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# Amphibian Herpetofaunal Study of the Niger Delta Region, Nigeria.

**A.B. Onadeko[1], R.I. Egonmwan[2], L.A. Ogunkanmi[3] and S.O. Ogoanah[4]**

[1,2]Department of Zoology,
University of Lagos,
Akoka,
Lagos,
Nigeria.

[3]Department of Cell Biology and Genetics,
University of Lagos,
Nigeria.

[4]Department of Animal and Environmental Biology,
University of Benin,
Nigeria.

Email: aonadeko@unilag.edu.ng

## Abstract

*The Niger Delta region in Nigeria is one of the world's largest wetlands and a host to a rich diversity of amphibian species which was investigated. Research studies were undertaken during the wet and dry seasons of the years 2022 and 2023 on three survey sites (each about 90,000m²) selected from each State in which amphibian samplings were conducted. There were a total of 1,647 individuals belonging to 43 species, 10 Genera and 15 Families. In Delta State and Bayelsa State, 42 species (97.7%) and 35 species (81.4%) were recorded respectively. However, more individuals [846(51.4%)] were recorded for Bayelsa State than Delta State [801(48.6%)]. In Delta State, the species with the highest individuals recorded was Hymenochirus sp (7.7%) followed by Amnirana albolabris (5.7%) while the least was Ptychadena retropunctata (0.2%). The highest individuals were recorded for Hymenochirus sp (7.6%) followed by Phrynobatrachus calcaratus (6.4%) while the least were Leptopelis boulengeri, L. modestus and Ptychadena aequiplicata each having 6 (0.7%) individuals in Bayelsa State. In total, Hymenochirus sp and Xenopus sp had the highest individuals recorded in both States combined. Only about 27.9% of species recorded in the Niger Delta were not observed in the Southwestern and Southeastern regions of Nigeria. The amphibian species richness was not statistically different between Delta and Bayelsa States (P=0.74, df=1, F=0.1059). The diversity indices showed that Simpson, Shannon and Margalef indices were higher in Delta state than Bayelsa State respectively (0.9651, 0.9611; 3.518, 3.378 and 6.132, 5.044). Different population of species were observed in various microhabitats based on habitat adaptability. The Niger Delta region is a biome of great amphibian diversity and it is imperative to establish environmental factors that will support the presence of amphibian population and ultimately their conservation. This study has provided important information about some aspects of the diversity and ecology of amphibians in the Niger Delta region and these data would help conservation-oriented bodies to make more informed decisions.*

**Keywords:** Niger Delta, Delta State, Bayelsa State, amphibian, microhabitats

**Author for Correspondence*

## INTRODUCTION

In comparison to other tropical regions, our understanding of the amphibian fauna of Sub-Saharan Africa remains notably incomplete (Streicher *et al.,* 2020). Despite being a charismatic group of vertebrates, the current number of documented amphibian species is likely to represent a vast underestimation of their true diversity (Wake and Vrendenburg, 2008).

Amphibian and reptile endemism in Sub-Sahara West Africa is high (Penner *et al.,* 2011) and new species are continuing to be discovered and described (Blackburn *et al.,* 2010; Rodel *et al.,* 2012; Ofori-Boateng *et al.,* 2018). In the last half-decade, nearly 150 species were described per year, with the trend for species description on the rise (Streicher *et al.,* 2020; Liedtke *et al.,* 2024).

In Sub-Sahara West Africa, the Niger Delta region in Nigeria is one of the world's largest wetland (third largest in the world) and Africa's largest delta covering some 70,000 km$^2$ (Paki and Ebienfa, 2011). It has unparalleled ecological richness, characterized by its intricate network of water ways, lush mangrove forests and diverse ecosystems (en.wikipedia.org/wiki/Niger_Delta). The vegetation varies from the mangrove swamp along the coast, to the evergreen forest in the middle and the savannah in the north east.

Most of the forest reserves in the Niger Delta are subjected to heavy logging pressure due to economic growth and social development (Enaruvbe and Atafo, 2016). This has led to vast loss of habitats and conducive areas for amphibian survival due to forest degradation. Onadeko (2015) observed the effect of vegetation degradation on the diversity and abundance of anuran species in Arun Owan, Sapele, Delta State. Native forest conversion to human-modified landscapes reduces and brings about fragmentations to natural habitats which is a major driver of biodiversity loss at multiple scales (Newbold *et al*., 2015). The development of anthropogenic activities has generated a decline in aquatic fauna populations and amphibians have been the most affected (Quilumbaquin, 2023). Notably Tiffany *et al.,* 2024, observed that amphibians are the most threatened group of vertebrates and are in a dire need of conservation intervention to ensure their continued survival.

Knowledge of the herpetofauna of the Niger Delta is still in the discovery phase. The Niger Delta is home to several amphibian species on which very limited studies have been undertaken (Akani *et al.,* 2004; Ogoanah, 2010; Ogoanah *et al.,* 2014). The effect of seasonal difference and land use types on the composition and distribution of amphibian assemblages and the habitat structure of some species were investigated in the Niger Delta (Onadeko, 2015; Onadeko and Ogoanah, 2016). Many species are known from a single specimen or location and information about their distribution, behavior and basic biology are lacking. Knowledge is still quite rudimentary about the diversity and abundance of amphibian species in the Niger Delta region. In order to close the gap, this paper investigates the diversity, distribution and abundance of amphibian species in the Niger Delta (Delta and Bayelsa States) region.

## MATERIALS AND METHODS

### Study Location

Research studies were undertaken on amphibian species within two States within the Niger Delta region namely, Delta and Bayelsa States. Three survey sites (each about 90,000m$^2$) were selected from each State in which amphibian samplings were conducted (see Figure 1). The vegetative structure, topography and location (GPS coordinates) are briefly described in Table 1.

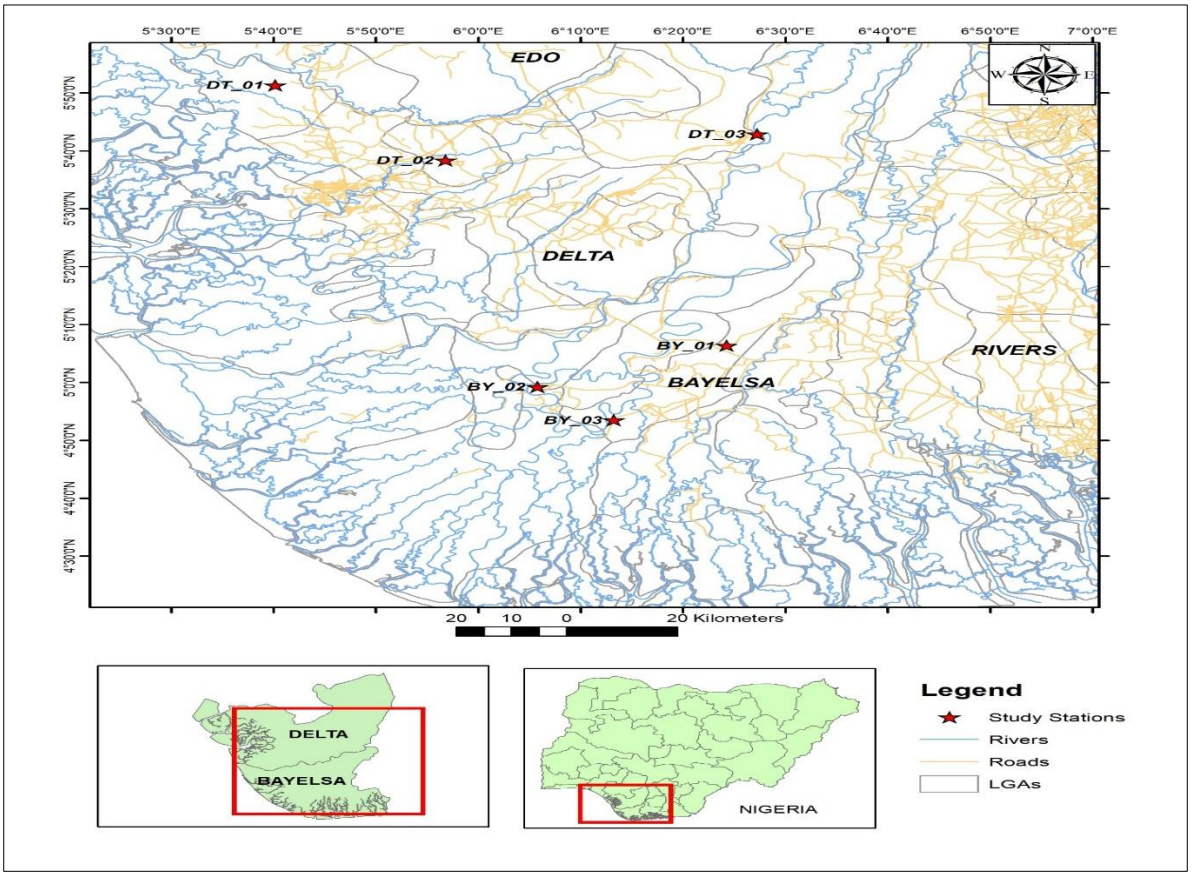


Fig. 1. Study sites located within Delta and Bayelsa states

Table 1. Brief habitat characterization and coordinates of study sites

| Study Area | Study site code | Brief Habitat Description | GPS (Lat.) | GPS (Long.) |
|---|---|---|---|---|
| Delta | DT 01 | Irregular patches of secondary forests with sparse undergrowth of vegetation in a swampy and muddy terrain. Few temporary small streams and ponds present during the wet season. | 5.855770 | 5.669021 |
| | DT 02 | Small patch of primary forest, mostly secondary vegetation with leaf litter undergrowth. A large stream flowing through. Few permanent pond with many temporary ones. Fallowed farmlands inclusive with existing agricultural plots e.g. cassava and maize. | 5.639710 | 5.946083 |
| | DT 03 | Secondary and degraded vegetation with a few temporary ponds during the wet season, but absent during the dry season. | 5.715204 | 6.452997 |
| Bayelsa | BY 01 | A small patch of primary forest present with majorly secondary vegetation. A river present with its bank having tertiary vegetation including pepper, maize and vegetable gardens. A small patch of mangrove vegetation present. | 5.106311 | 6.403732 |
| | BY 02 | Secondary forest with wet and muddy soil most of the year. Many temporary ponds are formed during the wet season, while few larger ponds remain during the dry season. Few small-sized creeks emptying into mangrove vegetation. Leaf litter microhabitat formed during the dry season under the secondary forest. | 4.987982 | 6.095428 |
| | BY 03 | Secondary succession with swampy region. A palm plantation bordering the secondary vegetation with a small river flowing through. Thick undergrowth located in few areas especially close to permanent ponds. Fallow farmlands located in some areas. Mangrove swamps cover about 20% of the study site. | 4.891867 | 6.219711 |

**Amphibian Sampling Methods and Efforts**

The sampling of amphibian species took place during the wet and dry seasons of the years 2022 and 2023. The same duration of time and method of sampling were applied to all the study sites in both states, which assured standardization of sampling efforts (see Table 2).

Table 2. Survey duration and time at study sites.

| Study Area | Study site | Survey duration | | Survey time | |
|---|---|---|---|---|---|
| | | Dry season | Wet season | Morning (hrs) | Night (hrs) |
| Delta | DT 01 | January 21-23 | May 13-15 | 05:00-08:00 | 19:00-22:00 |
| | DT 02 | January 25-27 | May 17-19 | 05:00-08:00 | 19:00-22:00 |
| | DT 03 | January 29-31 | May 21-23 | 05:00-08:00 | 19:00-22:00 |
| Bayelsa | BY 01 | February 1-3 | May 27-29 | 05:00-08:00 | 19:00-22:00 |
| | BY 02 | February 5-7 | May 31-June 2 | 05:00-08:00 | 19:00-22:00 |
| | BY 03 | February 9-11 | June 4-6 | 05:00-08:00 | 19:00-22:00 |

**Sampling Technique**

A combination of sampling methods were undertaken in each study site, notably pitfall traps along drift fences, refuge examination and opportunistic sightings. Specimens were located opportunistically using the VES (Visual Encounter Survey) and AES (Acoustical Encounter Survey) methods (Rodel and Ernst, 2004). All suspected hiding places were checked including decaying logs, leaf litter, under stones, tree holes and barks. Amphibian species were observed and recorded in various microhabitats such as leaf litter, low and high vegetation, muddy terrain, temporary and permanent ponds. The pitfall traps were positioned randomly with fencing to prevent animals from escaping which covered the different topographic conditions (Raxworthy and Nussbaum, 1996). The traps were made from 15-litre buckets (250cm in depth, 270 cm in top internal diameter and 210cm bottom internal diameter). The traps were checked daily in the mornings.

**Specimens' Identification and Storage**

Most specimens found were photographed, identified and released after the survey. Some of those individuals unidentified were also photographed then euthanized and stored in 10% formalin and 80% alcohol as voucher specimens. Voucher specimens (both identified and unidentified individuals) were brought to the Department of Zoology, University of Lagos and kept in the laboratory.

**Data Analysis**

Data analysis was carried out using the one way analysis of variance (ANOVA) with the SPSS version 22.0 to ascertain if species richness differ significantly between Delta and Bayelsa States. The diversity indices were calculated using the Paleontological Statistics Software Package for Education and Data Analysis (PAST) 4.03.

## RESULTS AND DISCUSSION

**Effectiveness of Sampling**

There were a total of 1,647 individuals belonging to 43 species, 10 Genera and 15 Families. In Delta State we recorded 42 species (97.7%) and in Bayelsa State we encountered 35 species (81.4%). See Figure 2. However, more individuals [846(51.4%)] were recorded for Bayelsa State than Delta State [801(48.6%)].

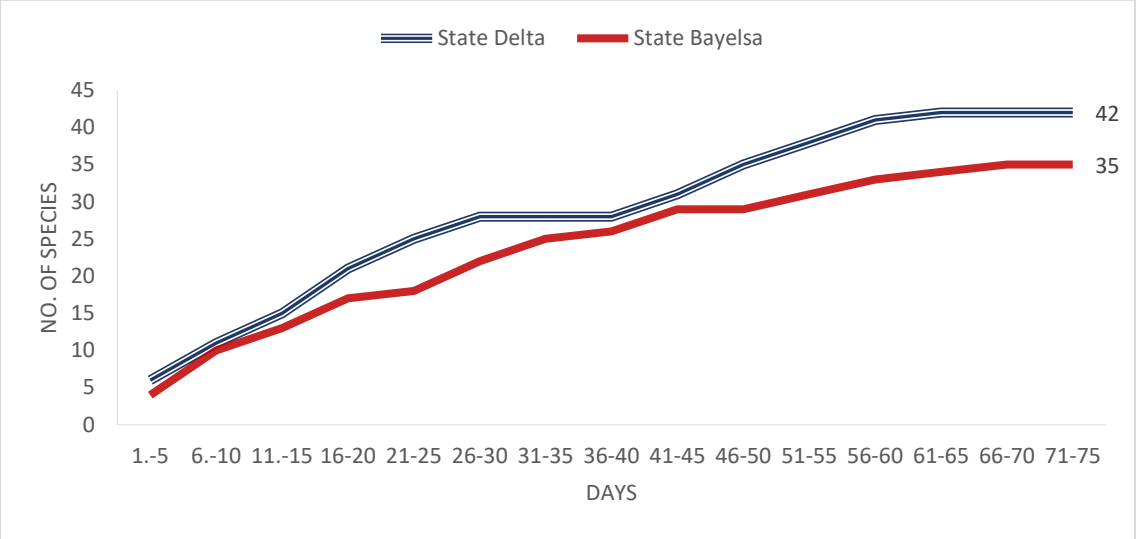


Fig. 2. Species cumulative curve of amphibians recorded from 21st January, 2022 to 6th June, 2023 in the Niger Delta region.

In Delta State, the species with the highest individuals recorded was *Hymenochirus sp* (7.7%) followed by *Amnirana albolabris* (5.7%) while the least was *Ptychadena retropunctata* (0.2%). After surveying in Bayelsa State, we had the highest individuals recorded for *Hymenochirus sp* (7.6%) followed by *Phrynobatrachus calcaratus* (6.4%) while the least were *Leptopelis boulengeri, L. modestus* and *Ptychadena aequiplicata* each having 6 (0.7%) individuals. See Table 3. In total, *Hymenochirus sp* and *Xenopus sp* had the highest individuals recorded in both States combined.

We did not register only one species, *Phrynobatrachus gutturosus* in Delta State, while eight species namely; *Nectophryne afra, Amnirana galamensis, Ptychadena longirostris, P. bibroni, Phrynobatrachus natalensis, Phrynobatrachus sp, Hyperolius ocellatus* and *Chiromantis rufescens* were not registered in Bayelsa State.

Table 3. Relative diversity and abundance of anuran species observed at survey sites in Delta and Bayelsa States.

| Anuran species | States | | Total |
|---|---|---|---|
| | Delta | Bayelsa | |
| **Bufonidae** | | | |
| *Nectophryne afra* | 8 | - | 8 |
| *Sclerophrys regularis* | 36 | 38 | 74 |
| *S. maculatus* | 24 | 26 | 50 |
| **Dicroglossidae** | | | |
| *Hoplobatrachus occipitalis* | 32 | 21 | 53 |
| **Ranidae** | | | |
| *Amnirana albolabris* | 46 | 23 | 69 |
| *A. galamensis* | 6 | - | 6 |
| **Arthroleptidae** | | | |
| *Arthroleptis variabilis* | 16 | 34 | 50 |
| *A. poecilonotus* | 8 | 12 | 20 |
| *Leptopelis boulengeri* | 4 | 6 | 10 |

| | | | |
|---|---|---|---|
| *L. calcaratus* | 16 | 31 | 47 |
| *L. viridis* | 23 | 12 | 35 |
| *L. modestus* | 6 | 6 | 12 |
| **Hemisotidae** | | | |
| *Hemisus marmoratus* | 12 | 9 | 21 |
| **Ptychadenidae** | | | |
| *Ptychadena aequiplicata* | 6 | 6 | 12 |
| *P. mascareniensis* | 16 | 18 | 34 |
| *P. pumilio* | 36 | 41 | 77 |
| *P. longirostris* | 22 | - | 22 |
| *P. oxyrhynchus* | 30 | 26 | 56 |
| *P. retropunctata* | 2 | 7 | 9 |
| *P. bibroni* | 16 | - | 16 |
| **Phrynobatrachidae** | | | |
| *Phrynobatrachus auritus* | 14 | 22 | 36 |
| *P. gutturosus* | - | 19 | 19 |
| *P. francisci* | 12 | 23 | 35 |
| *P. latifrons* | 36 | 39 | 75 |
| *P. cricogaster* | 24 | 32 | 56 |
| *P. calcaratus* | 28 | 54 | 82 |
| *P. plicatus* | 11 | 16 | 27 |
| *P. liberiensis* | 8 | 27 | 35 |
| *P. africanus* | 12 | 10 | 22 |
| *P. natalensis* | 9 | - | 9 |
| *P. rainerguentheri* | 12 | 38 | 50 |
| *Phrynobatrachus sp* | 4 | - | 4 |
| **Hyperoliidae** | | | |
| *Afrixalus dorsalis* | 23 | 11 | 34 |
| *Hyperolius fusciventris burtoni* | 18 | 13 | 31 |
| *H. nasutus* | 22 | 18 | 40 |
| *H. concolor* | 34 | 28 | 62 |
| *H. viridis* | 12 | 9 | 21 |
| *H. guttulatus* | 31 | 47 | 78 |
| *H. ocellatus* | 14 | - | 14 |
| *Phlyctimantis boulengeri* | 6 | 14 | 20 |
| **Rhacophoridae** | | | |
| *Chiromantis rufescens* | 6 | - | 6 |
| **Pipidae** | | | |
| *Xenopus sp* | 38 | 46 | 84 |
| *Hymenochirus sp* | 62 | 64 | 126 |
| Total number of species | 42 | 35 | 43 |
| Total number of individuals | 801 | 846 | 1647 |

**Diversity Indices**

The amphibian species richness was not statistically different from between Delta and Bayelsa States (P=0.74, df=1, F=0.1059). Results from the Diversity indices showed that Simpson, Shannon and Margalef indicies were higher in Delta State than Bayelsa State respectively (0.9651, 0.9611; 3.518, 3.378 and 6.132, 5.044). However, the evenness and equitability indices were higher in Bayelsa than Delta State. See Figure 3.

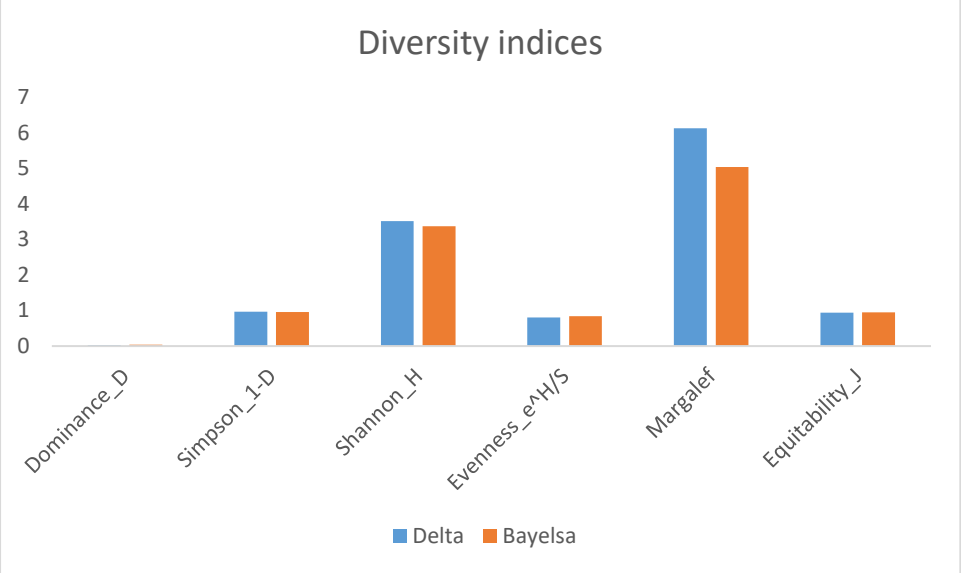


Fig. 3. Diversity indices of amphibian species in Delta and Bayelsa States.

**Spatial Microhabitat Distribution**

The spatial distribution and abundance of the amphibian community in the various microhabitats in the study area were observed and recorded as shown in Figure 4. We recorded the five most abundant species in each microhabitat.

In the leaf litter microhabitat, *Phrynobatrachus latifrons* was the most abundant while *P. rainerguentheri* showed the least occurrence. *Hymenochirus sp* was the most abundant species observed in both the temporary and permanent ponds while *P. gutturosus* and *Phlyctimantis boulengeri* were the least respectively. For the low and high vegetation, *Hyperolius guttulatus* and *Amnirana albolabris* were the most abundant respectively while *Phrynobatrachus auritus* and *Phlyctimantis boulengeri* were the least species respectively. Surveying the muddy terrain microhabitat, *Phrynobatrchus gutturosus* and *Ptychadena pumilio* were the most and least abundant species observed respectively.

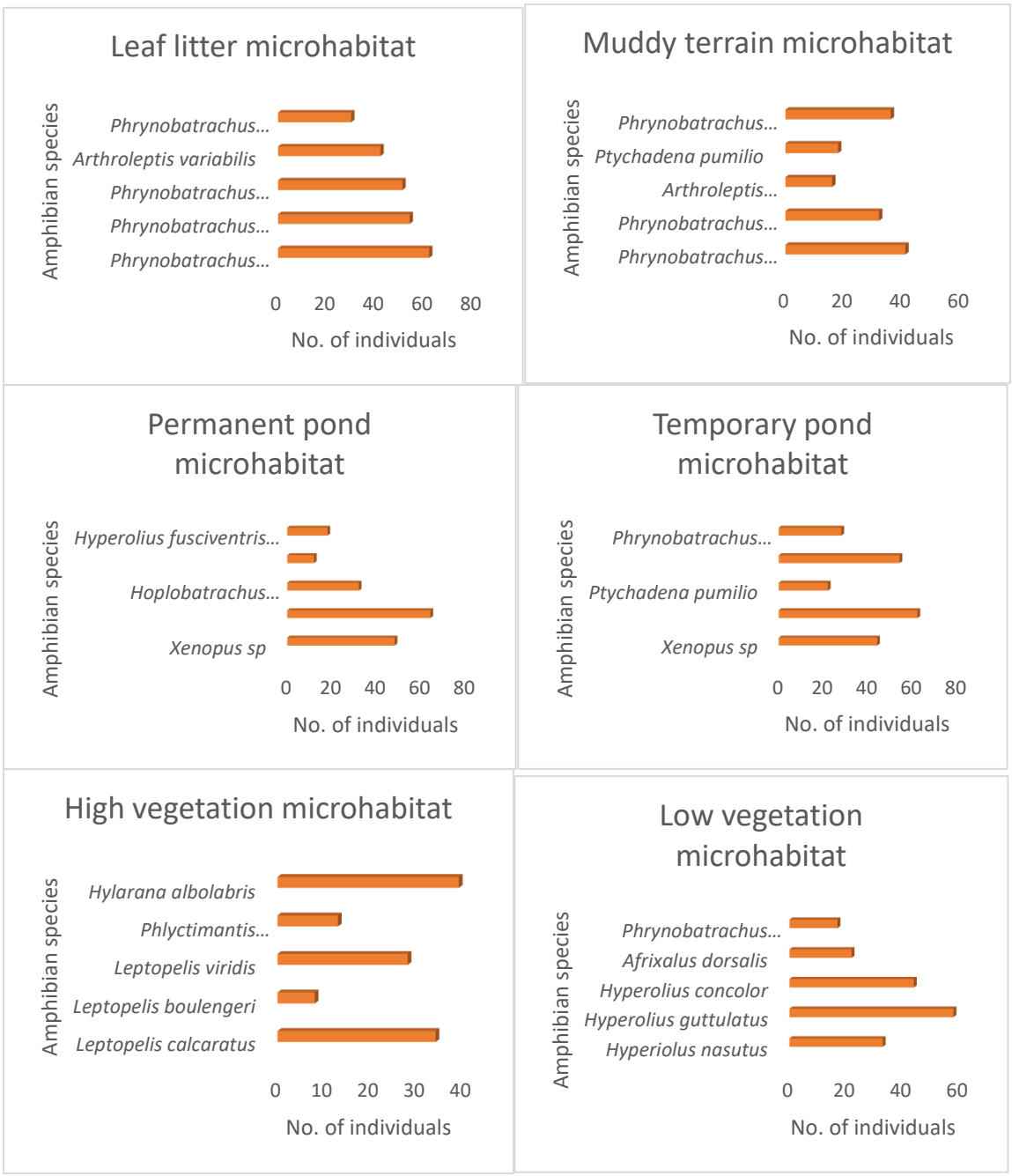


Fig. 4. Abundance of amphibian species in different microhabitats in the Niger Delta region.

**Species Account**

Brief description of the morphological features and distribution of few selected species are as follows.

*Hemisus marmoratus* (Plate 1) *H. mamoratus* is a stout cylindrically shaped frog. The snout is pointed and it has small eyes at the sides of the head and a smooth skin. Most of the specimens of *H. marmoratus* collected were from DT 01 and DT 03. Many were caught especially during and after excavation and digging of the soil which shows that *H. marmoratus* is probably a predominantly subterranean species.

*Amnirana galamensis* (Plate 2) *Amnirana galamensis* is also referred to as *Rana galamensis* or *Hylarana galamensis* in some literature. It is slightly robust in shape and the snout is not very

pointed. The lateral region adjoining the ventral region is mottled light brown with light spots. A light-yellow stripe emerges from the snout and runs above the eyes caudally on the dorsal lateral ridge toward the posterior region of the animal. Specimens were also collected only at DT 02 from undergrowth close to temporary ponds.

*Ptychadena oxyrhynchus* (Plate 3) Morphologically, it is a relative larger species of frog compared to other *Ptychadena sp*. It has a pointed snout and tympanum that is 85-90% the eye diameter. Among all specimens sampled, *P. oxyrhynchus* were the most difficult to catch. The locals called them "flying frogs". Because of their long, strong and muscular hind limbs, they can leap very long distances (4 to 5 meters and above). Majority of the specimens were collected at DT 02, DT 03, BY 01 and BY 02.

*Ptychadena aequiplicata* (Plate 4) This is a medium-sized frog with a pointed snout and bulging eyes. Their forelimbs do not possess webbing but their hindlimbs are long, muscular and toes are fully webbed. Specimens of *P. aequiplicata* were collected mostly from secondary and primary forests that had less undergrowth and puddles of water scattered all over in various areas. Specimens were collected at DT 01 and BY 01.

*Afrixalus dorsalis* (Plate 5) A small-sized cylindrical shaped treefrog. Majority of *A. dorsalis* examined had a dark-brown to light brown dorsum. The posterior end of the dorsal region close to the vent is also whitish-silver in colour. Vertebral stripe are prominent in some specimens. The tip of the snout up to the eye is light brown in colour. *A. dorsalis* were mainly collected from emergent plants and bushes around water bodies at DT 01, DT 02. DT 03 and BY 01. They are also secondary and tertiary forest dwellers and some occurring on farmlands.
*Hyperolius guttulatus* (Plate 6) This is a medium-sized tree frog with large eyes and a relatively broad head. Most of these specimens were collected in swamps with large stagnant ponds with heavy growth of *Pistia sp*. The swamps were located in the secondary forests and fallowed farmland of sites DT 02, DT 03, BY 01 and BY 02. Few of the specimens were collected from leaves of palm trees (*Elais guinensis)* not too far from a swamp.

*Leptopelis viridis* (Plate 7) This is a small to medium-sized stout treefrog with a smooth dorsum. *L. viridis* were encountered mostly in DT 03 in the derived savanna portion of the site and also in the forest area of BY 01. Personal discussions with some farmers also revealed that *L. viridis* are sometimes dug up while they are tilling their lands in preparation for the coming rainy season. But during the rainy season, they are seen mostly on the branches and leaves of shrubs and trees not far from the ground. These frogs bury themselves partially during the dry season probably because the soil contains moisture.

*Leptopelis boulengeri* (Plate 8) This is a medium sized treefrog with a blunt snout. Specimens of *L. boulengeri* were collected from DT 03 from the savanna/secondary forest portion and BY 01 from the secondary forest and caught among the undergrowth between the rubber trees.
*Phlyctimantis boulengeri* (Plate 9) This is a medium to large sized tree frog which has a vertical pupil with a very conspicuous tympanum. Most specimens were collected from vegetation at DT 01 and within permanent pond under floating *Pistia sp* at sites BY 02 and BY 03. These ponds was bordered by secondary forests and cultivated farmland.

*Phrynobatrachus francisci* (Plate 10) This is a small frog that has a blunt snout and a warty skin. The dorsal region of this frog is usually brownish in colour and either light or dark brown in the different specimens. These species were recorded in DT 01, DT 02, BY 02 and BY 03. They

were observed mostly on muddy terrain and also seen near ponds and temporary bodies of water after rainfall.

*Phrynobatrachus latifrons* (Plate 11) This frog has a pointed snout and the tympanum is not very distinct. *P. latifrons* collected had no discs present on the digits and they possess usually light brown to brown dorsum with grey colour. The warts present on the dorsum give the animal a darker colour. A dark line is present on the lateral side of the snout, which continues to the eyes. Specimens were collected mostly on leaf litter in DT 02, BY 01 and BY 03. Some were found on the bare ground close to temporary and permanent ponds.

*Arthroleptis poecilonotus* (Plate 12) A small-sized frog with bulging eyes and a blunt snout. The forelimbs of the males are very long due to the presence of an extremely long third finger which is very unique in this species. The toes and fingers are not webbed, nor are they enlarged to form discs. *A. poecilonotus* specimens were collected from the floor of secondary and primary forests in the sites of DT 01, BY 02 and BY 03. They were found mostly among leaf litter close to temporary pools of water. They were slightly clumsy and not very difficult to catch.

Other amphibian species collected such as *Xenopus sp* and *Hymenochirus sp* will be subjected to molecular testing for further analysis.

Plate 1. *Hemisus mamoratus*

Plate 2. *Amnirana galamensis*

Plate 3. *Ptychadena oxythnchus*

Plate 4. *Ptychadena auiplicata*

Plate 5. *Afrixalus dorsalis*

Plate 6. *Hyperolius guttulatus*

Plate 7. *Leptopelis viridis*

Plate 8. *Leptopelis boulengeri*

Plate 9. *Phlyctimantis boulengeri*


Plate 10. *Phrynobatrachus francisci*


Plate 11. *Phrynobatrachus latifrons*


Plate 12. *Arthroleptis poecilonotus*

The interplay of varied microhabitats (e.g. leaf litter, muddy terrain, low vegetation etc.) factors create different conditions that are suitable for organisms' survival (de Carvalho Teixeira *et al*., 2022). In both Delta and Bayelsa States, these vegetative and topographic conditions were present. We recorded a total of 43 species comprising of 167 individuals. Akani *et al.* (2004) reported a total of 29 species comprising of 300 individuals also in the Niger Delta (Rivers, Delta and Bayelsa states) while Ogoanah *et al.* (2014) working in a riparian community in Delta State reported 14 species of anurans belonging to 3 Families in 5 genera.

There was no significant difference between the diversity of amphibian species in both studied habitats (Delta and Bayelsa). However there were more species recorded in Delta State due to the appearance of a savanna-like habitat in one of the study sites. We recorded *Hyperolius ocellatus, Ptychadena bibroni* and *P. longirostris* in this location not observed in Bayelsa State. Onadeko and Rodel, (2009) observed some of these species in Southwestern Nigeria within the savanna habitat. Ayanlade, (2014) reported that among the major ecosystems in the Niger Delta, the derived savanna is also found in the Northern region which have derived from secondary rainforest to open woodland due to agricultural activities.

Despite having lower amphibian species, Bayelsa State had higher individuals of the amphibian population. Being geographically closer to the River Niger tributaries, there were more aquatic areas that were conducive for the reproductive purposes. The amphibians usually converged around water bodies for the purpose of reproduction, nutrition and easy escape. According to Miliniski and Parker, 1993 the distribution of resources, predators and even other individuals of the same species can be instrumental in determining a population's distribution and abundance.

The Niger Delta falls in between the Southwestern and Southeastern regions in Nigeria. Definitely one would expect some amphibian species of these two regions to be found within the Niger Delta. From research surveys of Onadeko and Rodel, (2009) and Onadeko *et al.* (2010) that worked in the Southwestern (Lagos, Ogun and Oyo states) and Southeastern (Obudu plateau, Mbe mountain and Oban Hills division of the Cross River National Park) regions of Nigeria respectively, it was revealed that 51.4% of amphibian species reported in Southwestern Nigeria and 18.6% of species in Southeastern Nigeria were observed in this present study. The Southwestern region has almost similar vegetative structure with the Niger Delta region that is mostly degraded with agricultural farmlands and a few patches of remaining forests. The Southeastern region studied had mostly montane forests with pristine forests, hence the low similarity of species. Only about 27.9% of species recorded in the Niger Delta were not observed in the two other regions namely; *Arthroleptis poecilonotus, Ptychadena retropunctata, Phrynobatrachus latifrons, P. cricogaster, P. calcaratus, P. africanus, P. natalensis, P. gutterosus, Leptopelis calcaratus, L. modestus, Hyperolius viridis* and *H. ocellatus.* The observation of these species may be due to the unique topographic and vegetative structures of the Niger Delta possessing swampy environments with many water ways, wetlands, creeks coupled

with tertiary, secondary and patches of primary forest in the ecosystem. The Niger Delta has been referred to as largest biodiversity hotspot in Africa that inhabits several species that are endemic in the region (Izah *et al*., 2017; Izah and Seiyaboh, 2018). However some of these species may not be restricted to the Niger Delta region only, but may also be observed in other regions.

The diversity indices indicate a relatively high value of amphibian diversity in the Niger Delta region. Greater biodiversity in ecosystems, species and individuals leads to greater stability (https://www.biologicaldiversity.org). Results in Delta State revealed greater species richness, but the relative abundance of species in Bayelsa State was higher. The evenness and equitability indices showed that Bayelsa State had a more evenly distributed individuals members distributed among the recorded species. This may be due mainly to the availability of water resources, favourable climatic conditions and the topography of the land.

Amphibians occur widely throughout the world with frogs and toads showing the greatest diversity in humid tropical environments. They occupy various microhabitats which reduces the competition that would likely be faced by these species in homogenous environments. As reported by (Pianka, 1986; Luiselli, 2006a and Luiselli, 2006b), the portioning of spatial resources of poikilothermic terrestrial vertebrates has been demonstrated to be a crucial structuring element for the communities of some taxonomic groups especially amphibians. In this study, *Leptopelis sp* were more dominant in microhabitats of high vegetations while *Hyperolius sp* were more in microhabitats of low vegetation. Probably species of different sizes occupy different microhabitats, thereby leading to difference in food and feeding habits which reduces competition. Onadeko and Ogoanah, (2016) observed that *Leptopelis boulengeri* being morphologically differentiated by having the largest size and weight among the treefrogs studied, inhabited the highest altitudes in the various sites studied. It was observed that unlike *Leptopelis sp, Hyperolius sp* with smaller weights mainly inhabited the leaves of grasses at lower altitudes of the same environment (Kouame *et al.,* 2014; Onadeko and Ogoanah, 2016). Both *Hymenochirus sp* and *Xenopus sp* were dominant species found both in the temporary and permanent ponds. They are all pipids which are aquatic frogs occurring in a variety of habitats, usually still or slow-moving water among vegetation (Vitt and Caldwell, 2009, 2010; Onadeko and Ogunkanmi, 2024). Their populations are found concentrated in the temporary and permanent ponds during the dry season, hence the high population of these species in these aquatic microhabitats.

*Phrynobatrachus latifrons* was the most dominant species in the leaf litter habitat and the second most dominant in the muddy terrain and the temporary pond microhabitats. *P. gutturosus* was the dominant species in the muddy terrain. *Phrynobatrachus* species are minute to medium-sized terrestrial frogs and there are about 85 species endemic to Sub-Sahara Africa (Zinkus *et al.,* 2010; Frost, 2017; Channing and Rodel, 2019). In this study the *Phrynobatrachus sp* were dominant in these microhabitats because they shared common boundaries. There were many temporary ponds within the leaf litter habitats in which they both shared borders with the muddy patches. These frogs migrated between these microhabitats in search of nutrition, avoidance of predators and to carry out reproductive activities hence their high population. Most *Phrynobatrachus sp* have aquatic egg deposition and exothrophic tadpoles (Rodel, 2000; Channing, 2001; Rodel and Enrst, 2002b; Channing *et al.,* 2012). Exceptions are species with terrestrial egg deposition and exotrophic tadpoles larvae (Rodel *et al.,* 2004) or terrestrial egg deposition and non-hatching (non-feeding) larvae (Rodel and Enrst, 2002a). Therefore these species lay eggs in the temporary ponds, muddy terrain and in dry leaves containing rain water. These conditions increase their populations in these microhabitats.

However, unfavourable environmental impacts that may cause changes to these conditions, reduction or loss of certainly suitable microhabitats that are essential to the survival of amphibian species with specialized ecological requirements and life history traits may account for observed changes (Hillers *et al.,* 2008; Nneji *et al.,* 2021).

**Conclusion and Future Perspectives**

The Niger Delta region is a biome of great amphibian diversity which have been shaped over millions of years by factors such as bioclimatic heterogeneity, landscape complexity and topographic uniqueness. Overall, 1767 individuals of 43 amphibian species were recorded in this study. We believe this diversity is still underestimated in relation to the number of species described. The inaccessibility to many areas, negative anthropogenic activities and lack of scientific investments are factors leading to the hindrance of the advancement of knowledge of amphibians in the Niger Delta.

The study again revealed that there was a high diversity of amphibian species in the Niger Delta and this was influenced by the various microhabitats located within the landscapes. The spatial distribution of the population of these species is as a result of an integration of the complex requirements of an organism's life style with the environment. The different microhabitats within the Niger Delta region offers survival opportunities for different organisms (species, genera, families etc.) to adapt evolutionarily thereby increasing the biodiversity potential of that ecosystem.

This study has unearthed further question which could be a topic for future discussion. Can the present high amphibian diversity in this region be conserved? Biodiversity worldwide including amphibians are being lost at an alarming rate due to anthropogenic factors. It is imperative we try to establish environmental factors that will support the presence of amphibian population in such a location as the Niger Delta region and ultimately their conservation. This study has provided important information about some aspects of the diversity and ecology of amphibians in the Niger Delta region and these data would help conservation-oriented bodies to make more informed decisions.

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