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ABUNDANCE, DISTRIBUTION AND DIVERSITY OF REPTILES IN NNAMDI AZIKIWE UNIVERSITY, ANAMBRA STATE, NIGERIA

Adeyemi Muhammed Adewole
ma.adeyemi@unizik.edu.com

Ilo Chiamaka Jennifer
jenniferjuan099@gmail.com

Nnamdi Azikiwe University Awka, Anambra State

Abstract

This study investigates the abundance, distribution, and diversity of reptile species in Nnamdi Azikiwe University, Awka, Nigeria, with a focus on three main habitats: woodland, wetland, and forest. A total of 124 reptiles from 6 families, 9 genera, and 11 species were recorded, with Agama agama being the most abundant. Data collection methods included pitfall and wire mesh traps, active searches, and road surveys. Species richness was highest in the forest habitat (9 species), followed by the woodland (6 species) and wetland (5 species). Reptile diversity was measured using the Shannon-Wiener index, yielding a low value of 1.53, indicating low diversity. The study also highlighted the impact of anthropogenic activities, such as habitat disturbance, on reptile populations. Results showed that the woodland habitat supported the highest reptile abundance, likely due to resource availability. In contrast, the forest habitat exhibited greater species diversity, possibly due to better food and breeding sites. The findings suggest that climatic conditions, seasonality, and human activities significantly influence reptile distribution and abundance. To improve conservation efforts, the study recommends comprehensive surveys, the use of GIS for monitoring, and the implementation of conservation awareness programs to mitigate human impact on reptile populations. The establishment of protected areas within the university is also proposed to safeguard reptile habitats.

Keywords: Abundance, Distribution, Diversity and Reptiles

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Introduction

Nigeria Most scientists believe that life on Earth is now faced with most severe extinction episode (Eldredge, 2009). No one knows exactly how many species are being lost because no one knows exactly how many species exist on Earth. Estimate varies but the most widely accepted figure lies between 10 and 13 million species, of these biologist estimate that as many as 27,000 species are becoming extinct every year. This translates into loss of 3species every hour (Eldredge, 2009). Species diversity of a community is a function not only of the rate of addition of species through evolution but also of the rate of loss of species through extinction or emigration (Charles, 1994). Compare with polar communities, the tropics could have a more rapid rate of evolution and a lower rate of extinction, and these two rates act together to determine species diversity. Knowledge of the history of diversity through geological time is based on analyses of the fossil records (Kim and Weaver, 1994). It is generally accepted that the fossil record can give a reasonable insight into past diversity in terms of taxonomic richness particularly at higher taxonomic levels. Since the living world is most widely considered in terms of species, biodiversity is very commonly used as a synonym of species diversity. The species level is generally regarded as the most natural one at which to consider whole organism diversity. Species are also the primary focus of evolutionary mechanisms and the origination and extinction of species are the principal agents in governing biological diversity in most senses. Every species occupies a specific niche with a specific set of habitat requirements and has a definite range of distribution. Each species has definite and specific roes to play in sustaining the dynamics of ecosystem processes as producers, consumers, decomposers, parasites and predators (Olembo, 1991).

Reptiles are known to be among the most successful vertebrates in terms of diversity, distribution and abundance as they occupy and live in a great variety of aquatic and terrestrial habitats. Reptiles are poikilothermic vertebrates possessing a dry and scaly skin on their body, a common characteristic that differentiates them from amphibians. Based on the patterns of opening in the skull roof behind the orbits, they are classified into four groups, these are anapsid, eurapsid, synapsid and diapsid. All living reptiles are diapsid except turtles and tortoises. Reptiles are known to be among the most successful vertebrates in terms of diversity, distribution and abundance as they occupy and live in a great variety of aquatic and terrestrial habitats. The world contains approximately 8,000 living species of reptiles known to man, there are grouped in 900 genera and in 48 families the global known reptile diversity stands at around 440 species. The Squamata (lizards, snakes and worm lizard/amphisbaenas) 95% of all the living reptiles of which turtles, crocodiles and represent only 41%. Among the three groups (lizards, snakes and worm lizard), lizards are the most diversified and successful group as they are well adapted for walking, running, climbing swimming burrowing the most populous country in Africa, has diverse including rainforest, coastal plains, mangroves, vast and climatic conditions all of which accounts for Nigeria's wide biodiversity of flora and fauna. It is believed that as a result anthropogenic activities such as urbanization, there is surmounting evidence that the abundance and diversity of reptiles are declining worldwide and also reductions of functional diversity of reptile species. It is estimated that approximately 20% of the world's reptiles are threatened with extinction. Reptiles

are now categorized as threatened group due to dramatic decline in population both at local and global level. They are currently facing extinction risks in future due to habitat loss and fragmentation, landscape modification, vanishing of natural ecosystem, global warming and climate changes, pressure of parasitism and other disease and invasion of floral and faunal species, unsustainable use and illegal trading in poaching market. Habitat loss and degradation is one of the greatest threats to reptile populations and occurs from a variety of sources, including urban/suburban development, aquatic habitat alteration from water withdrawals and stream diversions, water pollution, and off-road vehicle use in terrestrial habitats. 1994). The knowledge of diversity and distribution of Reptile in Nnamdi Azikiwe University is not yet fully documented. Lack of knowledge of available animal species and information of their population status will always limits their effective management. Therefore, this first study was aimed at investigating and providing information on the abundance, diversity and distribution status of reptiles in a rapidly changing environment of Nnamdi Azikiwe University Permanent Site, Awka, Anambra State. However, the specific objectives are to: determine the type of reptiles found in Nnamdi Azikiwe University, determine the distribution and abundance of reptile in Nnamdi Azikiwe University, look into the effect of human activities on the reptile species of Nnamdi Azikiwe University.

Review of Related Literature

Abundance and Distribution of Reptiles

The study of reptile abundance and distribution has gained increasing attention in recent years, as reptiles play vital roles in maintaining ecological balance and biodiversity. Recent research has explored how various factors, including habitat changes, climate variability, and anthropogenic pressures, influence reptile populations and their geographical distributions. According to Todd et al. (2020), habitat fragmentation and land-use changes have significantly impacted reptile abundance, particularly in regions undergoing rapid urbanization. These changes often result in the loss of critical habitats and migration corridors, leading to population declines. Furthermore, studies highlight the adaptive capabilities of certain species, such as urban-dwelling geckos, which thrive in fragmented environments, underscoring the complex dynamics of reptile distribution in modified landscapes. Climate change has also emerged as a critical driver of reptile distribution shifts. Huey et al. (2021) note that rising temperatures and altered precipitation patterns disrupt thermal niches crucial for reptile thermoregulation, impacting reproductive success and survival rates. For example, temperature-sensitive species like sea turtles face challenges in maintaining balanced sex ratios due to warming incubation environments. Such changes have profound implications for population stability and distribution trends. Community-driven conservation efforts also play a pivotal role in protecting reptiles and their habitats. Efforts to involve local communities in monitoring and conservation initiatives have yielded positive results, particularly in biodiversity hotspots. For example, Scheffers et al. (2022) report increased awareness and conservation actions in Southeast Asia following educational programs targeting habitat protection and sustainable land use practices.

Diversity of Reptiles

The diversity of reptiles, encompassing over 11,000 known species, is integral to ecosystem stability and functionality. Recent studies have delved into the drivers and threats to reptile diversity, highlighting the need for targeted conservation efforts in light of habitat degradation, climate change, and anthropogenic pressures. According to Böhm et al. (2021), habitat heterogeneity plays a critical role in sustaining reptile diversity. Regions with a wide range of microhabitats, such as tropical forests and arid zones, are often hotspots for reptilian biodiversity. These ecosystems provide niches that support a variety of species with distinct ecological requirements. Conversely, habitat fragmentation due to urbanization and agricultural expansion has led to localized extinctions and declines in species richness. Climate change further exacerbates threats to reptile diversity. Sinervo et al. (2021) document how warming temperatures and shifting precipitation patterns have altered habitat suitability for many species. For example, lizards with specific thermal requirements are particularly vulnerable, as they may be unable to migrate to cooler regions due to habitat barriers or limited dispersal capabilities. This underscores the need for climate-resilient conservation strategies. Invasive species also pose significant challenges to reptile diversity. Studies by Monzón-Argüello et al. (2022) reveal how introduced predators, such as cats and snakes, have led to declines in native populations, especially on islands where reptiles are highly endemic. Invasive species not only prey on reptiles but also compete for resources, further endangering native populations. Technological advancements have transformed the study of reptile diversity. Environmental DNA (eDNA) and GIS mapping have emerged as powerful tools for monitoring and analyzing species distributions. According to Karraker et al. (2023), these methods enhance our ability to detect rare or cryptic species, enabling more effective biodiversity assessments. Furthermore, community-based conservation initiatives have proven successful in regions such as Southeast Asia, where localized efforts have bolstered reptile conservation and habitat restoration (Scheffers et al., 2022).

Theoretical Framework

The Species-Area Relationship (SAR)

The Species-Area Relationship (SAR) theory was first introduced by the British naturalist Robert MacArthur and the American ecologist Edward O. Wilson in 1963. They developed the theory as part of their work on island biogeography, which seeks to understand the factors influencing the number of species on islands based on their area and isolation. Their book, The Theory of Island Biogeography (1967), formalized the theory. According to the SAR theory, the number of species in a given area tends to increase with the area, but the relationship is logarithmic, meaning that larger areas support more species, though the increase in species numbers slows down as the area grows. This principle has been widely applied to various ecosystems, including terrestrial habitats, and can be useful in studying biodiversity in areas like Nnamdi Azikiwe University, Anambra State, Nigeria. By examining the distribution and diversity of reptiles in

different habitats within the university, the SAR model could help explain how the size and variety of habitats influence reptile populations.

Empirical Reviews

Schwarz, R., Stark, G., & Meiri, S. (2019). Studied how diversity and abundance patterns have changed in Oren stream (Carmel Mountains, Israel) during the last 25 years. We tested whether temperature and habitat preferences of reptiles affected observation frequencies, to assess potential effects of global warming on the reptiles. We compared the results of a 1993-1994 survey in Oren stream to a survey we conducted during 2017-2018, using similar methods, survey area and effort. Species composition and abundance in Oren stream did not significantly change between studies, but the proportion of observations differed significantly across slopes for four out of the six most abundant species. The number of observations increased monotonically with increasing temperatures on the south facing slope, but decreased on the north-facing slope above a temperature of 22°C. The major biome species inhabit globally was unrelated to the number of observations across slopes or studies, but species inhabiting warmer ranges were more frequently observed in the current survey. Our results suggest that as global temperatures rise, reptile species which can tolerate higher temperatures, and those which can avoid the hottest temperatures of the day, may be able to cope better. These results however may also derive from better detection ability of some species over others between study teams.

Kypraios-Skrekas, V., Lazaris, A., Koutrouditsou, L.K., Sotiropoulos, K., & Giokas, S. (2024) investigate patterns of abundance and diversity among reptiles and amphibians within the protected area of Mount Chelmos, located in Peloponnese, Greece. Our aim was to examine the drivers influencing abundance (for lizards, snakes, chelonians, anurans, urodels) and diversity (for reptiles and amphibians) within the finely-scaled study area and identify biodiversity hotspots. Land cover significantly impacted the abundance and diversity of all studied groups. Elevation had a significant impact on the abundance of snakes, chelonians, and anurans, as well as on reptile and amphibian diversity. Climate influenced all groups except chelonians. Slope significantly impacted anuran abundance and amphibian diversity. Aspect primarily influenced the abundance of lizards, anurans, and urodels, as well as reptile diversity. We have also identified abundance and diversity hotspots, emphasizing the importance of conservation and management efforts. In reptiles, abundance hotspots were predicted in the west, east, and south of the mountainous massif, whereas amphibian abundance hotspots were mapped to the west and east-southeast of the massif. Regarding diversity, the patterns were similar for both reptiles and amphibians, with hotspots emerging in the west, south, and southeast boundaries of the study area, and a few spots north of the mountainous region. Notably, many of these hotspots coincided with areas susceptible to human exploitation and vehicular transit.

Methodology

The data collection methods that was used to survey the diversity, abundance and distribution of reptiles in Nnamdi Azikiwe university follows the standard methods proposed by Branch (1988); and Howell (2004).The methods included traps (pitfall and wire mesh traps), active search and

visual survey, and road survey was used to supplement data collected from the field to prepare a checklist of reptiles of the area. Active search was undertaken randomly in sites away from the transect lines and it involved turning over logs, leaf litter, tree holes, rocks, and other potential hideout searching for reptiles. Active search and visual survey was undertaken daily. Road surveys were conducted day and evening before sunset to collect data of live or dead reptiles on roads. The study area was stratified into 3 zones: zone 1, zone 2, and zone 3. Zone 1 was along science village (woodland), zone 2 was around Vc gate (wet land) and zone 3 wall from Nnamdi Azikiwe university primary school to Emelda hostel. Materials that was used for this study include; Field note and record book, field guide book on reptile, pencil, bush beating stick, measuring tape, cutlass, boot, and field bag. Primary data collected from the field through traps (pitfall and wire mesh), active search, and road surveys were used for statistical analysis (diversity, abundance and distribution) of reptile of University. Estimation of species abundance, diversity and distribution in the three zones will be known using; descriptive statistics of frequency, table, bar chart and Percentages

Abundance of species: Reptile abundance was calculated on seasonal basis in the study area using the formula $A = \frac{n}{N} x100$

Where
A=abundance expressed as a percentage of N
n=quantity/frequency of a particular species
N=total quantity of species encountered

Descriptive statistic was used to analyze abundance mean value for the resource in the study area in relation to location and season.

Distribution of species: Variation in species distribution within different ecological site was considered necessary in order to determine the species level of availability in relation to location and season in the study area.

Diversity of species
The diversity of species will be determined using Shannon-Wiener diversity index (H')
H' is the index of species diversity,
Σ is number of reptile,
RA is the proportion of the total sample belonging to the i-th species and InRA natural logarithm.

Data Analysis
4.1 RESULT

Composition of reptiles in Nnamdi Azikiwe University Awka.

A total of 124 reptiles which spread across 6 families *(Agamidae, Varanidea, Scincidae, Viperidae, eublepharidae and pythonidae), 9* genera *(Agama, varanus, plestioden, mabuya, Trachylepis, Dendroaspis, Afronatrix, Hemithelonyx and Python),* 11 species was recorded in this

study (Table 1). Among the genera observed, *Agama agama* was the most abundant with frequency of 49 followed by *Agama artra gravids* shown in (figure 1) with frequency of 43, then *Trachylepis strata* with frequency of 11, etc.



Plate I: Picture of *Agama agama and Agama artra gravids taken during the study.*

The general number of reptile observed in the three zones during the first week were 60 *Agama agama*, 55 *Agama artra gravids, 1 varanus varius*, 12 *Trachylepis strata* and 1 *plestiodon skiltonorus* as shown in (table). In the second week, 48 *Agama agama, 58 Agama artra gravids, 1 Varanus exanthemaied, 2 Pythonregicide* and 10 *plestiodonskiltonorus* were observed as shown in (table). In the third week I observed 54 *Agama* agama species, 56 *Agama artragravids*, 14 Plestiodon skiltonorus, 10 Trachylepis strata, 1 *Mabuyamacular, and* 4 *Dendroaspis viridis* shown in (table). In week four I observed 34 *Agama agama species*, 4 Agama artragravids, 1 *Hemithenolypx caudicine, 1 Afronatax anoscopus* and 1 *Dendroaspis varius* as shown in (table).

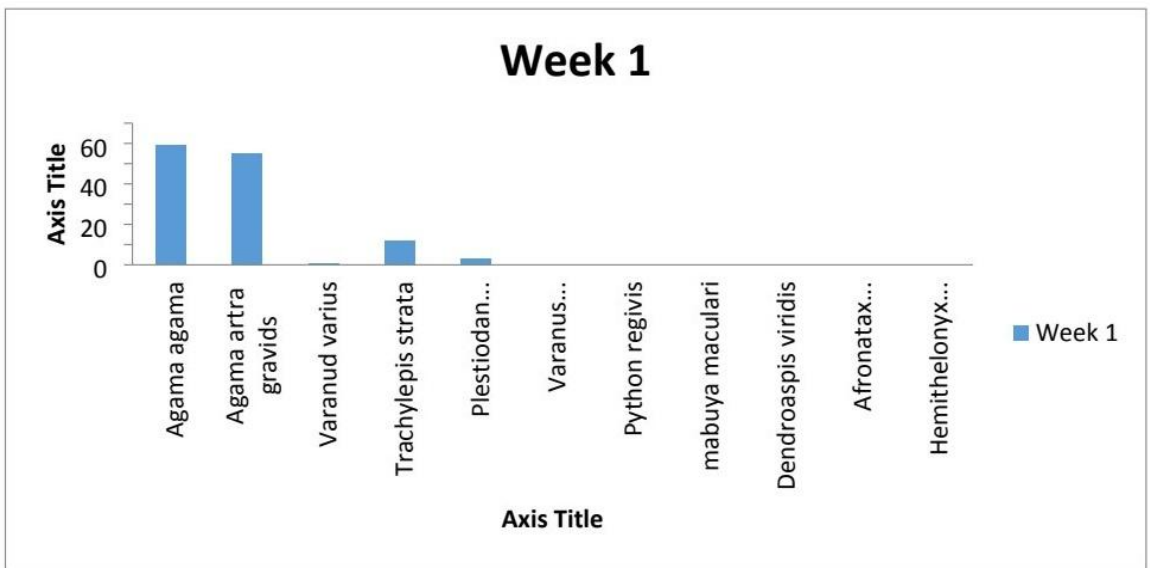

Figure 1: Data collected in week one

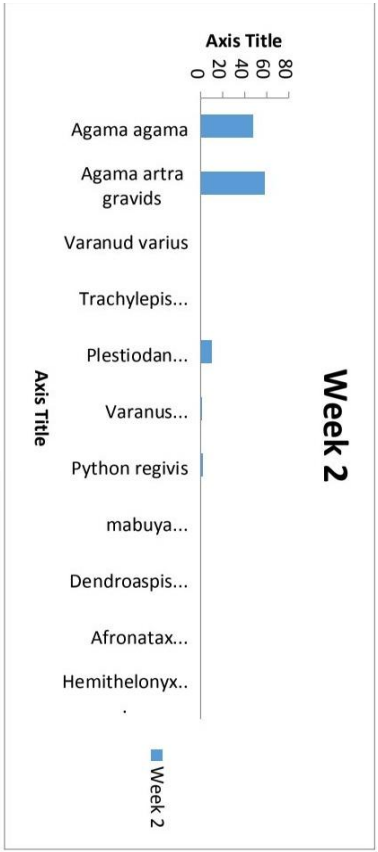

Figure 2: Data collected in week two.

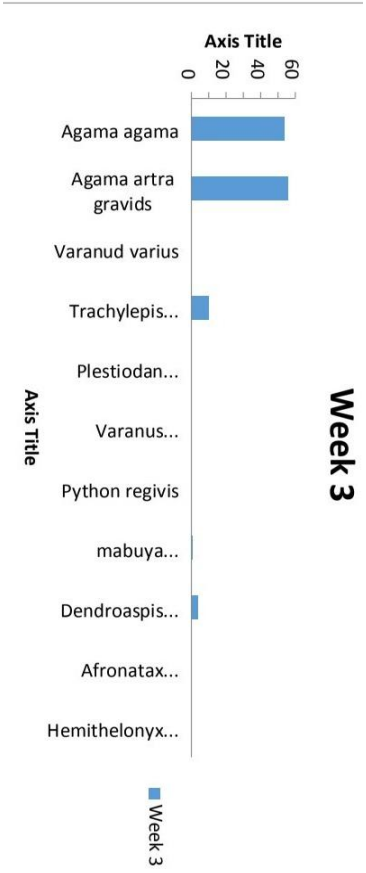

Figure 3: Data collected in third week

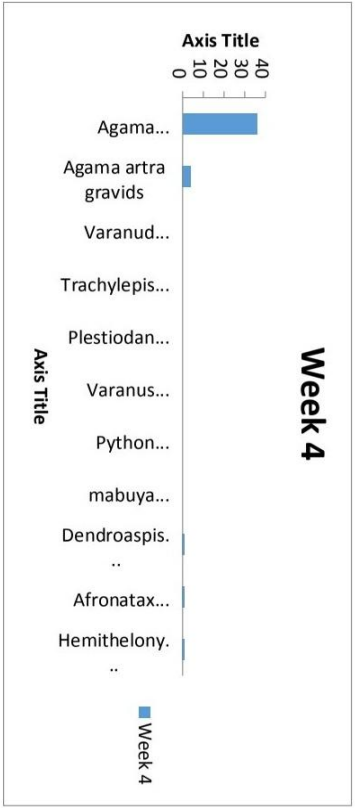

Figure 4: Data collected in fourth week

4.1.1 Abundance of reptile in Nnamdi Azikiwe University Awka

Among the genera observed, *Agama agama* was the most abundant with frequency of 49 followed by *Agama artragravids* with frequency of 43 then *Trachylepis strata* with frequency of 1l, etc, the least abundant was the *Mabinya macular* I, the *Hemithelonyx caudianatus* and the *Afronatax anoscapus* and shown in (table). The forest region had the highest number of species followed by the woodland and then the wetland. Species richness is more in the forested area because it is less disturbed.

4.1.2 Distribution of reptile in Nnamdi Azikiwe University Awka (Table)

S/N	Species	Common name	Family	Frequency	Relative Abundance	Ln(RA)	Shannon (H)
1	Afronatax anoscapus	African brown water snake	Viperidae	1	0.0081	-4.8204	0.0389
2	Agama agama	Red head agama	Agamidae	49	0.3952	-0.9285	0.3669
3	Agamaartra gravids	Female agama	Agamidea	43	0.3468	-1.0591	0.3673
4	Dendroaspis viridis	Green mamba	Viperidae	7	0.0565	-2.8744	0.1623
5	Hemithelonyx caudicine	African fat tailed gecko	Eublepharidae	1	0.0081	-4.8203	0.089
6	Mabuya maculari	Bronze grass skin	Scincidae	1	0.0081	-4.8203	0.089
7	Plestiodon skiltonorus	Western skin	Scincidae	7	0.0565	-2.8744	0.1623
8	Python regivis	Ball Python	Pythonidae	2	0.0161	-4.1271	0.0666
9	Trachylepis strata	Striped skink	Scincidae	11	0.0887	-2.4224	0.2149
10	Varanus varius	Lace monitor	Varanidae	1	0.0081	-4.8203	0.0389
11	Varanus exanthematicus	Savanna monitor	Varanidae	1	0.0081	-4.8203	0.0389
12	TOTAL			124	1		1.53

The woodland habitat had the highest number of reptiles with frequency of 56 followed by wetland with frequency of 43 then forest with frequency 24. The species that was present in all the three habitat types was *Agama agama* followed by *Agama artra gravids* followed by *Trachylepid strata* and then *Plestiodon skiltonorus* in 3 habitats then Two of Varanus species

and *Hemithelonyx caudicinen* were only seen in the forest habitat, the *Mabuya maculari* was only seen in the woodland, the *Afronatax annoscapus* was only seen in the wet land, the *Dendroaspis viridis* was seen in the wood land and forest habitat

Distribution of reptile species in Nnamdi Azikiwe University Awka.

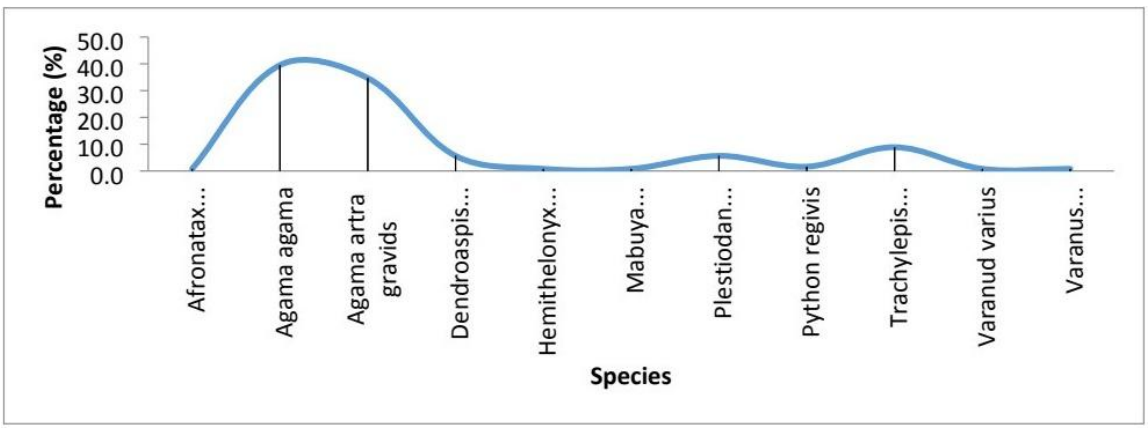

Figure 5: Graph showing the distribution of reptile species in Nnamdi Azikiwe University

Table 2. Distribution of reptile in the three Zones

NAME OF SPECIES	COMMON NAME	ZONE 1 (WOODLAND))	ZONE 2 (WETLAND)	ZONE 3 (FOREST)
Agama agama	red-headed agama	24	19	7
Agama artra gravids	female agama	22	14	8
Varanud varius	Lace monitor	0	0	1
Trachylepis strata	Trachyepis	4	5	3
Plestiodan skiltonorus	gecko stern skink	3	5	1
Varanus exanthemaied	savanna monitor	0	0	1
Python regivis	python	0	0	2
mabuya maculari	Bronze grass skink	1	0	0
Dendroaspis viridis	Green mamba	3	0	1
Afronatax anoscopus	African brown water snake	0	1	0
Hemithelonyx caudicinc	African long tailed	0	0	1
frequency of Species		56	43	24
Number of Species		6	5	9

4.1.3 Diversity of reptile in Nnamdi Azikiwe University Awka

The overall reptile's diversity level in Nnamdi Azikiwe University Awka was low (H'=1.53) as shown in (Table 3). The forest was the most diversified habitat with the highest number of species followed by the woodland habitat then wetland. Species richness was dominant in forest habitat (9 species) followed by woodland habitat (6species) then wetland habitat (5 species) Shown in (table 2).

Diversity Indices of the study area

Diversity Indices	Values
Families	6
Species	11
Genera	9
Frequency	124
Shannon-Wiener's diversity index (H')	1.53

Discussion of Findings

This study on the abundance, distribution and diversity of reptiles in Nnamdi Azikiwe University Awka clearly reveals a relatively low abundance and less diversity of reptile species is of conservation concern. This may be attributed to high human presence and anthropogenic activities taking place in the area. This is in agreement with previous literatures where habitat disturbance due to anthropogenic activities has been implicated as the cause of species decline in abundance and diversity as well as their distribution and eventual loss of reptile species. Also, the period (season) of the survey was a transition moment from the peak of late dry season (March). It should be noted that as data was collected during the end of the dry season there was a high average temperature of and a reduction in vegetation cover. This would be expected to cause a reduction of food sources and an expected shift to the use of more shady habitats. In agreement with the findings of Dickinson et al (2001), April possibly accounts for the low reptiles' composition. Climatic variables are one of the most important drivers of reptile distribution around the world. Furthermore, environmental conditions as well as the technique used could be other factors responsible for the low record obtained. Similarly, Kafash et al. (n.d) documented that ecological factors play important role in species richness of reptiles in an environment. The low number of reptiles recorded in this study contradicts the finding of Razzetti and Msuya (n.d) who reported that reptiles' abundance and activity pattern increase in early rain as they respond to the abundance of their food.

Summary of findings

The dominance of reptiles in the woodland habitat may probably be due to the availability of resources required for their breeding success and escape from predators. The presence of micro habitat such as foliage, tree trunks, branches, stone, open ground and termites' mounds probably are the factors which favoured high abundance of reptiles in woodland habitat. This conforms to the study by Michael and Lindenmayer (n.d) who reported that macrotermes and

ondontotermes, mounds provide den for reptiles. Our finding disagrees with the report of Musah et al. who documented more abundance of reptile species in grassland area of a changing coastal wetland in Ghana. *Agama agama, Agama artragravids* and *Trachylepis* strata was the most distributed among the 11 species *recorded. puthinidae* population was very high in forest habitat which was seemingly "a protected/safer zone" in the study area. The low distribution of the snake's n this study may possibly be due to their threat to humans. The very low diversity level (H'=1.53) of reptiles in the area may be due to very few species richness and unequal evenness recorded. The high diversity level of reptiles in the forest habitat may be as a result of sufficient resources such as food and breeding sites.

Conclusion

The population of reptiles in this study was minimal and diversity was quite low. *Agama agama* was the predominant reptile in the area and was found in all the three habitat types surveyed. The woodland habitat had the highest abundance of reptiles over other habitats. While the forest habitat has the highest diversity of reptile over other habitats that is, species richness was dominant in forest habitat. Due to anthropogenic activities in the area, the period the survey was carried out, environmental condition and as well as the type of technique used could be the factors responsible for the low record obtained. Hence, there should be a proactive approach towards the protection of reptiles in the Nnamdi Azikiwe University Awka so as to meaningfully contribute to ex-situ conservation efforts.

Recommendations

1. Conduct a comprehensive inventory of reptile species through systematic surveys and field studies across various habitats within the university. This will help in identifying the diversity of reptile species present and provide a baseline for future research and conservation efforts. A focus should be given to both common and rare species to assess their conservation status.
2. Use Geographic Information System (GIS) mapping and population monitoring techniques to track the distribution and abundance of reptile species across different habitats. This will help identify critical habitats and areas of high species richness. Furthermore, creating reptile population models can aid in understanding trends and predicting future population dynamics.
3. Implement a conservation awareness program targeting students, staff, and the surrounding community, emphasizing the impact of human activities (such as habitat destruction, pollution, and illegal collection) on reptile populations. Additionally, the university could establish protected areas or buffer zones to mitigate the negative effects of human activities on sensitive reptile habitats.

References

Böhm, M., Williams, R., & Bramhall, H.R. (2021). Habitat heterogeneity and reptilian biodiversity: Insights from global assessments. Biological Conservation, 261, 109-234.

Charles, A. (1994). Conservation of biodiversity: Principles and practice. Cambridge University Press.

Eldredge, N.(2009).Evolution and the fossil record: A guide to the evolutionary history of life. Oxford University Press.

Huey, R.B., Kearney, M. R., & Krockenberger, A. (2021). Climate warming and the thermal ecology of reptiles: Impacts on populations and distributions. Biological Conservation, 255,109007.

Karraker,N.E., Dudgeon, D., & Leung, L. M. (2023). Advances in environmental DNA applications for monitoring reptile populations. Journal of Applied Ecology, 60(3), 518-532.

Kim, Y., & Weaver, L. (1994). The ecology of urban habitats: Human impact on species distribution. Springer Science & Business Media.

Kypraios-Skrekas, V., Lazaris, A., Koutrouditsou, L. K., Sotiropoulos, K., & Giokas, S. (2024). Patterns and drivers of abundance and diversity of reptiles and amphibians in the protected area of Mount Chelmos.Amphibia-Reptilia,45(4),383-397.

Monzón-Argüello, C., Ferreira, J.B., & Martins, T.(2022). Invasive species and their impact on reptile populations: A global perspective. Global Ecology and Conservation, 34, e02034.

Olembo, N.K. (1991). Environmental education in Africa: A framework for action. Nairobi: Kenya Literature Bureau.

Scheffers, B.R., et al.(2022).Community-driven conservation: Lessons from Southeast Asia. Frontiers in Conservation Science, 3,885765.

Schwarz, R., Stark, G., & Meiri, S. (2019). A shift in reptile diversity and abundance over the last 25*years.Israel Journal of Ecology and Evolution*, 65(1-2), 10-20.

Sinervo,B., Méndez-De-La-Cruz, F., & Miles, D.B. (2021).Climate change impacts on lizard diversity and thermal niches. Science Advances, 7(23), eabc3660.

Todd, B. D., et al. (2020). Effects of urbanization on reptile abundance and distribution: Insights from long-term monitoring. Urban Ecosystems, 23(5), 953-965.