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RESEARCH PAPER

Distribution and Abundance of Toads from Selected Study Sites in Minna, Niger State

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ABSTRACT

Toads have relatively wide distribution, bimodal lifestyle, and ectothermic conditions with stable environmental temperatures. Currently, toads are among the world's most endangered animal groups. They are exhibiting a decline in their population as an indication of increased habitat loss, environmental pollution, global climate change, diseases, and Overharvesting. Land use coupled with indiscriminate usage of pesticides and fertilizers are the main drivers of habitat deterioration. The current study aimed to document the abundance, diversity, and distribution of toads for improved conservation plans and management policies. A total of Four (4) sampling sites were selected namely Bosso, Tunga, Chanchaga, and Gidan-Kwano covering Two (2) Local Government Areas in Minna. Data were gathered in both the rainy and dry seasons. Toad samples were collected for Twelve (12) months from 03 June 2020 – 29 May 2021 with the help of pond rangers at the study sites. Opportunistic observations, audio, and visual encounters were used to perform the survey. Temporal abundance of toads in the study areas showed that a mean total of 684.42 toads were sampled with Chanchaga having a total of 243.35 (35.55%) while Gidankwano, Bosso and Tunga ponds had a mean total of 170 (24.83%), 150 (21.91%) and 121.07 (17.68%) respectively. Toad species encountered at the sampling sites were *Amietophrynus regularis, Sclerophrys regularis,* and *Amietophrynus gutturalis*. Shannon's and Simpson's diversity index revealed that Chanchaga had the highest index value of 0.9841, while Tunga had the lowest diversity of 0.8244. This study improves knowledge of toad diversity and distribution in Minna, Niger State for improved conservation plans and management policies

Keywords: Amietophrynus regularis, Sclerophrys regularis, Amietophrynus gutturalis

INTRODUCTION

Amphibians are vertebrates that require moist or damp habitats such as near ponds, swamps, streams, and rivers. They play important roles in ecosystem, medical research, and pollution studies as bio-indicator organisms. Yet, nearly 41% of all existing amphibians are threatened with extinction. According to (AmphibiaWeb, 2022), over 8524 amphibian species have been identified worldwide and occupy virtually all habitats, except the coldest and driest regions, as well as the most remote oceanic islands (Ceríaco et al., 2014). Nigeria has a variety of ecosystems ranging from mangroves, rainforests, savannahs, and mountainous habitats (Onadeko & Rodel, 2009). Generally, toads have relatively wide distribution, bimodal lifestyle, and ectothermic conditions with stable environmental temperatures of 20-30°C. They have warty and dry skin, with short hind limbs, and can jump only in short distances around 1 to 2 times their

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body length. All these have made them susceptible to external changes. Hence, they are regarded as one of the best ecological indicators among vertebrates. In the ecosystem, toads function both as prey and predators. In science education, they have immense value as model specimens to understand anatomy and histology (Jongsma et al., 2014; Abeje et al., 2023). Currently, toads are among the world's most endangered animal groups (Daszak et al., 2003; Stuart et al., 2004; Ceballos et al., 2015; Abeje et al., 2023). They are exhibiting a decline in their population as an indication of increased habitat loss (Onadeko & Rodel, 2009), environmental pollution, global climate change, diseases and pathogens, and Overharvesting (Oluwakayode and Otobong, 2019). Land use coupled with indiscriminate usage of pesticides and fertilizers are the main drivers of habitat deterioration (Gururaja & Ramachandra, 2012). Monitoring toad diversity and their distribution would provide insight into the prevailing conditions of an ecosystem and its health. Such monitoring and documentation are important for the assessment and conservation of the biodiversity of a region, which in turn helps in prioritizing the region for immediate conservation and management action. Conservation plans require information on habitat variables such as humidity, temperature, vegetation, and other physico-chemical parameters of individual species. This study would provide such necessary information, ultimately helping in proper conservation measures for toads (Gururaja & Ramachandra, 2012ss). In Minna, Niger State, the current diversity and abundance of toads are unknown as there are limited studies on their diversity. Thus, it is necessary to document the abundance, diversity, and distribution of toads in Minna, Niger State for improved conservation plans and management policies.

MATERIALS AND METHODS

Study Area

The sampling procedures followed an ethical approval. The study was conducted in Minna, Niger State. Minna, Niger State experiences distinct dry and wet seasons with annual rainfall varying from 1,100mm in the northern parts to 1,600mm in the southern parts. The highest monthly temperature is recorded in March with an average daily temperature of 30°C and the lowest daily temperature is recorded in August at about 22°C. Niger State has a vegetation type classified as Guinea Savannah characterized by the presence of few scattered trees and dense grass cover. However, within the Niger trough and flood plains occur taller trees and a few oil palm trees (Daudu et al., 2017). Generally, the fertile soil and hydrology of the State permit the farming/cultivation of most of Nigeria's staple crops and still allow sufficient opportunities for grazing, freshwater fishing, and forestry development (Niger State Bureau of Statistics, 2012).

A total of Four (4) sampling sites were selected namely Bosso, Tunga, Chanchaga, and Gidan-Kwano (Fig. 1) covering Two (2) Local Government Areas in Minna. Bosso local government area has an area of 1592km² and a population of 203,134 as projected in 2019 using the national population census figures of 2006 with a 2.5% annual growth rate, while Chanchaga local government area has an area of 72km² and a population of 201,429 at the 2006 census.

Toad Sampling and species identification

Toad samples were collected for twelve (12) months, from 03 June 2020 to 29 May 2021, during the dry and rainy seasons, with the assistance of pond rangers at the study sites. The day (06:00-08:00) and nightly (1900-21:00) searches were carried out using visual encounter surveys and opportunistic observations, as described by Rödel & Ernst (2004). Each sampling site was searched for two to three hours once a week. Furthermore, distinct strategic locales that potentially harbour toads inside each sampling site were identified. When toads were spotted, information such as habitat type, physicochemical properties of habitats, vegetation, and geographic coordinates were recorded.

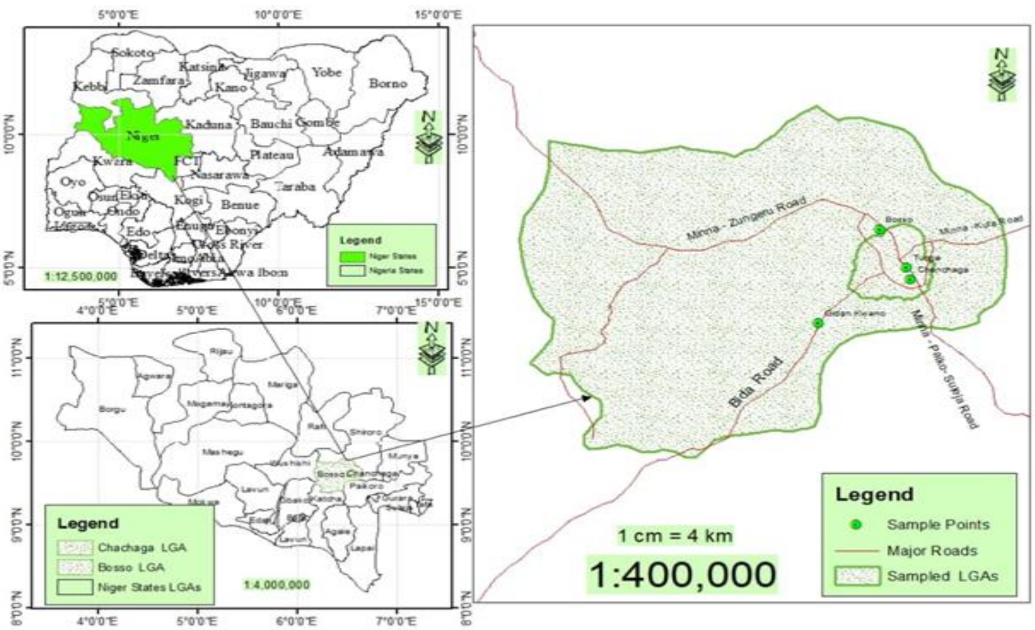

Figure 1. Map showing the sampling sites within Minna

Geographic coordinates were established using a Global Positioning System coordinate mobile application, and latitude and longitude were recorded. Until the search was over, all trapped toads were placed in perforated plastic buckets filled with new leaves and mud. All of the caught species were photographed. To avoid recapture, the toads were released around 50 meters away from the capture place, and some were recovered as reference materials. Rödel (2000), Frost (2007), Onadeko & Rodel, (2009), and AmphibiaWeb 2022 were used to identify toads at the species level**.**

Table 1: Table showing coordinates and altitudes of sampling sites for the toad survey

Study Site	Code	Latitude (ºN)	Longitude (º E)	Altitude (m)	Precipitation (mm)
Gidan-kwano Pond	GK	9.538550	6.4673500001	226.3	1100
Chanchaga Pond	CH	9.590627	6.5596366667	250.2	1600
Tunga Pond	TG	9.604753	6.555226666	258.5	1600
Bosso Pond	BS	9.651040	6.528338333	274.0	1200

Source: Niger State Bureau of Statistics (2012)

Analysis of Physicochemical Parameters

The water sample collected from the sampling site was examined for some physicochemical parameters that may be influencing the ecology of the water body. The physicochemical parameters studied include temperature, turbidity, hydrogen ion concentration (pH), biochemical oxygen demand, total dissolved solids, electrical conductivity, alkalinity, and dissolved oxygen. These were done according to details in the American Public Health Association (APHA, 2005).

Diversity Measures

Alpha (α) diversity is a measure of species diversity in a given habitat. It is measured both parametrically and non-parametrically. Shannon's and Simpson's index are non-parametric measures of alpha diversity. Evenness is measured to know how evenly species are distributed in a locality (Gururaja & Ramachandra, 2012).

Data analysis

Primary data (observational records) collected during the survey were used for the diversity analyses. Data from toad abundance were subjected to Analysis of Variance (ANOVA) to verify if there was a significant difference in toad abundance among the study sites. The relative abundance (r), Shannon – Weiner index (H'), and Simpson index of diversity (1-D) as implemented in PAST (Hammer, 2011), were used to compare the toad species compositions within the different habitat types. The relationship between toad species and the physicochemical parameters of the environment was determined using correlation analysis. Relationship among habitat variables, sampling sites, and species abundance was estimated through CCA using PAST (Hammer et al., 2001; Gururaja & Ramachandra, 2012).

RESULTS AND DISCUSSION

The monthly abundance of toads

Temporal abundance of toads in the freshwater bodies showed that a mean total of 684.42 toads were sampled with Chanchaga having a total of **243.35** (35.55%) while Gidankwano, Bosso and Tunga ponds had a mean total of 170 (24.83%), 150 (21.91%) and 121.07 (17.68%) respectively. The highest number of toads were encountered in Chanchaga Pond **243.35** (35.55%) and the least in Tunga Pond 121.07 (17.68%). In terms of monthly abundance, toads were encountered greatest in August with a mean abundance of (96.01) while the least abundance of toads was encountered in January with a mean abundance of (21.33). Tables 2 and 3 provide the sampling sites and toad abundance. ANOVA showed a significant difference in the monthly abundance of toads at $P < 0.05$.

Monthly abundance of toad species and Diversity

The result revealed that Three (3) species of toads were encountered at the four sampling sites belonging to one family and two genera. Table 4 details the species list with distribution. Toad species encountered at the sampling sites were *Amietophrynus regularis, Sclerophrys regularis,* and *Amietophrynus gutturalis* (Plate 1). The result on toad species abundance (Tables 5 and 6) revealed that a total of 1289 (62.63%), 496 (24.10%), and 273(13.26%) were recorded for *A. regularis, S. regularis* and *A. gutturalis* respectively with a mean total of 429.67 (62.77%), 165.33 (24.15%) and 89.34 (13.05%) for *A. regularis, S. regularis* and *A. gutturalis* respectively (Table 4.5). The highest toad species encountered was *A. regularis* while the least was *A. gutturalis*. The analysis also revealed that there was a significant difference in the amount of toad species encountered from the four study sites at $p < 0.05$.

Table 2: Monthly Abundance of Toad Encountered at the Study Sites

Months/sites	Chanchaga	Gidankwano	Bosso	Tunga	Total
June	86	57	50	37	230
July	95	65	57	46	263
August	105	71	62	50	288
September	90	61	54	40	245
October	74	55	40	38	207
November	33	24	19	12	88
December	25	17	16	12	70
January	20	16	16	12	64
February	33	27	20	23	103
March	35	32	32	24	123
April	50	36	40	32	158
May	85	54	44	36	219
Total	**731 (35.5%)**	**515 (25.0%)**	**450(21.8%)**	**362 (17.8%)**	**2058**

Table 3: Monthly Mean ± SD Abundance of Toad Encountered at the Study Sites

Months/sites	**Chanchaga**	**Gidankwano**	**Bosso**	**Tunga**	**Total**
June	28.67±6.77^{a}	19.00±9.54^{a}	16.67±6.33^{a}	12.33±6.43^{a}	76.67
July	31.67±9.74^{a}	21.67±12.17^{a}	19.00±8.50^{a}	15.33±7.54^{a}	87.67
August	35.00±14.19^{a}	23.67±12.33^{a}	20.67±8.41^{a}	16.67±7.84^{a}	96.01
September	30.00±7.81^{a}	20.33±9.84^{a}	18.00±9.29^{a}	13.33±6.74^{a}	81.66
October	24.67±7.22^{a}	18.33±9.84^{a}	13.33±7.69^{a}	12.67±6.49^{a}	69.00
November	11.00±5.29^{a}	8.00±4.16^{a}	6.33±3.38^{a}	4.00±3.06^{a}	29.33
December	8.00±4.91^{a}	4.00± 3.06^{a}	5.33±3.38^{a}	4.40±3.06^{a}	21.73
January	6.67±4.18^{a}	5.33±3.38^{a}	5.33±3.38^{a}	4.00±3.06^{a}	21.33
February	11.00± 5.13^{a}	9.00± 5.29^{a}	6.67±4.18^{a}	7.67±4.06^{a}	34.34
March	11.67± 5.24^{a}	10.67± 6.77^{a}	10.67±5.70^{a}	8.00±5.03^{a}	41.01
April	16.67± 7.84^{a}	12.00± 6.56^{a}	13.33±7.42^{a}	10.67±5.48^{a}	52.67
May	28.33±6.39^{a}	18.00± 8.62^{a}	14.67±4.80^{a}	12.00±4.16^{a}	73.00
Total	**243.35(35.5%)**	**170(24.8%)**	**150(21.9%)**	**121.07(17.6)**	**684.42**

Values followed by different superscript alphabets on the same column are significantly different at P < 0.05. Values are in means ± standard error of two determinations

Table 4: Toad Species Encountered at the Study Sites

Species	**Family**	**Synonym**	**Common Name**	**Distribution**
Amietophrynus regularis (Reuss, 1833)	Bufonidae	*Bufo regularis*	Common African Toad	Gidan-kwano, Bosso,Tunga, Chanchaga
Sclerophrys regularis (Reuss, 1833)	Bufonidae	*Bufo regularis*	Common African Toad	Gidan-kwano, Bosso,Tunga, Chanchaga
Amietophrynus gutturalis (Reuss, 1833)	Bufonidae	*Bufo regularis*	Common African Toad	Gidan-kwano, Bosso,Tunga, Chanchaga

Plate 1: Macro-photograph showing *Ameiophrynus regularis* (Field Photography, 2020)

Plate 2: Macro-photograph showing *Sclerophrys regularis* 8Field Photography 2020)

Plate 3: Macro-photograph showing *Amietophrynus gutturalis* (Field Photography, 2021)

Plate 4: Macro-photograph showing toad eggs (Field Photography, 2021)

Table 5: Abundance of Toad Species Encountered at the Study Sites

Site	A. Regularis	S. Regularis	A. Gutturalis	Total
Chanchanga	407	196	128	**731**
Gk	351	99	60	510
Tunga	241	91	30	362
Bosso	290	110	55	455
Total	**1289(62.63%)**	**496 (24.10%)**	**273 (13.26%)**	**2058**

Table 6: Mean ± SD Abundance of Toad Species Encountered at the Study Sites

Site	*Amietophrynus regularis*	*Sclerophrys regularis*	*Amietophrynus gutturalis*	Total
Chanchanga	135.67 ± 5.3^{a}	65.33 ± 19.1^{b}	42.67 ± 17.4^{ab}	243.67
Gk	117.0 ± 25.9^{a}	33.00 ± 7.63^{b}	20.00 ± 6.9^{ab}	170
Tunga	80.33 ± 12.9^{ab}	30.33 ± 6.8^{bc}	10.00 ± 4.5^{a}	120.7
Bosso	96.67 ± 14.0^{a}	36.67 ± 12.0^{ab}	16.67 ± 6.1^{ab}	150
Total	**429.67(62.77%)**	**165.33 (24.15%)**	**89.34(13.05%)**	**684.42**

Values followed by different superscript alphabets on the same row are significantly different at $P < 0.05$. Values are in means ± standard error of two determinations

Physico-chemical Parameters of the water bodies analysed (Habitats Variables)

The mean values of the physicochemical parameters of water in the sampling sites are shown in Table 7. Comparisons of parameters using overall means among the four water bodies showed that water temperature, pH, dissolved oxygen (DO) and biochemical oxygen demand (BOD), total dissolved solids (TDS) were found to vary significantly amongst the four water bodies. Also, comparisons showed that there were great significant differences among electrical conductivity and alkalinity in the water bodies. Among the four waterbodies, there was no significant difference ($P > 0.05$) for air temperature. The results of the correlation analysis between Physicochemical parameters and toad species abundance in the four water bodies are presented in Table 7. It showed that *S. regularis and A. regularis* had a very strong correlation with electrical conductivity and biological oxygen demand respectively. *A regularis*, *S. regularis*, and *A. gutturalis* correlated positively with conductivity, dissolved oxygen, biochemical oxygen demand, TDS, and alkalinity, but correlated negatively with water temperature and pH. *S. regularis and A. gutturalis* both correlated negatively with air temperature, while *A. regularis* had a weak positive correlation with air temperature.

Table 7: Mean Physicochemical characteristics of the selected sampling sites in Minna

Parametres	Chanchaga	Gidankwano	Tunga	Bosso
Air Temperature	32.00 ± 0.89^a	32.90 ± 1.08^a	32.20 ± 1.11^a	31.84 ± 0.96^a
Water Temperature (^{0}C)	26.86 ± 0.94^a	28.08 ± 0.93^c	27.84 ± 0.83^b	28.90 ± 1.28^c
PH	6.45 ± 0.19^b	7.50 ± 0.42^c	7.47 ± 0.45^c	5.64 ± 0.33^a
Electrical Conductivity (µS/cm)	753.00 ± 59.63^c	154.6 ± 9.44^a	240.80 ± 47.95^b	323.60 ± 46.87^{ab}
Dissolved Oxygen (mg/l)	8.58 ± 1.94^b	8.84 ± 1.73^b	6.12 ± 1.21^a	6.82 ± 1.33^a
Biological Oxygen Demand	7.83 ± 1.60^c	6.92 ± 1.60^b	5.04 ± 1.18^a	5.12 ± 1.29^a
Total Dissolved Solid (mg/l)	196.27 ± 1.77^c	139.46 ± 12.93^b	140.22 ± 12.97^b	117.02 ± 21.86^a
Total Alkalinity	224.00 ± 0.10^c	66.00 ± 0.12^a	150.00 ± 0.01^b	112.00 ± 0.10^b

Values followed by different superscript alphabets on the same row are significantly different at $P < 0.05$ level of significance. Values are presented in mean ± standard error of two determinations

Table 8: Correlation coefficient matrix between toad species and physicochemical parameters of water in the study sites

	A. Regularis	*S. regularis*	*A. gutturalis*
Air temp.	0.14606	-0.39413	-0.18419
Water temp.	-0.60633	-0.74601	-0.74162
PH	-0.13701	-0.37207	-0.27429
EC	0.66436	*0.97682	0.89752
DO	0.91733	0.51239	0.70255
BOD	*0.96532	0.76072	0.88623
TDS	0.74824	0.88872	0.88593
TA	0.35093	0.81642	0.67398

Keys: E.C = Electrical conductivity; BOD = Biological oxygen demand; TDS = Total dissolved solid; TA= Total Alkalinity; DO = Dissolved oxygen

Alpha Diversity Measures of Toads Encountered

Species Richness is the total number of different species in an area and it does not matter how abundant they are, while Species Diversity incorporates both the number of species in an area and the evenness of their abundance. Table 9 provides alpha diversity measures of the sampling sites. Species richness was found to be the same (3) in all sampling sites. Shannon's and Simpson's diversity index revealed that Chanchaga had the highest index value of 0.9841 and 0.5875 respectively, while Tunga had the lowest diversity of 0.8244. In terms of Evenness, the study site with the highest index for evenness was Chanchaga with an index of (0.891), followed by site Bosso (0.796), GK (0.762) and Tunga (0.760).

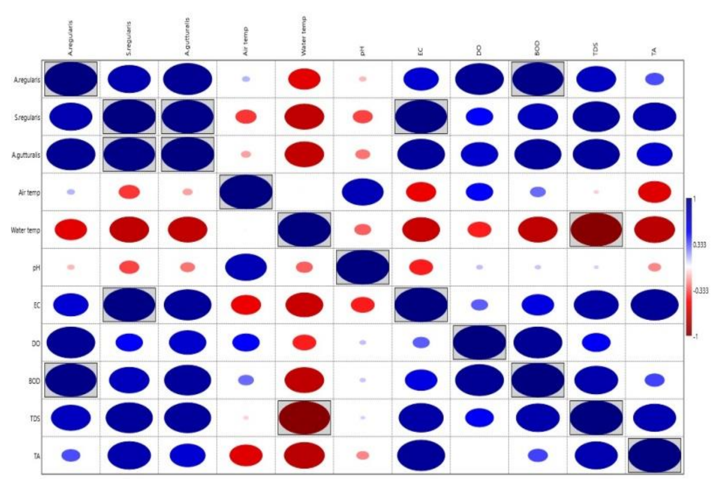

Fig. 2: A correlation chart showing significant relationship between the toad species and the physicochemical parameter

Table 9: Alpha Diversity Measures of Toad Species in the Sampling Sites

Diversity Index/ Sampling Sites	CH	GK	TU	BOS
Taxa_S	3	3	3	3
Individuals	731	510	362	450
Dominance_D	0.4125	0.5252	0.5133	0.4874
Simpson_1-D	0.5875	0.4748	0.4867	0.5126
Shannon_H	0.9841	0.8271	0.8244	0.8716
Evenness_e^H/S	0.8918	0.7622	0.7601	0.7969
Brillouin	0.975	0.8154	0.8089	0.8585
Menhinick	0.111	0.1328	0.1577	0.1414
Margalef	0.3033	0.3208	0.3395	0.3274
Equitability_J	0.8957	0.7529	0.7504	0.7934
Fisher_alpha	0.3993	0.4228	0.448	0.4316

Relationship between Habitat Variables and Toad Abundance

Triplot of habitat variables, sites and species occurrence is illustrated in Figure 2. Variables, like DO, BOD, alkalinity, electrical conductivity and total dissolved solids, are highly correlated with axis 1. CCA scores of the first two axes are given in Table 10. Species (*A. gutturalis* and *S.regularis*) in this ordination are positively influenced by aforesaid habitat variables. Air temperature, Water temperature and pH were negatively correlated with axis 1 while dissolved oxygen (DO has a weak positive correlation with axis 1. A positive correlation is stronger with DO than any other variable in axis 2. *A. regularis* seemed to be independent of the influence of these habitat variables. Meanwhile, all the study sites had a high influence from the habitat variables.

Table 10. CCA scores of habitat physicochemical parameters explained in first two axes

Toad Species Sites Physicochemical parameters	Axis 1	Axis 2
A.regularis	-0.70271	0.314492
S.regularis	0.69337	-1.63044
A.gutturalis	2.09658	1.50493
CH	0.161777	0.001453
GK	-0.10238	0.076997
TU	-0.11978	-0.07577
BOS	-0.05041	-0.02867
Air temp	-0.45106	0.721778
Water temp	-0.69672	-0.06967
PH	-0.44209	0.203204
EC	0.982447	-0.09706
DO	0.477875	0.904685
BOD	0.72143	0.670139
TDS	0.85239	0.138019
TA	0.813552	-0.43441

Keys: DO = Dissolved oxygen; E.C = Electrical conductivity; CH= Chanchaga; GK = Gidan-kwanu; BOS = Bosso; TUN = Tunga; BOS = Bosso;; TUN = Tunga**;** BOD = Biological oxygen demand; GK = Gidan-kwanu; TDS = Total dissolved solid; TA=Total Alkalinity

Table 11. CCA eigenvalue percentage of habitat physicochemical parameters explained in the first two axes

Axis	Eigenvalue	%
1	0.0025063	72.5
2	0.0009508	27.5

Table 12. CCA eigenvalue permutation of habitat physicochemical parameters explained in the first two axes

Axis	Eigenvalue	P
1	0.01481	0.525
2	0.002657	0.451

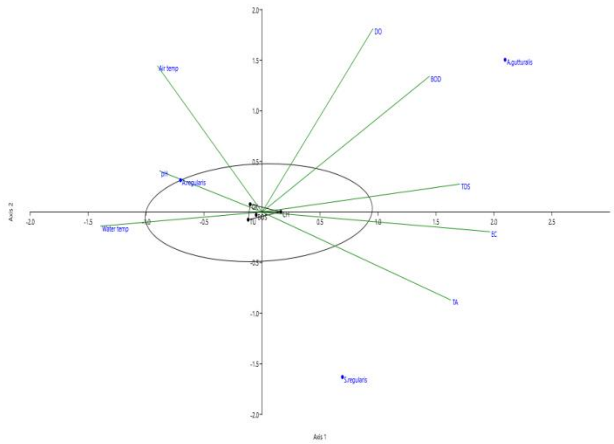

Figure 3. Triplot of CCA showing sampling sites, species and habitat variables

There has always been a noticeable change in the anuran population between the rainy and dry seasons. Many authors (Duellman, 1995; Vonesh, 2001; Onadeko *et al.*, 2013; Onadeko, 2015) have stated this fact due to the existence of available water during the wet season, which favours the species' prospering conditions. Apart from the reproductive potentials brought about by the wet season, it was discovered in this study that species developed temporal niches that aided in the acquisition of additional food. As a result, the number of anurans rose in regions where they were previously absent during the dry season.

This study gives a toad inventory in Minna, with three (3) toad species. This variety appears to be less than in other parts of Nigeria. For example, anuran species richness has been observed in south-western Nigeria (7 species of Bufonidae; Onadeko & Rödel, 2009), and forest areas of the Ikpan wetland (6 species; Eniang & Luiselli, 2002), but similar to the forest swamp areas of the River Niger Delta (3 species; Akani *et al.*, 2004)

Toad species distribution and diversity are heavily influenced by the type and preferences of their habitats (Jongsma Gregory *et al.*, 2014; Onadeko, 2016), as well as many environmental factors associated with habitat structure that are important for toad diversity and abundance (Pearman, 1997; Abeje *et al.*, 2023). Among the factors for variance in species diversity include habitat and environmental heterogeneity (Gouveia *et al.*, 2015, Silva *et al.*, 2011, Tomé, 2011). The variety of Chanchaga toads (Shannon-Wiener (H) and Simpson (D) was much greater than that of Gidan-kwano, Bosso, and Tunga.

The greater variability in resources for foraging, reproduction, and predator cover seen in chanchaga habitats during our investigation was most likely owing to greater variability in resources for foraging, reproduction, and predator cover, all of which influence toad habitat choices (Dodd, 2010; Abeje *et al.*, 2023). Overgrazing, agricultural expansion, and water draining, on the other hand, are destroying this habitat and endangering the existence of these toad species (Abeje *et al.*, 2023). Because toad species have a low taxonomic turnover, habitat protection and conservation are crucial. The majority of the community in the study region relies on agriculture.

The onset and duration of toad reproductive seasons are directly impacted by climatic conditions (Giaretta, 2004; Abeje *et a*l., 2023). The majority of toad species reproduce during the rainy season in tropical places with seasonal climates (Nneji *et al.*, 2019). Rainfall has a substantial impact on the diversity and abundance of toads and frog species in tropical forests with clearly defined wet and dry seasons (Vonesh, 2001; Abeje *et al.*, 2023). This is also true for the current study region in terms of toad species diversity and abundance.

Toad distribution and abundance are also influenced by abiotic factors such as BOD, precipitation, temperature, and altitude. These factors, which can be beneficial or negative, have been carefully studied (Blaustein *et al.*, 2010; Abeje *et al.*, 2023). As a result, various levels of components cause varied responses in different species (Wanger *et al.*, 2009; Sirami *et al.*, 2010; Cortés-Gómez *et al.*, 2013; Abeje *et al.*, 2023). The altitudinal gradient and weather, for example, play a role in this because as altitude increases, species assemblages are negatively affected by changes in temperature and habitat, resulting in fewer species successfully establishing populations outside their altitudinal range (Abeje *et al.,* 2023). It is worth noting that *A. regularis* seems to be unaffected by the influence of these habitat characteristics. Regions with the greatest influence from habitat variables must be given top conservation priority. These priority regions in Minna are all the study sites

Amphibians have an important role in ecological services, medical research, and as bioindicators, but their biodiversity is declining. The causes of the amphibian population decrease are various, and there does not appear to be a single cause (Blaustein *et al*., 2010), although the following factors are implicated:

Habitat loss

Habitat is the key to the survival of the species. Habitat loss poses a major threat to about 70% of the amphibians, as described by Baillie *et al*. (2004). Agricultural expansion, logging and mining operations as well as land occupied by people are frequently the cause of habitat loss. Over 90 % of Nigeria's forest land and savannah are gone as well (Onadeko & Rodel, 2009).

Environmental Pollution

Areas along the coast of Nigeria have been found to have a higher biodiversity of amphibians. The Niger Delta is a region notoriously polluted because of the booming oil industry. This type of pollution is expected to affect amphibians since their larvae feed upon algae and excrete water throughout the year that can be used for respiration. There is also a danger of contamination from agricultural farmlands to surface waters and neighbouring habitats for amphibians.

Global Climate Change

The global climate change, caused by the production of greenhouse gases, has many implications for amphibians' survival. These effects may have a direct or indirect effect. The temperature is a major factor in the life cycle of amphibians (Blaustein *et al*., 2010). In amphibians, temperature acts as a key control factor for numerous physical processes such as oxygen uptake, heart rate, locomotion, water balance, digestion, developmental stage, sex determination, and immune function.

Overharvesting

Both consumptive and non-consumptive uses have been made with anurans. Some ethnic communities in Nigeria consider certain frog species to be delicacies and edible. Dried, skinned toad meat and fresh frog meat have been proven to be beneficial in Nigeria for feeding poultry and catfish, either as whole fish meal or as raw materials for processed feed (Tran, 2015). In 1998, the value of the global frog leg trade was estimated to be USD 48.7 million (Teixeira *et al*., 2001). Frog exports are on the rise, and the rate at which edible anuran species are being eliminated from the wild is greater than their rate of reintroduction (Onadeko *et al.*, 2012). According to a study conducted by Mohneke *et al*. (2010), approximately 2,738,610 frogs were harvested each year. The majority of frogs that are traded are said to come from northern Nigeria and nearby nations like Benin, Niger, and Chad.

CONCLUSION

Information on the seasonal abundance of the Minna toad community is provided by this study. Additionally, it shows that in the four sampling sites, three (3) species of toads from one family and two genera were found. Species of toads found at the sampling locations were *Amietophrynus gutturalis, Sclerophrynus regularis, and Amietophrynus regularis*. The study's findings imply that species richness was discovered to be constant (3) across all sample locations. The variables of the habitat had a good influence on the species (*A. gutturalis and S. regularis*). *A. regularis* appeared to be unaffected by the variables in the habitat. To preserve a high species richness of amphibians, a wide variety of habitats need to be studied and preserved. Our findings suggest that a variety of habitat types may be essential for sustaining the populations of various toad species. This implies that while creating management zones, these habitat types as well as maybe others should be taken into account. The present work aims to motivate conservationists to investigate the ecological patterns of amphibian communities across geographic regions by offering relevant and helpful information to guide conservation and management efforts. We advise implementing conservation interventions in different environments to preserve toad populations and provide a suitable home for Minna's indigenous toad species.

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