

Research Article

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Fauna Checklists of Al-Abiar Zone (Zaza, Jeera and Takes) Cyrenaica province – Libya

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Abstract: The annotated checklist, meticulously crafted through a blend of extensive literature review, the author's keen observations, and the wisdom of local communities, unveils the 36 species representing 29 families. The checklist delves into their geographical distribution, mapping their footprints across the zone. This comprehensive picture allows us to understand the delicate dance between each species and its preferred habitat. However, anthropogenic pressure plays a critical role in shaping the distribution and population density of the zone's fauna. It serves as a potent reminder of the urgent need for conservation efforts. The checklist lays the groundwork for identifying and safeguarding crucial habitats and threatened species, ensuring that the symphony of life in this corner of the world continues to resonate for generations to come.

Keywords: Checklists, Fauna, Cyrenaica province, Libya

قائمة الثروة الحيوانية في منطقة الابيار (زازة - جيرة - تاكنس) برقة - ليبيا
المستخلص: تكشف القائمة المرجعية لمنطقة الدراسة، التي تم إعدادها بدقة من خلال مزج الدراسات السابقة من المراجع، والزيارات الميدانية والملاحظات المباشرة للمؤلفين، وملاحظات المجتمعات المحلية، عن 36 نوعاً تمثل 29 عائلة. وتتناول القائمة المرجعية توزيعهم الجغرافي، وتسجل تواجدها في منطقة الدراسة. تتيح لنا هذه الصورة الشاملة فهم العلاقة الدقيقة بين كل نوع البيئات التي تعيش فيها. ومع ذلك، يلعب النشاط البشري دوراً حاسماً في تشكيل التوزيع والكثافة للأنواع للحيوانات في المنطقة. إنه بمثابة تذكير قوي بالحاجة الملحة لجهود الحفاظ والتنوع الحيوي البري في برقة. تضع القائمة المرجعية الأساس لتحديد وحماية الموائل الحيوية والأنواع المهددة بالانقراض، مما يضمن استمرار صدى سيمفونية الحياة في هذا الركن من العالم للأجيال القادمة.

الكلمات المفتاحية: قائمة الحيوانات البرية. برقة - ليبيا.

INTRODUCTION

The concept of biodiversity includes all biogeography, habitat ecology, legislation and regulation of sustainable development for biodiversity. While the term wildlife includes all wild birds, mammals and reptiles. it is concerned with wildlife management (Caughley, 1994).



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Approximately 320 mammal species are native to the Mediterranean basin countries. The majority of mammal species are small volant and non-volant mammals, for example, but not limited to (rodents, bats, shrews, hedgehogs and moles). The Muridae family, which includes rats and mice, is the largest group of mammals in the region. Only 297 of these mammal species have been evaluated, and more than 16% of them, or around 49 species, are currently threatened with extinction. Ungulates, primates, carnivores, and lagomorphs (rabbits and hares) are the groups of mammals with the highest rates of endangerment (Gippoliti, Amori, Castiglia, Colangelo, & Capanna, 2014; Hoffmann *et al.*, 2010).

Out of the 297 mammal species that have been assessed in the Mediterranean basin, 16.5% are considered threatened, according to (Vié, Hilton-Taylor, & Stuart, 2009). This includes 3% that are critically endangered, 5% that are endangered, and 8% that are vulnerable. An additional 8% of the species are considered near threatened, and 12% are considered data deficient. Seven species, including the lion (*Panthera leo*) and the tiger (*P. tigris*), have been extirpated from the region.

As the report indicated that the terrestrial mammal biodiversity is higher in mountainous parts of the regions in Mediterranean countries. Of the 49 threatened species of Mediterranean mammals, 20 (41%) are unique to the region. As the report noted, the endemic species richness is particularly high in the Maghreb, although the Iberian and Italian peninsulas also hold important concentrations of endemic species, as do the Mediterranean islands.

The first attempts to document Libyan mammals date back to the recent decade, where an Italian researcher (Fraser, 1844) published a list of birds. Studies on Libyan birds continued by (Ghigi, 1913; MoLTONI, 1935; Salvadori, 1922; Giuseppe Scortecci, 1934; Giuseppe Scortecci, 1935); listed, the 38 terrestrial reptile species known in Libya and, (Zavattari, 1937) noted, the 56 species and subspecies. (Al-Awami, 1973) argue that there are not many studies on wildlife vertebrates compared with neighboring countries. The Center for the Studies of Arid Zones and Dry Lands (Dougrameji, 1975) indicated the presence of 26 species of mammals in the AL-Jabal AL-Akhdar zone in particular.

It was also indicated in the latest study (Elkahwage & Jdeidi, 2018) that included a categorical study of mammals in the Msallata National Park Reserve, where the presence of 14 species of mammals was recorded (Wudl, Wobschall, & Hufnagel, 1972). (A. M. Bauer, DeBoer, & Taylor, 2017) collected the Libyan reptiles, where they collected local data from 3350 museum specimens and 163 scientific sources, which resulted in 683 unique sites that were geographically identified and used to create a lexicon. Geographic and maps as well as species maps for each of the 66 reptile species confirmed to exist in Libya. The known reptile fauna of Libya is one of the poorest on the African continent (A. Bauer, 1993) with only 63 terrestrial species recognized. (El Harer, 2014) stated that the fauna in Libya is composed of (65) mammal species and Aves (343) species, While, (A. M. Bauer *et al.*, 2017) stated reptelia are composed of 66 in Libya.

The last comprehensive review was by (Rosendal & Schei, 2012), according to this review, there are no accurate surveys of biological diversity in Libya. In addition, there have been, since 2011, significant human activities in some parts of Libya that have had an impact on biological diversity. Because of this, this report is no longer reliable, and it's crucial that reports be updated to give a more accurate picture. The fourth report provides the most important species of wild animals that are vulnerable to extinction, and indicates that there are 455 vertebrate species and 3,958 invertebrate species. The report also indicates that mammals are one of the most sensitive groups in Libya and that this group has suffered many extinctions.

Location and physiography

The Libya is located in the north of Africa, from 20 to 34° N and 10 to 25° E, stretching on the Mediterranean coast in the north over 2000 Km, and bounded from the east by Egypt and from the west by Tunisia (Agency, 2004). The total area of Libya is about 1.76 Million km², more than 95% of Libya is desert due to continental tropical air's year-round dominance (Nelson, 1979). Little information is still available in recent years about the eco-diversity contexts in Libya (Stokes *et al.*, 2015).

The study area is located on the eastern coast of the Mediterranean Sea in the north-east of Libya on the first terrace, from the Al-Rajma area in the west of the study area to the south of the Tokra area, at a distance of approximately 30 km, on the Mediterranean coast. The study area is located from the plateau southeast of Al-Rajma (N 32.083068 and E 20.350277) to the plain northeast of Al-Rajma (N 32.193021 and E 20.226580) near the Sidi Khalifa area and extends to the northeast of Al-Hamda (N 32.526994 and E 20.653896), which is south of Tokrah. The area is located in wadi Zaza, one of the most important wadies in the zone (N 32.375580 and E 20.544370), which is considered a natural environment with vegetation, biodiversity and also a safe haven for many animals.

There are many wadies, the most important of which is wadi Zaza, which extends to about 38 kilometers to the south, which is about 20 kilometers from Tokrah, and the wadi rises from a large surface level to about 290 meters.

These climatic conditions in Cyrenaica led to biodiversity than the lands that surround it, where the evergreen trees and shrubs of the Cyrenaica region grow on the Mediterranean Sea, the most important of which are juniper, eucalyptus, and shammari. These features made it one of the best environments suitable for the presence of many types of wildlife provides them food and shelter. The occasion is throughout the year, and various forms of wild animals, mammals, reptiles, and resident and migratory birds are endemic to this part of the AL- Jabal AL-Akhdar (Alaib, El-Sherif, & Al-Hamed, 2017).

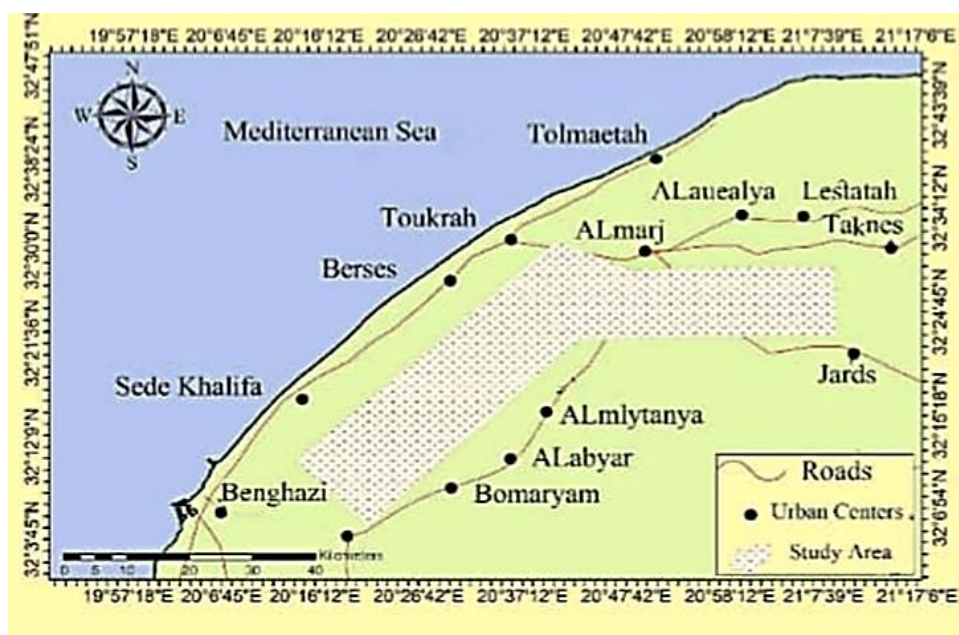


Figure (1) Geographical location of the study zone.

MATERIALS AND METHODS

The mammals present in this study were recorded in three ways: through field views, field questionnaires and documentation from local residents via photos and videos. The basic information for each species shows the scientific name, English name and local name together. In most cases, the primary data comes from new notes, new recordings.

Wildlife fauna was studied through several field trips, in which many wild species were monitored in the study area in stages, where they were documented and identified according to the classification of Carlos Linnaeus 1758. Interim schedule for years: (Jeera, Wadi Zaza, Taknes) 2021-2022.

- | | |
|----------------------|------------------------|
| 1- April 2021 trip | 5 - October 2021 trip. |
| 2-May 2021 trip. | 6- March 2022 trip. |
| 3- July 2021 trip. | 7- April 2022 trip. |
| 4- August 2021 trip. | 8- June 2022 trip |

RESULTS AND DISCUSSION

A total of 36 species belonging to 29 families were recorded, with mammalia being the most diverse group, followed by aves and reptilia. This pattern of vertebrate diversity is similar to that observed in other Mediterranean regions (e.g., Greece, Italy, Spain). For instance, a study by (Brotons, Thuiller, Araújo, & Hirzel, 2004) in Greece found that birds were the most abundant vertebrate group, followed by mammals and reptiles. Similarly, a study by (Maiorano, Falcucci, & Boitani, 2006) in Italy found that birds were the most diverse vertebrate group, followed by mammals and reptiles.

The data also noted that, the fauna status in the study zone is considered to range from near threatened to threatened due to the intensity of human activities. This is a common concern throughout the Mediterranean region, where human activities such as urbanization, agriculture, and tourism have led to habitat loss, fragmentation, and overexploitation of wildlife. For example, a study by Blondel *et al.*, (1999) found that habitat loss was the main threat to bird populations in the Mediterranean Basin. Similarly, a study by (Cooney, 2004) found that overexploitation of wildlife was a major threat to biodiversity in the Mediterranean region.

Also, the data pointed out that the species in the study zone represent 8.5% of the total fauna species in Libya (474 species). This suggests that the study zone is an important area for biodiversity conservation in Libya. However, as noted above, the fauna in the study zone is threatened by human activities. Therefore, it is important to implement conservation measures to protect the biodiversity of the study zone.

The differences in the observed distribution of fauna between the current study and a previous study by (Bsis, 2019). While Bsis found rodents to be the most widespread fauna group in the northern eastern part of Libya, the current study found birds, particularly *Alectoris barbara*, to be more prevalent. Additionally, turtles were found to be the dominant reptile species, especially in residential zones and farms. This difference in observed distribution patterns could be attributed to several factors, including the spatial variation due to habitat differences, climate variation, and anthropogenic factors. Also, temporal variation, this study was conducted over a different time period than Bsis's study, and fauna can fluctuate over time due to environmental factors, human activities,

and natural population dynamics. Moreover, the methodology differences, the sampling methods, and the survey techniques employed in the two studies could also contribute to the observed differences. Different methods may have varying sensitivities to detecting different fauna groups, leading to discrepancies in the perceived distribution patterns.

Similar variations in faunal distribution have been observed in other countries and regions. For instance, a study by (dos Anjos et al., 2011) in Brazil found that the abundance of bird species varied significantly across different habitats within the Atlantic Forest biome. Similarly, a study by (Herrmann, Babbitt, Baber, & Congalton, 2005) in the United States demonstrated that the distribution of amphibian species was influenced by a combination of landscape features, climate factors, and anthropogenic disturbances.

The study of Libyan fauna, despite the efforts of previous researchers, remains limited and incomplete. This highlights the need for further research, particularly in the areas of taxonomy, environmental biology, and the factors influencing faunal distribution and abundance. The current study represents an extension of the work initiated by earlier researchers in the past century.

Reptiles are considered one of the least abundant animal groups in the region, with snakes like *Naja haje* and *Macropododon cucullatus* being particularly scarce. This observation aligns with the findings of (A. Bauer, 1993) who noted that the reptile fauna of Libya, particularly when compared to that of other African regions, is relatively impoverished.

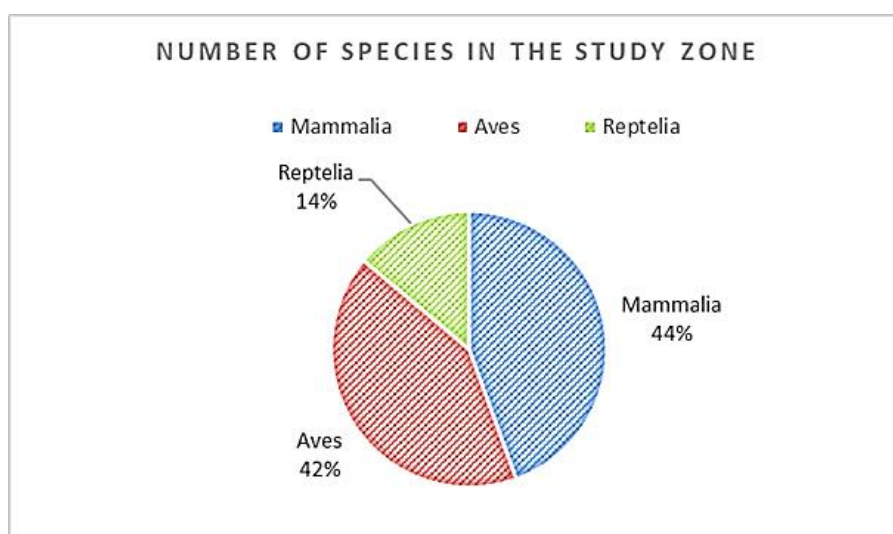


Figure (2) Percentage of species in the zone.

The study also highlights the negative impacts of human activities, such as urban expansion, hunting, and deforestation, on mammal populations. These activities have caused direct threats to mammal survival, as evidenced by their observed migration towards the southern marginal zones. This observation is consistent with the findings of (Panel, 2011), who emphasized the sensitivity of mammals to direct anthropogenic disturbances. The limited knowledge of Libyan fauna is not unique to this region. Similar situations have been observed in other countries, particularly those with challenging environmental conditions or limited research resources. For instance, a study by (Antonelli et al., 2022) on the herpetofauna of Madagascar revealed significant gaps in knowledge regarding the distribution and conservation status of many reptile species. Similarly, a study by (Peres & Nascimento, 2006) on the Amazonian rainforest highlighted the need for comprehensive biodiversity surveys to adequately assess the conservation status of the region's rich fauna.

We conclude that there is a pressing need for increased scientific efforts to study Libyan fauna, given the various anthropogenic pressures it faces. These pressures are continuously intensifying and pose a threat to the habitats of faunal species in the study area. The encroachment of human activities into Cyrenaica has impacted its biodiversity, leading to faunal loss and habitat degradation. This has altered mammal fauna communities in the region. As a result, Cyrenaica's fauna can be considered a valuable source of biodiversity data for Libya, both for conservation purposes and for reconstructing the population history of mammalian species in Libya and the wider Mediterranean region.

The situation in Libya is not unique. Similar scenarios have been observed in other countries, particularly those with fragile ecosystems or limited research resources. A study by (Ceballos, Ehrlich, & Dirzo, 2017) on the global mammal decline concluded that human activities are the primary driver of mammal extinction. Similarly, a study by (Ripple et al., 2015) highlighted the alarming decline of vertebrate populations worldwide, with anthropogenic factors being the main cause of this trend.

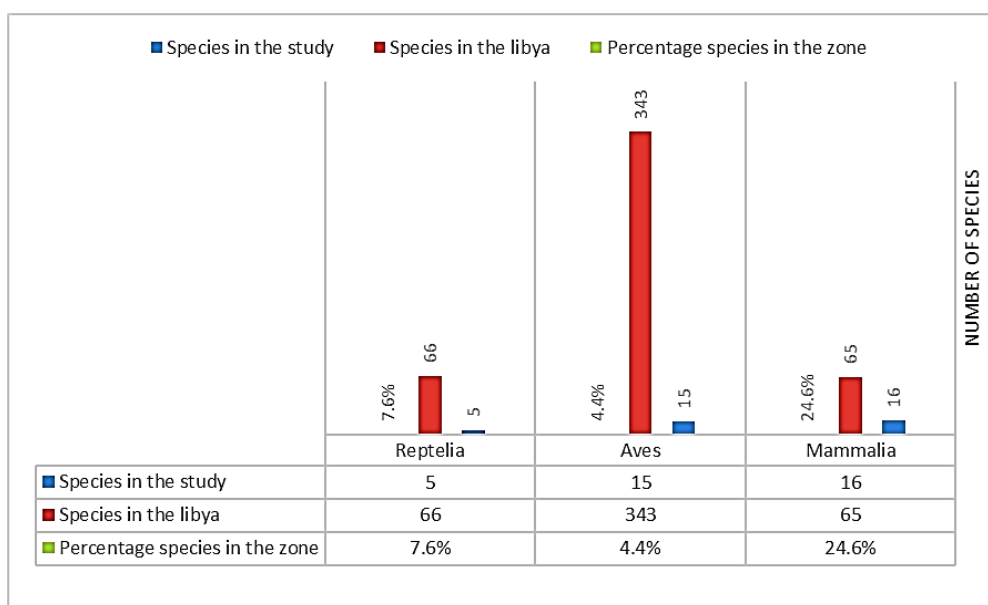


Figure (3) percentage of species in the zone compared with the number of species in Libya.

list of fauna species:

Mammalia

1- *Pipistrellus kuhlii* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Mammalia
 Order Chiroptera
 Family Vespertilionidae

2- *Lapus capensis* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Mammalia
 Order Lagomorpha
 Family Leporidae

3- *Hystrix cristata* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Mammalia
 Order Rodentia (bowdich, 1821)
 Family Hystricidae (fischer de Waldheim,1817)

4- *Spalax ehrenbergi* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Mammalia
 Order Rodentia
 Family Spalacidae

5- *Hemiechinus auratus libycus* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Mammalia
 Order Erinaceommorpha
 Family Erinaceidae (fischer,1814)

6- *Jaculus jaculus* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Mammalia
 Order Rodentia (bowdich, 1821)
 Family Dipodidae (fischer de Waldheim,1817)

7- *Mus musculus domesticus* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Mammalia
 Order Rodentia (bowdich, 1821)
 Family Muridae (Illiger,1811)

8- *Microtus guentheri* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Mammalia
 Order Rodentia (bowdich, 1821)
 Family Cricetidae (fischer ,1817)

9- *Fennec vulpes zerda* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Mammalia
 Order Carnivora
 Family Canidae

10- *Hyaena hyaena* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Mammalia
 Order Carnivora (bowdich, 1821)
 Family Hyaenidae (gray,1821)

11- *Vulpes vulpes* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Mammalia
 Order Carnivora (bowdich, 1821)
 Family Canidae (fischer,1817)

12- *Canis anthus* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Mammalia
 Order Carnivora (bowdich, 1821)
 Family Canidae (fischer,1817)

13- *Poecilictis libyca* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Mammalia
 Order Carnivora (bowdich, 1821)
 Family Mustelidae

14- *Felis Caracal caracal* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Mammalia
 Order Carnivora (bowdich, 1821)
 Family Felidae

15- *Felis lybica* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Mammalia
 Order Carnivora (bowdich, 1821)
 Family Felidae

16- *Gazella dorcas* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Mammalia
 Order Artiodactyla (owen,1848)
 Family Bovidae (gray,1821)

List of fauna species.**Aves****1- *Hirundo rustica rustica* (Linnaeus, 1758)**

Superclass (Tetrapoda)
 Class Aves
 Order Passeriformes
 Family Hirundioidae

2- *Strptopelia turtur* (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Aves
 Order Columbidae
 Family Columbidae

3- Columba livia (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Aves
 Order Columbiformes
 Family Columbidae

4- Coturnix coturnix (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Aves
 Order Galliformes
 Family Phasianidae

5- Upupa epops (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Aves
 Order Bucerotiformes
 Family Upupidae

6- Galerida cristata (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Aves
 Order Passeriformes
 Family Alaudidae

7- Alectoris barbara (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Aves
 order Galliformes
 family Phasianidae

8- Eremophila bilopha (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Aves
 Order Passeriformes
 Family Alaudidae

9- Chlamydotis undulata (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Aves
 Order otidiformes
 Family otididae

10- Athene noctua (Linnaeus, 1758)

Superclass (Tetrapoda)
 Class Aves
 Order strigiformes
 Family Strigidae

11- *Aquila chrysaetos* (Linnaeus, 1758)

Superclass (Tetrapoda)

Class Aves

Order Accipitridae

Family Accipitridae

12- *Corvus corax* (Linnaeus, 1758)

Superclass (Tetrapoda)

Class Aves

Order Passeriformes

Family Corvidae

13- *Lanius excubitor* (Linnaeus, 1758)

Superclass (Tetrapoda)

Class Aves

Order Passeriformes

Family Lanidae Rafinesque (shrikes, 1815)

14- *Ardea purpurea* (Linnaeus, 1758)

Superclass (Tetrapoda)

Class Aves

Order Pelecaniformes

Family Ardeidae (leach.1820)

15- *Coccothraustes coccothraustes* (Linnaeus, 1758)

Superclass (Tetrapoda)

Class Aves

Order Passeriformes

Family Fringillidae (leach.1820)

list of fauna species.**Reptalia****1- *Naja haje* (Linnaeus, 1758)**

Superclass (Tetrapoda)

Reptalia Class

Order Squamata

Family Elapidae

2- *Testudo kleinmanni* (Linnaeus, 1758)

Superclass (Tetrapoda)

Class Reptalia

Order Testudines (batsch,1788)

Family Testudinidae (batsch,1788)

3- *Mabuya vittate* (Linnaeus, 1758)

Superclass (Tetrapoda)

Class Reptalia

Order Squamata

Family Scincidae

4- *Macroprotodon cucullatus* (Linnaeus, 1758)

Superclass	(Tetrapoda)
Class	Reptilia
Order	Squamata (oppel,1811)
Family	Colubridae (oppel,1811)

5- *Chamaeleo chamaeleon* (Linnaeus, 1758)

Superclass	(Tetrapoda)
Class	Reptilia
Order	Squamata
Family	Chamaeleonidae

CONCLUSION

Scientific reports on Libyan mammals are scarce and provide only a partial overview of the country's mammalian diversity. Previous checklists of Libyan mammals have been limited in scope, with only a few covering the entire fauna. While the report by the General Authority for the Environment focuses on the most endangered Libyan wild animal species, its coverage of other Libyan species is incomplete. Due to the incompleteness of previous checklists, it was deemed necessary to compile a new and updated checklist for select Libyan regions.

This checklist is based on the author's original field observations during the study period. It provides a more accurate picture of the distribution of various species within the Al-Abiar Zone (Zaza, Jeera, and Taknes) than was previously possible. The lack of comprehensive faunal studies is a common challenge faced by many countries, particularly those with vast and diverse ecosystems or limited research resources. For instance, a study by (Schipper et al., 2008) on African mammal diversity revealed significant gaps in knowledge regarding the distribution and conservation status of many species. Similarly, a study by (Wilson & Reeder, 2005) on global mammal diversity highlighted the need for urgent conservation efforts to protect the world's mammal fauna from extinction.

Finally, the authors hope that the new reviews and additional data on some of the less well-known species found within Cyrenaica's habitat boundaries will encourage various competent bodies in the country to utilize this information for distribution and conservation purposes. The present checklist includes several species and subspecies not mentioned in previous reports.

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Duality of interest: The authors declare that they have/ have no duality of interest associated with this manuscript.

Author contribution: A, B conducted the theoretical formalism, A, B, C, D, performed the field work and analytical calculations, A, B, C, D, E, contributed to the final version, A, B, supervised the work.

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REFERENCES

- Agency, C. I. (2004). World factbook: Central Intelligence Agency.
- Al-Awami, A. (1973). Wild Vertebrate Animals In The Libyan Arab Republic, (1st ed.). Tripoli, Libya: Dar AL-Fikr Library, pp.23_24. (In Arabic).
- Alaib, M., El-Sherif, I., & Al-Hamed, R. (2017). Floristic and ecological investigation of Wadi Al—Agar in Al—Jabal Al—Akhdar—Libya. *Libyan Journal of Science. Technology* 5(1).
- Antonelli, A., Smith, R. J., Perrigo, A. L., Crottini, A., Hackel, J., Testo, W., Andermann, T. (2022). Madagascar's extraordinary biodiversity: Evolution, distribution, and use. *Science*, 378(6623), eabf0869.
- Bauer, A. (1993). African-South American relationships: a perspective from the Reptilia. *Biological relationships between Africa South America* 244-288.
- Bauer, A. M., DeBoer, J. C., & Taylor, D. J. (2017). Atlas of the Reptiles of Libya. *Proc. Cal. Acad. Sci*, 64(8), 155-318.
- Brotons, L., Thuiller, W., Araújo, M. B., & Hirzel, A. H. (2004). Presence - absence versus presence - only modelling methods for predicting bird habitat suitability. *Ecography*, 27(4), 437-448.
- Bsisa, H. A., Fadil, M., and Basbhir, T., (2019). the Libyan journal of science, 22, 27 44.
- Caughley, G. (1994). Directions in conservation biology. *Journal of animal ecology*, 215-244.
- Ceballos, G., Ehrlich, P. R., & Dirzo, R. (2017). Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines. *Proceedings of the national academy of sciences*, 114(30), E6089-E6096.
- Cooney, R. (2004). The precautionary principle in biodiversity conservation and natural resource management: an issues paper for policy-makers, researchers and practitioners: IUCN.
- dos Anjos, L., Collins, C. D., Holt, R. D., Volpato, G. H., Mendonça, L. B., Lopes, E. V., . . . Carvalho, J. (2011). Bird species abundance–occupancy patterns and sensitivity to forest fragmentation: implications for conservation in the Brazilian Atlantic forest. *Biological conservation*, 144(9), 2213-2222.
- Dougrameji, J. (1975). Arab Centre for the Studies of Arid Zones and Dry Lands (ACSAD), Damascus, Syria. activities of the Soil--Water Division. *Soils Bull Food Agric Organ UN*.
- El Harer, H. S. (2014). Extinction and its impact on wild animal diversity in Libya, The Seventh International Conference on Development and Environment in the Arab World,. Center for Environmental Studies and Research - Assiut University - Egypt (research paper) (in Arabic).23_25

- Elkahwage, I. E., & Jdeidi, T. B. (2018). Survey of the wild mammalian species in Misallatah Nature Reserve and National Park (MNRNP). *Attie Memorie Dell'ente Fauna Siciliana*, 12, 101-112.
- Fraser, L. (1844). Description of three new species of birds. Paper presented at the Proc. Zool. Soc. London.
- Ghigi, A. (1913). Materiali per lo studio della fauna libica. *Memorie Reale Accademia delle Scienze di Bologna*, 10, 253-296.
- Gippoliti, S., Amori, G., Castiglia, R., Colangelo, P., & Capanna, E. (2014). The relevance of Italian museum collections for research and conservation: the case of mammals. *Rendiconti Lincei*, 25, 351-357.
- Herrmann, H., Babbitt, K. J., Baber, M. J., & Congalton, R. G. (2005). Effects of landscape characteristics on amphibian distribution in a forest-dominated landscape. *Biological conservation*, 123(2), 139-149.
- Hoffmann, M., Hilton-Taylor, C., Angulo, A., Böhm, M., Brooks, T. M., Butchart, S. H., . . . Cox, N. A. (2010). The impact of conservation on the status of the world's vertebrates. *Science*, 330(6010), 1503-1509.
- Maiorano, L., Falcucci, A., & Boitani, L. (2006). Gap analysis of terrestrial vertebrates in Italy: priorities for conservation planning in a human dominated landscape. *Biological conservation*, 133(4), 455-473.
- MoLTONI, E. (1935). a-Uccelli inanellati. *Riv. It. Ornit*, 5, 116-117.
- Nelson, H. D. (1979). *Libya, a country study*: The University.
- Panel, U. N. E. P. I. R. (2011). Decoupling natural resource use and environmental impacts from economic growth: UNEP/Earthprint.
- Peres, C. A., & Nascimento, H. S. (2006). Impact of game hunting by the Kayapó of south-eastern Amazonia: implications for wildlife conservation in tropical forest indigenous reserves. *Human exploitation biodiversity conservation* 287-313.
- Ripple, W. J., Newsome, T. M., Wolf, C., Dirzo, R., Everatt, K. T., Galetti, M., . . . Lindsey, P. A. (2015). Collapse of the world's largest herbivores. *Sci. Adv.* 1, e1400103. In.
- Rosendal, K., & Schei, P. J. (2012). Convention on Biological Diversity: from national conservation to global responsibility. In *International Environmental Agreements* (pp. 119-132): Routledge.
- Salvadori, T. (1922). Missione zoologica del Dott. E. Festa in Cirenaica: I-Uccelli. *Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino* 36(738), 318-352.
- Schipper, J., Chanson, J. S., Chiozza, F., Cox, N. A., Hoffmann, M., Katariya, V., . . . Temple, H. J. (2008). The status of the world's land and marine mammals: diversity, threat, and knowledge. *Science* 322(5899), 225-230.

- Scortecci, G. (1934). Ofidi velenosi della Somalia italiana: Istituto poligrafico dello Stato.
- Scortecci, G. (1935). Relazione preliminare delle ricerche zoologiche eseguite nel Fezzàn per conto della Reale Società Geografica. Bollettino della Società Geografica Italiana, 279-291.
- Stokes, K., Broderick, A., Canbolat, A., Candan, O., Fuller, W., Glen, F., . . . Distributions. (2015). Migratory corridors and foraging hotspots: critical habitats identified for Mediterranean green turtles. Diversity, 21(6), 665-674.
- Vié, J.-C., Hilton-Taylor, C., & Stuart, S. N. (2009). Wildlife in a changing world: an analysis of the 2008 IUCN Red List of threatened species: IUCN.
- Wilson, D. E., & Reeder, D. M. (2005). Mammal species of the world: a taxonomic and geographic reference (Vol. 1): JHU press.
- Wudl, F., Wobschall, D., & Hufnagel, E. J. (1972). Electrical conductivity by the bis (1, 3-dithiole)-bis (1, 3-dithiolium) system. Journal of the American Chemical Society 94(2), 670-672.
- Zavattari, E. (1937). Ricerche faunistiche in Africa Orientale. Italian Journal of Zoology 8(1), 247-253.