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RESEARCH ARTICLE



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ABUNDANCE AND DISTRIBUTION OF RANA SPECIES IN STREAMS IN ONDO WEST LOCAL GOVERNMENT, ONDO TOWN, SOUTH -WESTERN NIGERIA.

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ABSTRACT

This study investigated the seasonal abundance of *Rana species* in three streams in Ondo Town, Ondo State South-western Nigeria during the wet season (much precipitation) and dry season to determine their abundance and distribution in their respective habitats. The sampling stations include; Arigbabola, Funbi-Fagun Estate, and Jordan streams in Ondo Town Southwest Nigeria. Morphometric measurements were done on *Rana species* which include *Hoplobatrachus occipitalis*, *Xenopus laevis*, and *Ptychadena aequiplicata*. Specimens were collected weekly for 24 weeks by recording their morphometric parameters which are; weight, body length, length of the fore limb, length of the hind limb, length of the head, and snout-vent length. The frogs are kept in 10 litres capacity bucket with a perforated lid, containing water from their respective habitats, and returned to their respective habitats without mutilating their body parts on the second day of capturing. Numbers of individual frogs captured in each month and season were recorded. The number of Rana Species captured altogether in the three locations equals 232. All streams experienced a major increase in Rana species during the wet season and were less populated during the dry season. The records showed that *H. Occipitalis* is abundant in the three locations. There are few *P. aequiplicata*. It didn't show in all the locations. *X. Laevis* shows its presence by having a count In one of the three Locations This pioneer study of Rana species provides a crucial foundation for understanding the abundance of Rana species in Ondo Town, South-western Nigeria.

Keywords: Abundance of species, Amphibian Distributions, Morphometric, Rana species Stream.

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INTRODUCTION

The abundance and distribution of Rana species in streams of Ondo Town, Ondo West Local Government, Ondo State, South-western Nigeria are; Hoplobatrachus *occipitalis, Xenopus laevis* and *Ptychadena aequiplicata*. This has been a subject of interest among researchers due to the ecological importance of these species. Rana species, commonly known as frogs, are an essential part of the aquatic ecosystem. They play a crucial role in controlling insect populations Torres (2022) serving as prey for predators, and contributing to soil fertility through their excretions, Mills and Barnhart (1999). However, the population of Rana species has been declining in recent times due to human activities such as habitat destruction, pollution, and climate change. In Nigeria, studies on Rana species have focused mainly on their medicinal properties and toxicity level Hatutale (2022). Edible Rana species in streams of Ondo Town, Ondo West Local Government, Ondo State, South-western Nigeria. This study is crucial because it will provide information on the distribution and abundance of Rana species in the study areas to determine if there were significant differences in the morphological characteristics of frogs collected from selected habitats. The results will be useful in developing conservation strategies to protect these species and their habitats.

Furthermore, the study will contribute to the body of knowledge on Rana species ecology and their importance in the aquatic ecosystem. This study aims to investigate the abundance and distribution of Rana species in streams of Ondo Town, Ondo West Local Government, Ondo State, South-western Nigeria. Several studies have been conducted on Rana species, focusing on various aspects of their ecology. This study aims to investigate the abundance and distribution of Rana species in streams of Ondo Town, Ondo West Local Government, Ondo State, South-western Nigeria, using various methods. Frogs are members belonging to the frog class or phylum Chordata. They comprise more than 7,500 species,88% of all amphibians. Their capacity to survive both on land and in water makes them unique Jared et al., (2020). According to O'Shea and Maddock (2024), frogs have powerful hind limbs, webbed feet that are useful for swimming and leaping, prominent eyes, and no tail. Certain species—like climbing African frogs and banana frogs have evolved to thrive in certain environments. Frost (2006). Long legs and streamlined bodies characterize edible frog species like Rana esculenta, which protect stream banks while feeding on insects. Thousands of eggs can be laid by females. Tyler, (1994), Staeck (2022). The rapidly disappearing Afrixalus nigeriensis is one of Nigeria's edible species and Hoplobatrachus occipitalis and Frost (2006), are both widely available. Frost, (2006). Frog skin processes oxygen from water for breathing and shedding allows growth, regeneration, and prevents infections. Webbed feet propel swimming while bulging eyes allow excellent vision. Plotkin (2020). The absence of the neck aids swimming, while the largemouth and sticky tongue help swallow prey. Kemp (2021), Deutsch et al. (2021). Frogs are bioindicators of environmental quality and change as they are sensitive to habitat changes and contaminants. Zaghloul et al., (2020). They serve as early warnings of pollution impacts. Cantonati et al. (2020). This study aims to understand the impact of the flooded streams on frog populations and their habitats.

MATERIALS AND METHODS

Study species

Hoplobatrachus occipitalis, Xenopus laevis, and *Ptychadena aequiplicata* from the family Dicroglossidae, Pipidae and Ptychadenidae respectively were considered for this study.

The study was carried out in three sampling stations, Arigbabola Stream which lies within latitude of 7°.00' -7°.10'N, longitude of 4°.00'-4°.82'E), Funbi-Fagun Estate, situated within Latitude of 7°.00' -7°.09'N and longitude of 4°.00'-4°.81'E and Jordan stream lies within latitude of 7°.00' -7°.07'N and longitude of 4°.00'-4°.83'E in Ondo West Local Government, Ondo State, South-western Nigeria. These areas experience annual flooding which affects nearby human activities and habitats. Human activities near the streams include the construction of fish ponds near Arigbabola Stream and commercial activities (car wash) beside Funbi-Fagun Estate stream. A Field sampling was conducted for six months. Three months during the rainy season, from May to July 2023, and three months during the dry season, from October to December 2023. October to November represent dry seasons because precipitation is not as much as the months used to represent wet seasons. Frogs were collected by catching with bare hands, using of fishing net, and search light. Five people did the catching between 22:00 and 3:00 am because frogs are nocturnal and can only be seen during that period in Jordan, Funbi-Fagun Estate and Arigbabola streams all in Ondo Town. Frogs are captured once a week in each sampling station for 24 weeks 12 weeks which equals 3 months during the dry season and 12 weeks which equals 3 months during the wet season. The frogs were brought to the laboratory in a plastic bucket of 10 litres capacity with the lid perforated for aeration. Chloroform was used to anaesthetize the frogs to take the weight and length of the captured frogs. Specimens were identified at the species level using standard identification key guides by Rodel and Spieler, (2000). Determination of the head, fore limb, hind limb, body, and snout-vent lengths was done using Vernier Callipers and metre rule. Electronic analytical weighing balance, the Melter Toledo model was used to determine the body weights. Individual frogs captured are put in 10 litres capacity containing water from respective habitats to make them feel secure. Frog species are returned to their respective habitats the day after capturing the day. Each species was tagged with their habitat's name and returned to their respective habitats after taking the measurements of their morphometric parameters. Aluminum foils in ring form were tied to one of their hind limbs to avoid repeated capturing. Photographs of all identified species were taken for reference purposes. Representative(s) of captured species were kept inside a transparent air-tight container with formalin for preservation. Species for proven were deposited at the Collection unit of the Department of Zoology, Obafemi Awolowo University, Ile-Ife. The data collected were analysed using descriptive statistics which include frequency tables, means, standard deviation, percentages, and diversity index.



Figure 1: Map showing sampling locations in Streams of Ondo Town, Ondo West Local Government, Ondo State, South–Western, Nigeria

RESULTS

Three species of frogs were identified in the 232 frogs captured. It comprises of *Hoplobatrachus occipitalis* (96.1), %, *Xenopus laevis* (0.4%), and *Ptychadena aequiplicata* (3.5%), were recorded.

-	NUMBERS OF		NUMBERS OF		NUMBERS
MAY	SPECIES	JUNE	SPECIES	JULY	OF
	CAPTURED		CAPTURED		SPECIES
5/5/2023	9	2/6/2023	3	7/7/2023	5
12/5/2023	7	9/6/2023	5	14/7/2023	2
19/5/2023	5	16/6/2023	2	21/7/2023	4
26/5/2023	4	23/6/2023	4	28/7/2023	2
		30/6/2023	3		
	TOTAL=25		TOTAL=17		TOTAL=13

Table 1: Total number of species captured during the dry season in Jordan stream = 24

Total number of frog species captured in May =25, frog species recorded in the month of June=17, and frog species recorded in the month of July=13.Total number of frog species captured =55

	NUMBERS		NUMBERS O	F	NUMBERS
MAY	OF SPECIES	JUNE	SPECIES	JULY	OF SPECIES
	CAPTURED		CAPTURED		CAPTURED
6/5/2023	5	3/6/2023	4	8/7/2023	5
13/5/2023	10	10/6/2023	2	15/7/2023	4
20/5/2023	2	17/6/2023	1	22/7/2023	3
27/5/2023	0	24/6/2023	5	29/7/2023	2
	TOTAL=17		TOTAL=12		TOTAL=14

Table 2: Total number of species captured during the wet season in Funbi-Fagun Estate stream = 43

Population of individual frog species captured in the month of May=17, the ones captured in June =12, and frogs captured in the month of July=14. The total number of frogs =43

	NUMBERS OF		NUMBERS OF	1	NUMBERS
	SPECIES		SPECIES		OF SPECIES
MAY	CAPTURED	JUNE	CAPTURED	JULY	CAPTURED
7/5/2023	6	4/6/2023	3	2/7/2023	5
14/5/2023	3	11/6/2023	3	9/7/2023	4
21/5/2023	8	18/6/2023	4	16/7/2023	3
28/5/2023	2	25/6/2023	3	23/7/2023	2
				30/7/2023	7
	TOTAL=19		TOTAL=13		TOTAL=21

Table 3: Total number of species captured during the wet season in Arigbabola

The number of frog species captured in the month of May=19, the ones captured in June =13, and frog species captured in the month of July=21, the total number of frog species captured in the stream=53

OCTOBER	NUMBERS OF	NOVEMBER	NUMBERS OF	DECEMBER	NUMBERS OF
	SPECIES		SPECIES		SPECIES
	CAPTURED		CAPTURED		CAPTURED
6/10/2023	3	3/11/2023	2	1/12/2023	2
13/10/2023	1	10/11/2023	1	8/11/2023	2
20/10/2023	2	17/11/2023	3	15/12/2023	3
27/10/2023	4	24/11/2023	0	22/12/2023	0
				29/12/2023	1
	TOTAL=10		TOTAL=06		TOTAL=8

Table 4: Total number of species captured during the dry season in Jordan stream = 24

Total number of frog species captured in October =10, frog species recorded in the month of November=06, and frog species recorded in the month of December=08. Total number of frog species captured =24. The number of frog species recorded =24

	NUMBERS		NUMBERS OF		NUMBERS
	OF SPECIES		SPECIES		OF SPECIES
OCTOBER	CAPTURED	NOVEMBER	CAPTURED	DECEMBER	CAPTURED
7/10/2023	5	4/11/2023	3	2/12/2023	3
14/10/2023	4	11/11/2023	3	9/12/2023	2
21/11/2023	1	18/11/2023	2	16/12/2023	1
28/11/2023	2	25/11/2023	0	23/12/2023	2
				30/12/2023	3
	TOTAL=12		TOTAL=8		TOTAL=11

Table 5: Total number of species captured during the dry season in Funbi-Fagun Estate stream = 31

The total number of frog species captured in October =12, frog species recorded in the month of November=08, and frog species recorded in December =11. Total number of frog species captured =31.

	NUMBERS OF		NUMBERS OF		NUMBERS OF
	SPECIES		SPECIES		SPECIES
OCTOBER	CAPTURED	NOVEMBER	CAPTURED	DECEMBER	CAPTURED
1/10/2023	3	5/11/2023	3	3/12/2023	2
8/10/2023	2	12/11/2023	0	10/12/2023	2
15/10/2023	1	19/11/2023	1	17/12/2023	2
22/10/2023	2	26/11/2023	2	24/12/2023	1
29/10/2023	3			31/12/2023	2
	TOTAL=11		TOTAL=06		TOTAL=09

Table 6: Total number of species captured during dry season in Arigbabola stream = 26

Number of frog species captured in October =11, frog species recorded in the month of November=06, and frog species recorded in the month of December=09. Total number of frog species captured =26.

Streams	Average of BL(mm)	Average of HL(mm)	Average of W(g)	Average of LFL(mm)	Average of LHL(mm)	Average of SVL(mm)
Arigbabola	53.10126582	32.5822785	59.2278481	34.2278481	111.835443	52.05063
stream						
Funbi-Fagun	53.75675676	30.9324324	53.6891892	37.36486486	112.7702703	48.28378
Estate Stream						
Jordan Stream	60.82051282	30.4358974	78.8987342	42.5443038	112.3924051	49.5819

Table 7: Average Morphometric Parameters of Frogs in the Streams

The average morphometric values reveal Rana species' physical traits in selected Ondo Town streams. For each stream, body length (BL), head length (HL), weight (W), forelimb length (LFL), hind limb length (LHL), and snout-vent length (SVL) are measured. Arigbabola Stream averages 53.10 mm(BL), 32.58 mm (HL), 59.23 g (W), 34.23 mm (LFL), 111.84 mm(LHL) and 52.05mm (SVL). Together, these parameters characterize the *Rana species* in the Arigbabola Stream. Funbi-Fagun Estate Stream averages 53.76 mm (BL), 30.93 mm (HL), 53.69 g (W), 37.36 mm (LFL), 112.77 mm (LHL) and 48.28mm (SVL). These values show Rana species morphology in the Funbi-Fagun Estate Stream and compared to other streams. Jordan Stream has an average BL of 60.82 mm, HL of 30.44 mm, W of 78.90 g, LFL of 42.54 mm, LHL of 112.39 mm and 49.58 SVL. Jordan Stream may have different ecological conditions or species composition due to its longer and heavier body. Comparative examination of these average morphometric parameters will help ecological research and conservation efforts in Ondo Town streams comprehend Rana species variances and adaptations in different streams.



Figure 2: Abundance of Rana species in the sampling stations during Dry and Wet seasons

The table shows the quantity and distribution of Rana species and other frogs in selected streams in Ondo Town, Ondo West Local Government, Ondo State, South-western Nigeria, during dry and wet seasons. The count for each stream is shown. In the dry season, Arigbabola Stream counted 26 individual frog species, Funbi-Fagun Estate Stream has 31 individual frog species and Jordan Stream has 24 individuals of frog species during the dry season. Frog species captured during the dry season totaled 81 across all streams. In contrast, frog species grew dramatically during the wet season. Arigbabola Stream had 53 species, Funbi-Fagun Estate Stream had 55 frog species. The total number of frog species across the three streams during the wet season was 151. The total for both seasons across the three streams was 232 frog species. The greater count during the wet season implies that increasing precipitation may affect frog species' existence and variety.



Figure 3: Abundance of Rana species in Jordan stream.

The temporal distribution of wet season numbers is more varied and dynamic. The counts range from 1 to 9 species, with some days showing higher abundance. The greatest count is 9 species on 5/5/2023. The wet season may be better for Rana species due to increased moisture and breeding circumstances. Various counts on different dates during the wet season suggest a complicated interaction of environmental factors affecting Jordan Stream Rana species abundance.



Figure 4: Abundance of Rana species in Arigbabola stream.

In the dry season, the Arigbabola stream had 26 *Rana species*, fewer than usual. It appears that variety was reduced and constant during this period, with occasional swings on specific occasions. On the 7th and 28th of May 2023, I captured 6 and 2 species, respectively. Wet season counts reached 53 Rana species, a significant increase. Higher numbers signalled a better Rana species for diversity and presence. Peaks of 7, 8, and 3 species were detected on July 30th, May 21st, and October 8th, 2023. *Rana species* in Arigbabola Stream may breed and thrive during the wet season due to increased moisture. Conservation and management of amphibian populations in the ecosystem require understanding these trends.



Figure 5: Abundance of Rana species in Funbi-Fagun Estate stream

Wet season peaked in Rana species abundance are 13/5/2023, 24/6/2023, and 7/10/2023, with 10, 5, and 5 species respectively. Peaks reflect breeding occurrences throughout these dates. The rise in species count during the wet season suggests Rana species benefit from higher precipitation and suitable nesting grounds.



Figure 6: Species composition

Three different species of frogs were identified in the 232 frogs captured. It comprises of *Hoplobatrachus occipitalis* (223) (*Xenopus laevis* (1) and *Ptychadena aequiplicata* (8). There is 81 individual of frog species in the dry season and 151 individuals frog species in wet season. *Hoplobatrachus occipitalis* are found in dry season with 81 individuals and 142 individual species in wet season. *Ptychadena aequiplicata* was recorded in wet season only and only a count of Xenopus *laevis* was recorded in wet season.

Diversity Indices and Species Richness

For each stream, the specie richness is evaluated. Observed Species in Jordan Stream is; *Hoplobatrachus occipitalis*. Therefore, the count of unique species in Jordan stream is 1. Observed species in Funbi –Fagun Estate Stream are; *Hoplobatrachus occipitalis*. and *Xenopus laevis*. Therefore, the count of unique species in Funbi –Fagun Estate Stream are 2. Observed species in Arigbabola stream are; *Hoplobatrachus occipitalis* and *Ptychadena aequiplicata*. Therefore, the count of unique species in Arigbabola stream are 2. Each stream has different amphibian compositions based on species abundance. Hoplobatrachus *occipitalis* alone in Jordan Stream has a species richness count of 1. With *H. occipitalis* and *X. laevis*, Funbi-Fagun Estate Stream is more diverse. The species richness count for this stream is 2. However, Arigbabola Stream has a similar richness count of 2, including *H. occipitalis* and *P. aequiplicata*. Jordan Stream, Funbi –Fagun Estate Stream, and Arigbabola Stream have distinct amphibian compositions, reflecting their species diversity. This knowledge of each stream's species helps explain amphibian biodiversity in the sampling stations

Table 8: Simpson's Diversity Index (D)

Streams	Diversity Index
Jordan	0.98645
Funk: France France	0.09467
Fundi – Fagun Estate	0.98467
Arigbabola	0.98687

The Simpson's Diversity Index values for Jordan, Funbi-Fagun Estate, and Arigbabola streams show amphibian diversity and evenness in each environment. Diversity increases with index values from 0 to 1. Jordan Stream's diversity index of 0.98645 indicates a diverse and even species distribution in this aquatic habitat. Funbi – Fagun Estate Stream has a diversity index of 0.98467, indicating a varied amphibian community with species representation.

With a diversity score of 0.98687, Arigbabola Stream has a diverse and even amphibian population. The values near to 1 indicate that these streams have a diverse species mix, boosting ecosystem resilience. The stream diversity indices are strikingly comparable, suggesting that each environment supports a diverse and uniformly dispersed amphibian population. Conservation efforts and understanding the ecological dynamics of these streams in Ondo Town, Ondo State, South-western Nigeria require this information.

DISCUSSION

The findings shed light on amphibian populations across the streams under study, frog species abundance varied greatly with season, among the three sampling locations, which are: Jordan Stream, Arigbabola Stream and Funbi – Fagun Estate Stream. Jordan Stream had 24 individual frog species, Arigbabola Stream had 26 and Funbi-Fagun Estate Stream had 31 species during the dry season. The dry season decline in species count is consistent with researches showing that lower precipitation affects amphibian activities and abundance. Lemm and Tobler (2021). Stream may contribute to higher number of frog species during the wet season. Arigbabola, Funbi-Fagun Estate, and Jordan streams have 53, 43, and 55 species, respectively. The high species count increase during the wet season supports the idea that higher precipitation promotes amphibian mating, feeding, and activity, Vagi *et al.* (2020). This supports researches such as Drayer and Richter (2016) which showed that wetland ecosystems sustain varied amphibian groups. Jordan stream's wet season indicated a considerable increase in the population of Rana species. The diversity and evenness of species distribution during this period suggest that increased precipitation benefits amphibian populations, supporting earlier research on the importance of precipitation in amphibian diversity as reported by Vagi *et al.* (2020). Funbi-Fagun Estate Stream also had species counts that peaked during the wet season. These peaks may indicate breeding or migration. Species count increases coincide with wet season dates, highlighting the complexity of environmental factors affecting amphibian abundance. Temporal fluctuations in Arigbabola stream's

wet season data showed that amphibians may adapt to changing environmental conditions. Vagi *et al.* (2020) stated that the increase in species count during the wet season suggests ideal breeding and foraging conditions, emphasising the relevance of temporal changes in amphibian ecology

The findings corroborate ecological hypotheses such as Evans *et al.* (2020), that frogs are sensitive to environmental changes and freshwater habitats. The seasonal variations showed that climate matters when measuring amphibian populations. These findings enhance the understanding of tropical freshwater ecosystems and affect amphibian biodiversity conservation in South-western Nigeria.

To further understand Rana species in South-western Nigeria, future research should expand morphometric measures and diversity evaluations. The findings enhance our understanding of amphibian populations in South-western Nigeria and emphasise the need for ongoing research and conservation to protect these crucial habitats and dry season morphometric counts for the three species *Hoplobatrachus occipitalis* and *Xenopus laevis* in Funbi-Fagun Estate Stream showed seasonal changes. *H. Occipitalis* levels declined somewhat in the dry season, suggesting seasonal environmental changes. *X. laevis*, present in one individual during wet season, this might be as a result of unfavourable climatic factors that have affected the species. Due to the small sample size, judgements should be drawn cautiously. Temperature, diet, and reproduction affect Rana species growth and development, causing morphometric differences and differences in population counts. Ecological variety among streams may explain the observed physical qualities, emphasising the need of understanding each habitat's distinct properties. The observed variations support, previous research such as Wang (2020) on amphibian morphometric and environmental factors thereby demonstrating amphibians' adaptability to different environmental conditions. Research in this area is essential to understand the complex links between environmental variables and Rana species morphology.

CONCLUSION

Rana species should be protected through environmental conservation agencies, this will help in maintaining the ecosystem, widen the horizon of knowledge and provide baseline information on the usefulness of frog species to further research work. Efforts should be put together to ensure the survival of frog species because they are good bio indicators in the ecosystem.

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