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Faunal Diversity and Natural Resource Management in the Steppe region of Tiaret, Northwest of Algeria

Nawel Ganaoui*[1], Souhila Chadli [2], Walid Dahmani[2], Maroua Ganaoui[3] Rifka Aissat [4] et Hayet Mahmoudi [4]

[1] Laboratory for Rural Economic Development, Ibn Khaldoun University, Tiaret, Algeria
[2] Laboratory of Agro-Biotechnology and Nutrition in Semi-arid Areas, Ibn Khaldoun University of Tiaret, Algeria.
[3] Laboratory of Epidemiological surveillance, health, production and reproduction, experimentation and cell therapy of domestic and wild animals, Faculty of Natural and Life Sciences, Chadli Bendjedid University, 36 000 El Tarf, Algeria.
[4] Department and Faculty of Nature and Life Sciences, University of Ibn Khaldoun, Tiaret, Algeria.

Email : nawel.ganaoui@univ-tiaret.dz

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Abstract

This study aims to assess the local fauna of the Tiaret region, evaluate species diversity, and highlight the impact of management practices on this biodiversity.The study was conducted in three distinct ecological stations: El M'haka, Frenda, and Djebilet Rosfa, which represent various steppe and semi-arid environments. The analysis identified a total of 202 animal species, distributed across four major classes: 127 birds, 36 mammals, 32 reptiles, and 7 amphibians. The results reveal a high diversity, with a significant presence of protected species, such as *Aquila chrysaetos* and *Testudo graeca*, as well as North African endemics like *Bufotes boulengeri* and *Sclerophrys mauritanica*. The Frenda station stands out particularly, with remarkable species richness and hosting several rare and vulnerable species. The study also shows that protected areas, such as El M'haka, contribute to improving faunal diversity due to effective management and conservation measures. However, the region faces major threats, including desertification, habitat degradation, and pressures from unregulated agriculture and grazing. These challenges highlight the need for sustainable management and the protection of natural habitats to preserve the region's biodiversity.This study emphasizes the importance of conservation efforts to maintain the faunal diversity of the Tiaret region, particularly the preservation of sensitive habitats and the implementation of tailored strategies to mitigate anthropogenic pressures. The findings provide a solid foundation for improving natural resource management and ensuring the long-term sustainability of Algeria's steppe ecosystems.

Keywords: Fauna, Steppe, Biodiversity, Conservation, Protected Species.

Introduction

The steppe region of Algeria, located on the periphery of the Mediterranean domain, harbors a rich faunal biodiversity despite the arid and semi-arid climatic conditions. This region, primarily extending across the steppe zones and the High Plateaus, is an ecological crossroads where endemic species coexist with those adapted to semi-desert environments. It represents a crucial habitat for a wide variety of animals, including invertebrates, amphibians, reptiles, birds, and mammals (Benhadid et al., 2020). However, despite the ecological importance of this region, knowledge about the fauna of the Algerian steppe remains insufficient. Previous research, such as that of Benkhalifa (1991) and Guezoul and Doumandji (1995), mainly focused on invertebrates and certain vertebrate groups. These studies provided basic information on faunal diversity but remain limited. Moreover, studies on mammals and birds in this region are relatively scarce, with little focus on the interactions between species and their adaptation to steppe environments (Belkaid et al., 2020). The fauna of the steppe plays a critical role in maintaining ecological balance and in the functioning of local ecosystems. In fact, animal species contribute to regulating plant populations, pollination, seed dispersal, and soil dynamics (Ramade, 1989). The management of natural resources and the conservation of faunal biodiversity are therefore essential to prevent habitat degradation and combat phenomena such as desertification, which increasingly threaten steppe ecosystems (Chahbar et al., 2019). In light of these challenges, conservation efforts are urgently needed, particularly through the implementation of sustainable management strategies and the creation of natural reserves. This study proposes a comparative analysis of various aspects of the fauna in the steppe region of Tiaret, highlighting species diversity and the challenges related to their management. We will also examine the impact of human activities, such as agriculture and unregulated grazing, on local biodiversity and the conservation strategies in place to protect steppe habitats (Benkhalifa, 2022).The primary goal is to provide key information for integrated natural resource management in the region to preserve its faunal heritage for future generations.The objective of this study is to conduct an inventory of faunal diversity in three steppe zones of the Tiaret province. Using a comparative approach, this research aims to better understand the composition and evolution of animal communities in the region, while identifying rare and protected species. This study will thus help fill existing gaps in the knowledge of steppe fauna and guide the development of appropriate conservation strategies for this unique territory.

Materials and Methods

1. Study Areas and Selection of Stations

The study was conducted between September 2022 and June 2023 in three distinct stations located in the Tiaret region, northwest of Algeria. Each station was selected to represent a specific ecological environment within the region. (Fig. 1, Tab. 1)

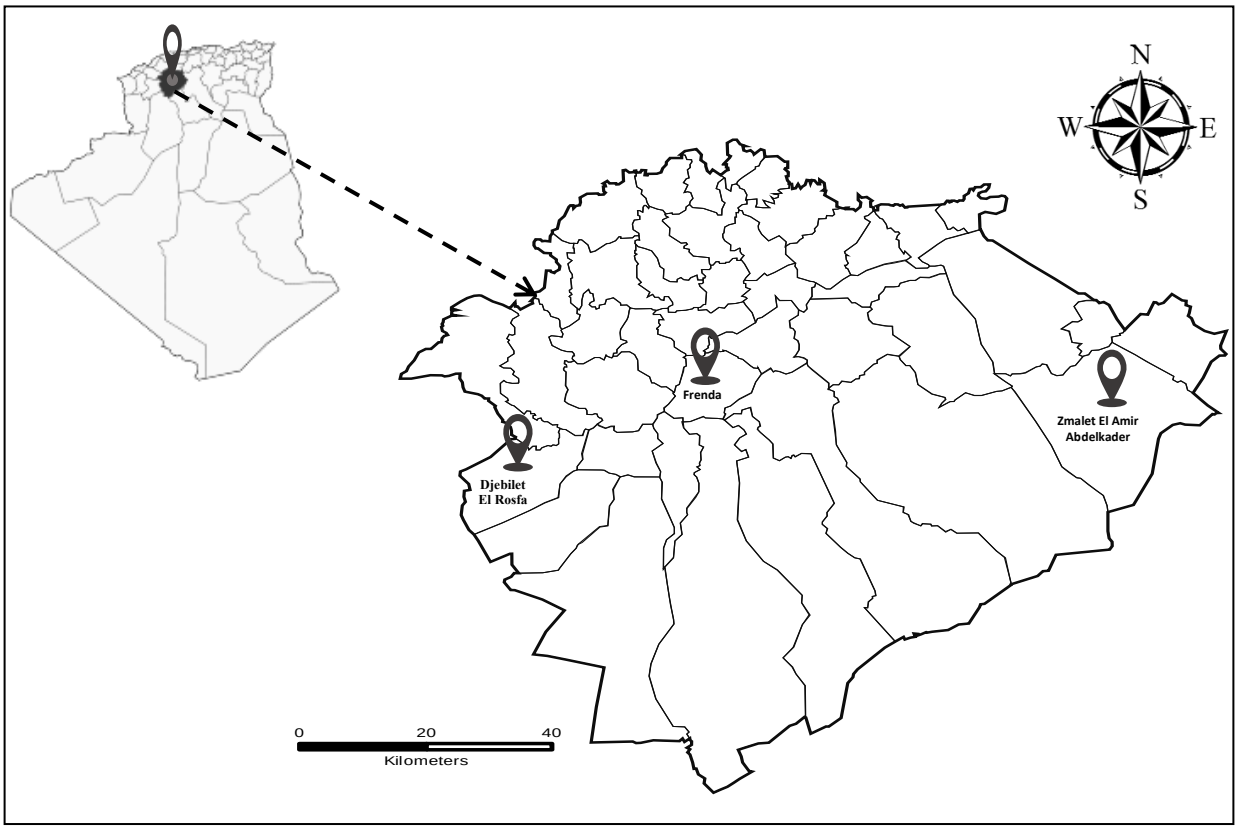

Fig.1 Geographical location of the study area

El M'haka Station "Zemalt Emir Abdelkader: This station is characterized by an arid climate, with low cereal yields and a predominance of sheep farming. It provides important insights into the relationship between climate conditions, agricultural productivity, and biodiversity conservation in a steppe environment.

Frenda Station " The Sdamas forest :This area is dotted with agricultural enclaves and plays a crucial role in biodiversity conservation. It is considered a key site for the preservation of various species, both protected and endemic, due to its relatively higher ecological stability compared to other regions in the area.

Djebilet Rosfa Station:This station exhibits a climatic and ecological contrast to the other two, with drier and less fertile conditions. This makes it an interesting site for studying biodiversity and the adaptability of species to harsher environments. The station's unique characteristics provide valuable data for understanding how wildlife thrives under more extreme conditions.

Tab. 1: Geographic coordinates of the study stations.

Station	*X*	*Y*	*Altitude*
El M'haka	002º 33' 2.4''	35º 04' 36.4''	788.5m
The Sdamas forest	1°01'28.412''	35°00'51.875''	985m
Djebilet Rosfa	1°01'13.679''	35°00'08.268''	715m

2. Faunal Study

The study of the fauna was carried out using several complementary methods. Direct field observations allowed for the identification and localization of the animal species present. Non-lethal traps were used to capture and study small mammals. Additionally, indirect indices such as footprints, droppings, and nests were collected to confirm species presence and assess their distribution across different habitats, following the methods recommended by Bang & Dahlström (1999), Olsen (2013), Quéré & Le Louarn (2011), Rolland et al. (2017), and Simonnet et al. (2019). For the inventory of amphibians and reptiles, sampling routes (transects), pit-fall traps, and systematic searches of refuge sites were employed, following the techniques outlined by Ramanamanjato and Rabibisoa (2002) and Rakotomalala and Raselimanana (2003). A spotting scope mounted on a tripod and a pair of binoculars were used for bird surveys.

3. Identification

The identification of species was carried out using the identification keys of Bons and Giron (1962), Fretey (1987), Salvador (1997) cited by Fahd (2001), as well as those of Schleich et al. (1996). For birds, identification was based on the guide by Svensson et al. (2014) covering species from Europe, North Africa, and the Middle East

4. Indices of Composition

To assess the faunal diversity of the region, indices of abundance and species richness were used. These indices help evaluate the variety and distribution of species within the different habitats of the Tiaret steppe.

Results

The faunal study allowed for the collection of 202 species, belonging to four major classes: 127 birds, 36 mammals, 32 reptiles, and 7 amphibians.

1.Birds

1.1. Richness by families across the study area

In the Frenda station, the highest species richness was recorded within the Accipitrida**e** and Muscicapidae families, each with 7 species, followed by the Fringillidae family with 6 species. In the Rosfa station, the Alaudidae family dominated with 5 species, followed by Muscicapidae (4 species) and Columbidae (3 species). In the Taguine station, species richness was lower, and no family stood out significantly. The bird families in this station were represented by a similar number of species, with no clear dominance (Fig. 2).

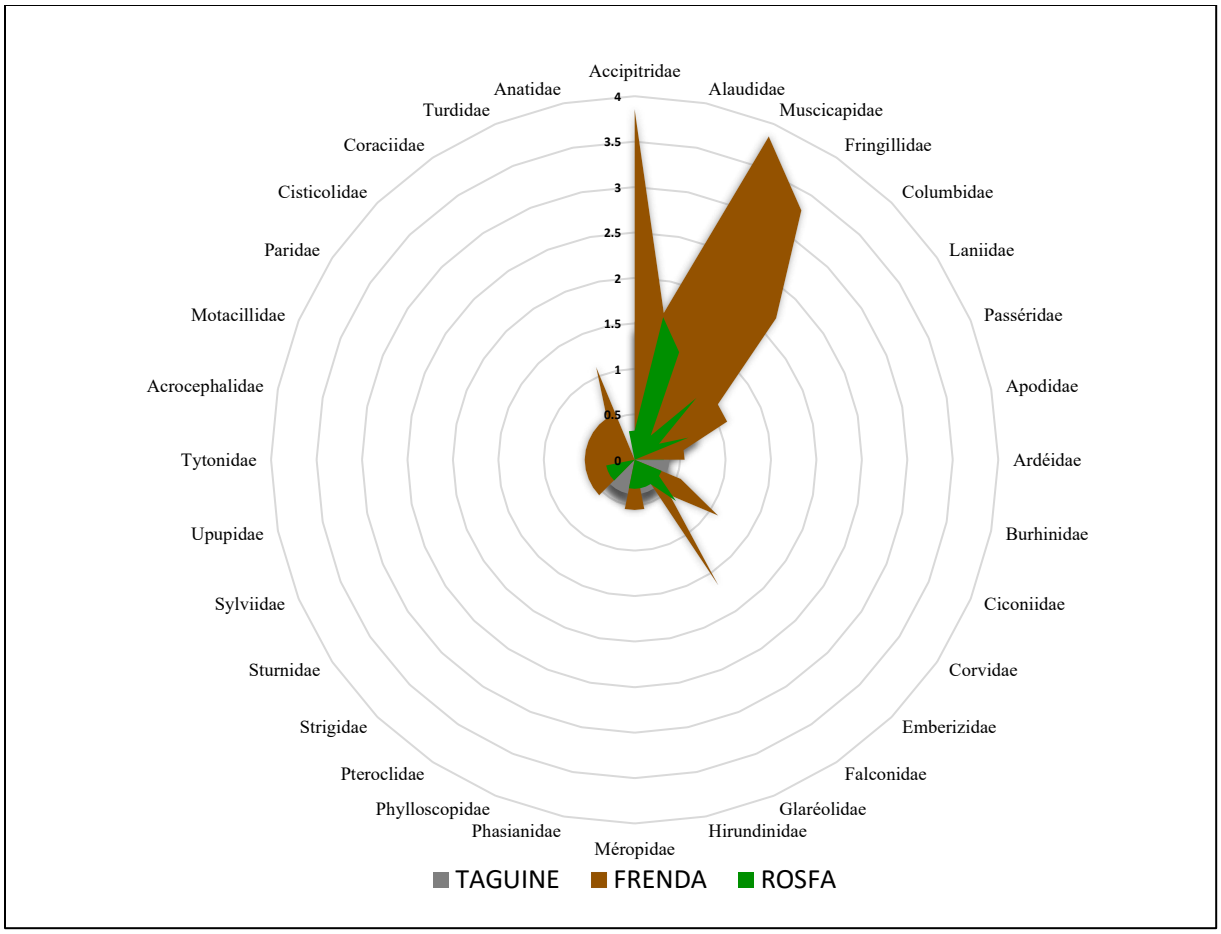

Fig. 2: Bird Families Across the Three Stations

1.2.Protected Bird Species

Birds represent the most diverse faunal class among the groups studied. Among the species recorded, a significant proportion are protected, including: *Milvus migrans* (Black Kite), *Hieraaetus pennatus* (Booted Eagle), *Buteo buteo* (Common Buzzard) and *Circaetus gallicus* (Short-toed Snake Eagle). In total, 34% of the bird species recorded across the three stations are protected (Fig. 3).

The Frenda station stands out with a particularly high number of protected species, hosting 23 protected species, accounting for over 50% of the bird species observed there. Taguine station ranks second, with 12 protected species out of 36 species recorded. Rosfa station houses 8 protected species (Fig. 4).

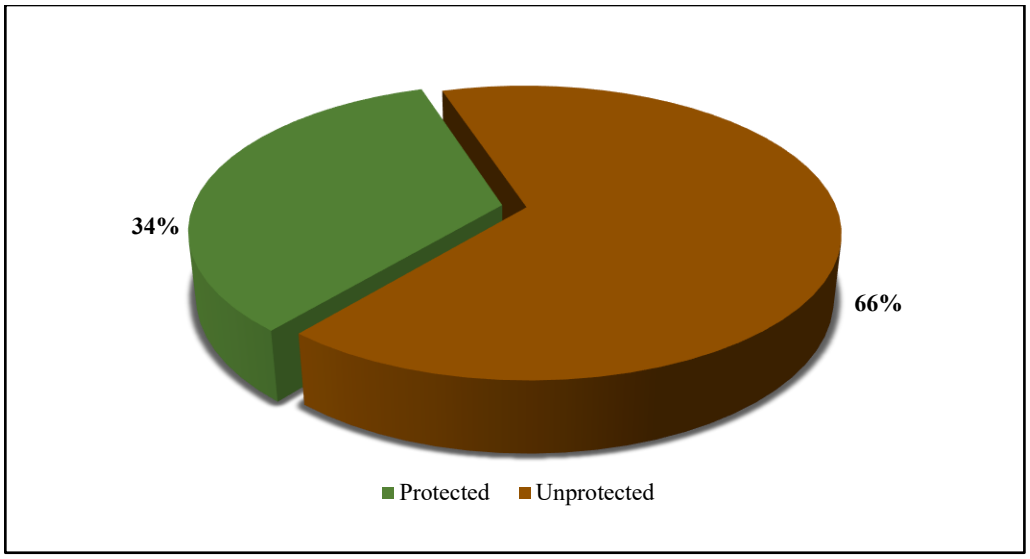

Fig. 3: Percentage of Protected Bird Species Across the Three Stations

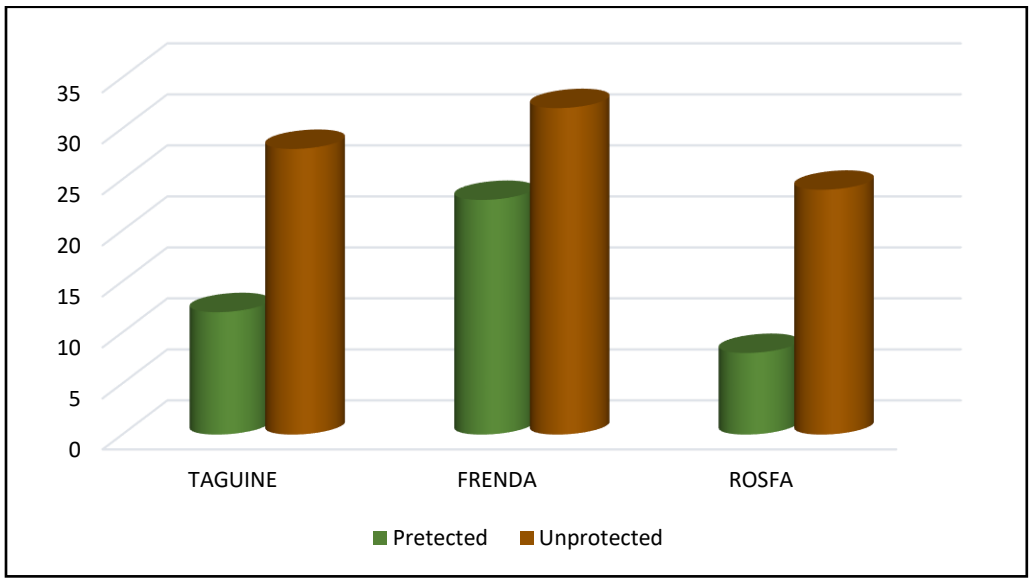

Fig. 4: Percentage of Protected Bird Species Across the Three Stations

2.Reptiles

Among the 32 reptile species recorded, the Lacertidae family was the most dominant across the three study stations, followed by the families Colubridae**,** Testudinidae**,** and Scincidae. All these families were present in the three stations, with the exception of the Chamaeleontidae family, which was observed only at the Frenda and Rosfa stations (Fig. 5).

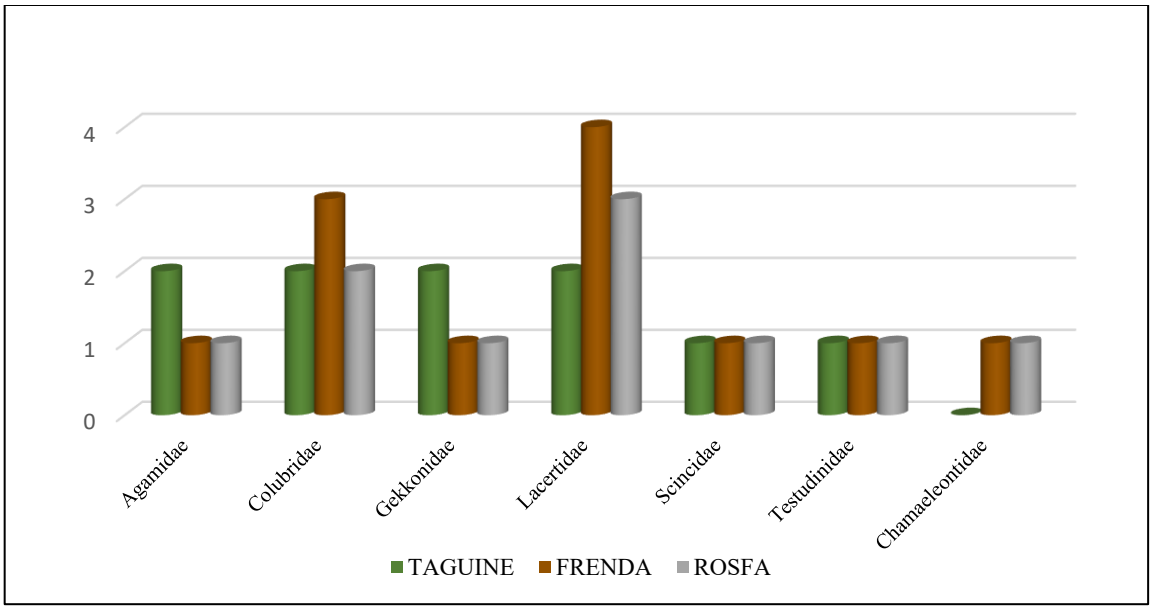

Fig. 5: Variation in Species Richness of Reptiles by Family Across the study stations

3.Mammals

The Muridae family predominates in all three stations, followed by the Canidae and Leporidae families. The Hystricidae were recorded only in the Frenda and Taguine stations. The Felidae were observed in the Rosfa and Frenda stations, while the Hyaenidae are found exclusively in the Taguine area. The two families, Suidae and Viverridae, were recorded only in the Frenda area (Fig. 6).

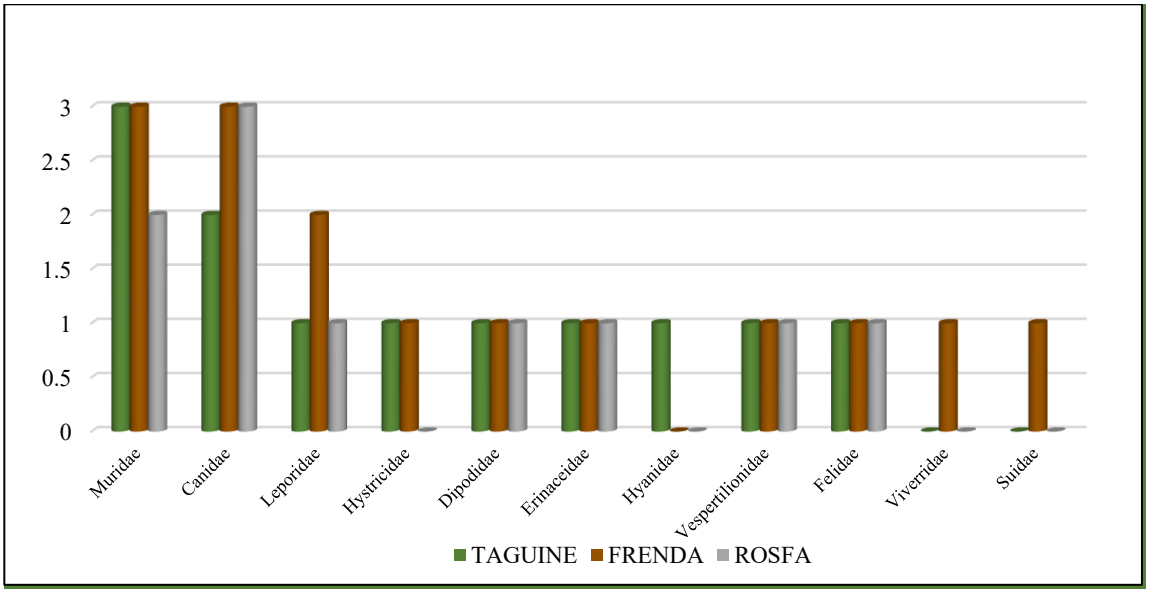

Fig. 6: Variation in the species richness of mammals by family across the three stations.

4. Amphibians

This class is represented by two families, Bufonidae and Ranidae, in the Frenda station. In the Taguine and Rosfa stations, only the Bufonidae family is present (Fig. 7).

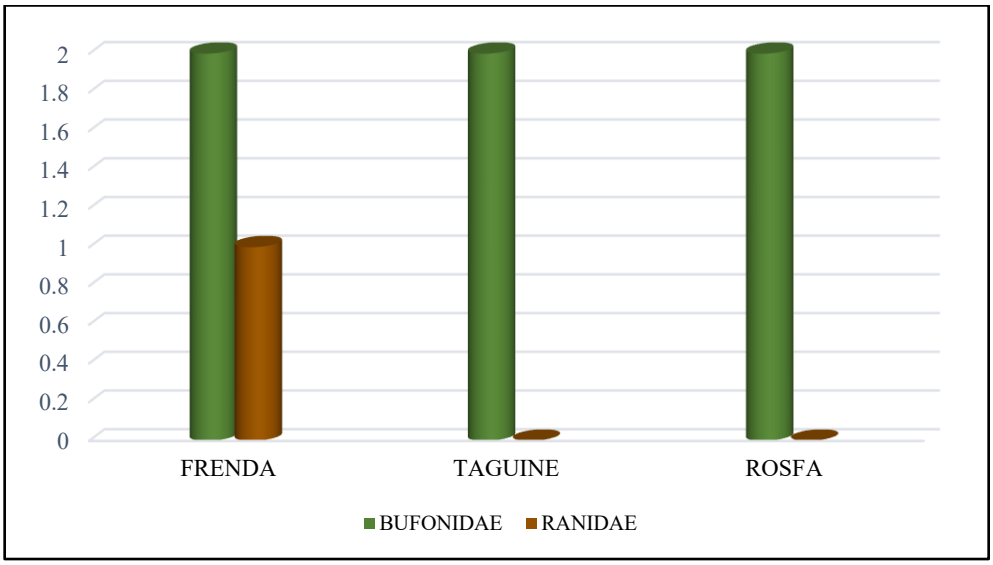

Fig. 7: Variation in the species richness of amphibians by family across the three stations.

Number of species per class between the three stations

Frenda is the station with the highest species diversity, with a total of 85 species, followed by Taguine with 63 species, and then Rosfa with 54 species. Frenda stands out particularly in all groups (birds, mammals, reptiles, and amphibians), making it the station with the highest biodiversity among the three. Taguine and Rosfa have relatively similar profiles, although Taguine has slightly more birds and mammals than Rosfa (Fig. 8)

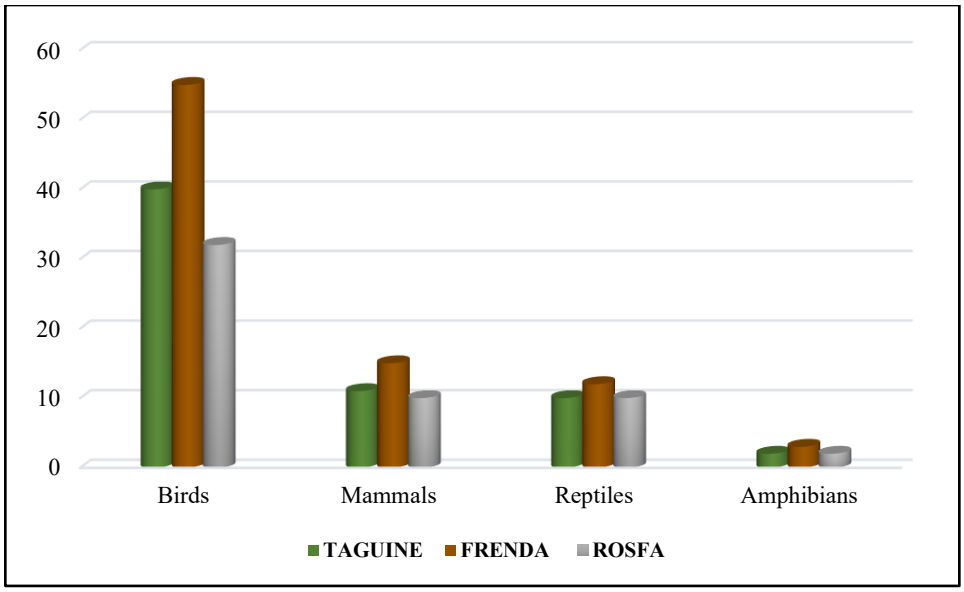

Fig. 8: Variation in species richness by class across the three stations

Abundance by class between the three stations

The comparison of the three habitats reveals that the bird class dominates in terms of abundance across all three stations. In Taguine, a total of 911 individuals were recorded, while in Rosfa, this number reaches 1,392 individuals. The highest abundance was observed in Frenda, with 2,021 individuals. For reptiles, Rosfa shows the highest abundance with 258 individuals, followed by Taguine (236 individuals) and Frenda (226 individuals). In terms of mammals, Frenda harbors the largest population, with 234 individuals, followed by Rosfa (113 individuals) and Taguine (93 individuals). Amphibians, on the other hand, show relatively low abundances, with fewer than 50 individuals across the entire study area. However, Frenda stands out with the highest abundance in this class, although it remains low (Fig. 9).

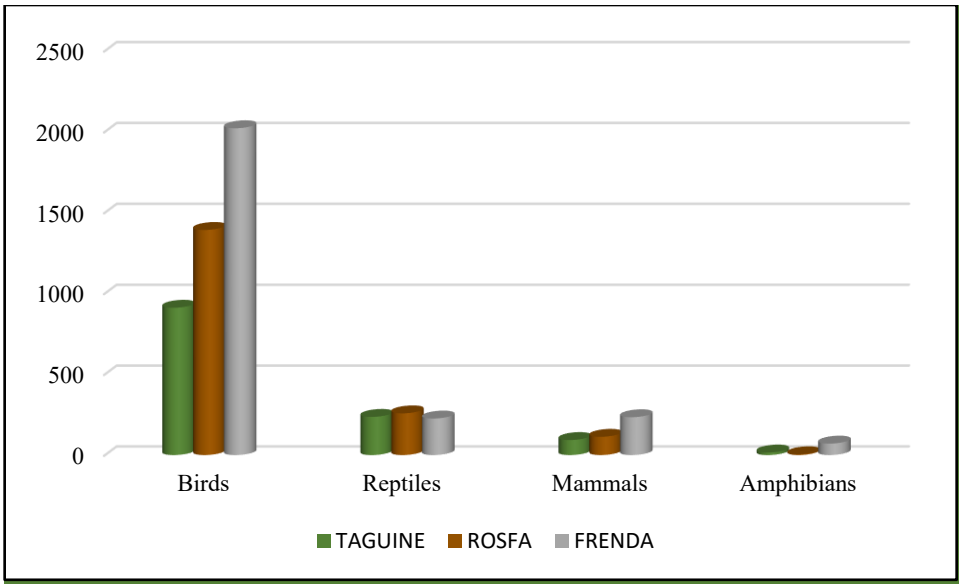

Fig. 9: Variation in abundance by class across the three stations.

Discussion

The results of this study confirm the classical trends observed in other research conducted in Algeria and in similar ecosystems, particularly regarding the distribution and abundance of different faunal classes. As in other studies, birds are the most abundant faunal group. Their dispersal ability, broad ecological niche diversity, and adaptation to various habitats explain this dominance. In contrast, reptiles and mammals, while essential for ecological balance, show lower densities due to their specific habitat requirements and higher ecological specialization (Bons & Geniez, 1996; Fahd, 1993).

Birds

The Accipitridae family proved to be dominant, with a notable presence of protected species such as *Milvus migrans, Hieraaetus pennatus, Buteo buteo*, and *Circaetus gallicus*. These raptors, also observed in West Africa and Europe, face similar threats in these regions, including illegal hunting, habitat loss due to deforestation and urbanization, as well as poisoning (Probst et al., 2020; Ringim, 2022). In this context, Algeria although the Black Kite (*Milvus migrans*) is frequently observed, the density of some other species, such as large eagles (*Hieraaetus pennatus* and *Circaetus gallicus*), remains relatively low. This can be attributed to the impact of anthropogenic pressures, which particularly affect these vulnerable species (Dik et al., 2022). Algeria, located on a strategic migratory route between Europe and Africa, is home to around 450 bird species, several of which are endemic or threatened. Iconic species, such as the Golden Eagle (*Aquila chrysaetos*), Peregrine

Falcon (*Falco peregrinus*), White Stork (*Ciconia ciconia*), and Houbara Bustard (*Chlamydotis undulata*), benefit from legal protections due to their concerning conservation status. Their survival depends on effective habitat management and the regulation of human activities, particularly combating poaching and protecting sensitive areas (Youcefi, 2022). The presence of these species underscores the importance of maintaining protected habitats and ensuring their accessibility during migratory periods.

Mammals

Mammals play a crucial role in food chains and the structuring of ecological communities (Drouai et al., 2018). However, these ecosystems are threatened by desertification, habitat fragmentation, and human pressures related to intensive agriculture and uncontrolled grazing. In response to these challenges, conservation efforts are essential, particularly through the protection of threatened species and the establishment of nature reserves. The Muridae, Canidae, and Leporidae families dominate in the three studied stations, with particularly high abundance in Frenda. This station offers ecological conditions that are favorable to a wide variety of mammals, including rare species such as Suidae and Viverridae. In contrast, Taguine is distinguished by the exclusive presence of Hyaenidae, a specificity that highlights the adaptability of certain species to semi-desert habitats. This observation is supported by research conducted in similar regions of Algeria and Morocco, where vegetated habitats, like those of Frenda, are associated with a greater abundance of mammals, particularly Muridae and Canidae, which are adapted to semi-arid environments (Schleich et al., 1996). Among rodents, the Muridae family dominates, which is consistent with the findings of Adamou-Djerbaoui et al. (2015) and Khidas et al. (1999), who also reported the predominance of this family. Among the species observed, *Mus spretus*, a species well-known for its preference for semi-arid areas (Khidas et al., 1999), was present. This observation aligns with the ecological preferences of this species, which is commonly found in similar habitats. *Meriones shawi*, a crop pest, was also captured in cereal-growing areas, consistent with the findings of Adamou-Djerbaoui et al. (2011, 2013), who also found it in agricultural zones of the Algerian High Plateaus. *Mus musculus*, the house mouse, was captured in all the studied stations, particularly near agricultural storage areas, which is in line with the work of Souttou et al. (2012), who highlighted the strong association of this species with human habitats.

Reptiles and Amphibians

Reptiles, such as the Hermann's Tortoise (*Testudo graeca*), the Horseshoe Whip Snake (*Hemorrhois hippocrepis*), and the Impala Agama (*Agama impalearis*), are key elements of the Algerian fauna, playing a crucial role in controlling invertebrate populations and regulating food chains (Bons, 1967; Fahd, 1993; Fahd & Pleguezuelos, 2001). The diversity of reptiles varies across the stations, with Frenda and Rosfa offering conditions favorable to certain species, such as chameleons (Family *Chamaeleontidae*), which are absent at Taguine, suggesting notable ecological differences between these habitats.

Amphibians, although less abundant, also play an important role in local ecosystems. *Bufotes boulengeri* and *Sclerophrys mauritanica*, both endemic to North Africa (Kisserli et al., 2011; Rouag, 2012), are found in desert and semi-desert areas and are particularly vulnerable to habitat destruction and water pollution (Bons & Geniez, 1996). However, the Frenda station seems to provide favorable microhabitats for these species, despite the low densities observed, highlighting the importance of wetlands for amphibian conservation (Kisserli et al., 2017). In contrast, the low abundance of amphibians in this study is consistent with observations made in other regions, where the degradation of aquatic habitats is a limiting factor for their populations (Salvkn(ç xv…ador, 1996; Ben Hassine & Nouira, 2012).

Bufotes boulengeri was also observed in areas at different bioclimatic levels, including subhumid and humid zones, demonstrating its ability to adapt to a variety of ecological conditions. This presence has been confirmed by several studies, including those by Samraoui et al. (2012), Mateo et al. (2013), and Ben Hassine & Escoriza (2017). Furthermore, species such as *B. bufo*, *Sclerophrys mauritanica*, and *Bufotes boulengeri* have also been reported in coastal regions, as corroborated by the work of Amrouche et al. (2015). These observations underscore the wide range of habitats that these amphibians can colonize, from arid environments to wetter and coastal zones.

Relationships between Herpetofauna and Vegetation

During this study, we observed that the majority of the land in the region is dedicated to cereal and vegetable cultivation. Our results showed that many reptile species present in these agricultural lands do not show a particular preference for a specific type of habitat, and are largely influenced by the availability of prey and vegetation in these cultivated areas (Bons & Geniez, 1996). These observations support the work of Schleich et al. (1996), who also noted that reptiles can adapt to environments altered by agriculture, particularly due to the abundance of food resources.

Conclusion

The study of the fauna in the steppe region of Tiaret revealed significant ecological diversity, despite challenging climatic conditions. The three stations studied demonstrated remarkable species richness, with a predominance of birds, mammals, reptiles, and amphibians, including several protected species. Frenda particularly stood out for its high biodiversity, notably due to the presence of rare species . This faunal diversity is closely linked to specific vegetation types, such as *Stipa tenacissima*, *Thymus ciliatus*, *Artemisia herba-alba*, and *Juniperus phoenicea*, which provide essential habitats and food resources for the species present. These results highlight the importance of preserving natural habitats and implementing effective conservation strategies to combat ecosystem degradation and desertification, thereby ensuring the sustainability of the local fauna.

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