklist of amphibians, and (2) compare the amphibian species richness in the lowland and highland areas of the Idanre forest ecosystem.

Materials and methods

Study site

Our study area (Fig.1) – the Idanre forest ecosystem – encompasses Idanre Forest Reserve and Idanre Hills. It is located in Ondo State, Southwestern Nigeria. The Idanre Forest reserve is a lowland forest with an altitude of 10 - 400 meters above sea level. It is located between longitude 04˚59' E to 5˚12' E and latitude 6˚45' N to 6˚58' N. On the other hand, the Idanre Hills is located between longitude 5˚00' E to 5˚15' E and latitude 7˚00' N to 7˚15' N. It resides 3000 ft above sea level and it is characterized by valleys

interspersed by the inselberg and hilly forest across the area. The mean annual rainfall of the Idanre forest ecosystem is about 1,60-2000 mm (Ige *et al*., 2011; Orimaye *et al.*, 2012) with July and September considered being the period of highest rainfall. The dry season usually lasts for about 3-4 months spanning November through February. The average temperature of the area is between 24 – 34˚C (Ige *et al*., 2011).

Specimen collection, identification, and diversity analyses

A preliminary survey was carried out during the rainy season for 28 days from 2nd July 2018 to 30th July 2018. Diurnal (05:00 - 08:00) and nocturnal (18:00 - 22:00) searches were conducted using the visual encounter an opportunistic survey method (Rödel and Ernst, 2004). Different microhabitats, including streams, under rocks, within crevices, forest, agricultural farmland, and under wet logs (Fig. 2), were searched randomly for amphibians. Voucher specimens were euthanized with hydrous chlorobutanol, and tissue (muscles) samples were collected and subsequently stored in 95% ethanol for DNA-based identification.

Figure 2. Picture showing some of the sampled localities within Idanre Hills, Southwestern Nigeria.

The voucher specimens were fixed with 10% formalin and preserved in 75% ethanol. Specimens were deposited in the museum of the Department of Zoology, University of Ibadan, Nigeria. Preliminary identification of the specimen was conducted using primary literature (Rödel, 2000). For the DNA-based identification, the phenol-chloroform method by Sambrook et al. (1989) was followed. A partial mitochondrial 16S ribosomal RNA was amplified and used for genetic identification. The primer pairs designed by Bossuyt and Milinkovitch (2000) were used for the amplification. The molecular-based identification followed the methods of Nneji et al. (2019c). Further, we referred to the IUCN Red List to evaluate the threat status of the species (IUCN, 2020). We estimated the relative abundance of each of the species encountered.

Results and discussion

A total of 218 individuals comprising 11 species distributed in five families of the order Anura were observed (Table 1). No record of caecilian (order: Gymnophiona) was observed from the area. Suffice to say that there is a high likelihood of encountering more amphibian species from the Idanre forest

ecosystem. However, factors such as area restriction due to traditional belief at Idanre Hills, inaccessibility of some areas due to rainfall, sampling techniques, and short duration of field sampling precluded an extensive survey of the area. Thus, we recommend a continuous field survey to document the amphibian compositions of the Idanre forest ecosystem.

Family Bufonidae and Ptychadenidae had the highest number of species representatives (n = 3 species). The most abundant species were Phrynobatrachus plicatus (Günther, 1858) (n = 57; r = 26.20%) and Ptychadena longirostris (Peters, 1870) (n = 45; r = 20.60% (Table 1). Species such as Leptopelis aubryi (Duméril, 1856) and Ptychadena bibroni (Hallowell, 1845) were encountered less frequently (n = 3; r = 1.40%) (Table 1). The IUCN Red List showed ten species from the Idanre forest ecosystem as Least Concern and one (S. perreti) as Critically Endangered (Table 1). Previously, S. perreti, endemic to the Idanre Hills, was declared lost. However, studies by Onadeko et al. (2014) and Nneji et al. (2019d) reconfirmed its presence and described the species as micro endemic. During our field survey, we observed S. perreti from batholitic granite rocks and also within low herbal vegetation that grows on the soil between the rocks. The varied skin coloration of S. perreti provides a perfect camouflage to this microhabitat and may have accounted for its persistence in the ecosystem. Comparing both study sites, result showed that the species richness is high (n = 9 species, n = 184 individuals; r = 84.40%) in the lowland region compared to the highland region (n = 5 species, n = 34 individuals; r = 15.60%). Although a bias-related sampling procedure (382 person-hours in the lowland compared to 153 person-hour at the highland) may contribute to this finding, we most likely attribute the abundance of amphibians in the lowland region to the presence of suitable environmental conditions such as humid forest, swamps, leaf-litters, etc. The Idanre Hills comprise rock-outcrop habitats with direct sun exposure and this might have accounted for the fewer number of amphibians observed from the area.

Our survey revealed three species (Arthroleptis poecilinotus (Peters, 1863) Hoplobatrachus occipitalis (Günther, 1858), and Sclerophrys regularis (Reuss, 1833)) common to the highland and the lowland forest regions. Previous studies have reported these species from a wide range of habitats. For instance, A. poecilinotus has been reported in secondary forests, herbaceous vegetation, and agricultural land. Hoplobatrachus occipitalis is also found in dry savannah to highly degraded forests, including highly polluted streams (Nneji et al., 2019a). On the other hand, S. regularis has also been reported from the dry savannah region, montane region, agricultural land, and degraded habitats (Nneji et al., 2019a). The ability to adapt to a wide variety of habitats can explain the presence in both study sites.

Potential threats to the amphibians in the Idanre forest ecosystem have been identified anecdotally during the field survey (Fig. 3). These threats include forest fires, a continuous harvest of trees for firewood, extensive use of chemicals in agriculture, slash-and-burn agricultural practices, and forest clearing. Human-induced forest fires and logging are widespread during the farming season, which destroys the habitats of amphibians. Indeed, the direct and indirect effects of these activities could significantly impact the amphibians and their associated habitats in the Idanre forest ecosystem. Our preliminary study demonstrates that the Idanre forest ecosystem has the potential to be an important natural area in terms of amphibian diversity and raises the conservation needs of amphibians and their associated habitats. We recommend a conservation action plan that would involve the government and local community geared towards improving the long-term persistence of the flora and fauna of the Idanre forest ecosystem.

Figure 3. Picture showing human activities within Idanre Hills, Southwestern Nigeria

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Table 1. Checklist of Amphibian species in Idanre Forest Ecosystem, Ondo State, Southwestern Nigeria

Family	Genus	Species	IUCN status	The total number of individuals observed	Idanre Forest Ecosystem	Idanre Hills
Arthroleptidae						
	Arthroleptis					
		A. poecilinotus (Peters, 1863)	LC	22 (10.10%)	21 (11.40%)	1 (2.90%)
	Leptopelis					
		L. aubryi (Duméril, 1856)	LC	3 (1.40%)	3 (1.60%)	0 (0.00%)
Bufonidae						
	Sclerophrys					
		S. regularis (Reuss, 1833)	LC	10 (4.60%)	9 (4.90%)	1 (2.90%)
		S. maculata (Hallowell, 1854)	LC	7 (3.20%)	0 (0.00%)	7 (20.60%)
		S. perretti (Schiøtz, 1963)	CE	23 (10.60%)	0 (0.00%)	23 (67.70%)
Dicroglossidae						
	Hoplobatrachus	*H. occipitalis* (Günther, 1858)	LC	20 (9.20%)	18 (9.80%)	2(5.90%)
Phrynobatrachidae						
	Phrynobatrachus					
		P. plicatus (Günther, 1858)	LC	57 (26.20%)	57 (31.00%)	0 (0.00%)
		P. auritus (Boulenger, 1900)	LC	9 (4.10%)	9 (4.90%)	0 (0.00%)
Ptychadenidae						
	Ptychadena					
		P. bibronii (Hallowell, 1845)	LC	3 (1.40%)	3 (1.60%)	00 (0.00%)
		P. longirostris (Peters, 1870)	LC	45 (20.60%)	45 (24.50%)	0 (0.00%)
		P. oxyrhynchus (Smith, 1849)	LC	19 (8.70%)	19 (10.30%)	0 (0.00%)
TOTAL				**218**	**184**	**34**

Note: IUCN Status: LC= Least Concern, CE= Critically Endangered; Values in the bracket represent the relative abundance.