



Biodiversity Assessment of Wild Animal Species in Barware, Gulli, and Atroshe Areas of Duhok Governorate, Kurdistan Region of Iraq

Avraz Hassan Mustafa¹ , Nizar Jalal Hussein^{1*} , Muhammad Owais^{2*}

¹Department of Environmental Sciences, College of Science, University of Zakho, Duhok, Kurdistan Region of Iraq

²Department of Zoology, Ghazi University, Dera Ghazi Khan, Punjab, Pakistan

*Corresponding Author e-mail: nizar.hussein@uoz.edu.krd

Keywords	Abstract
biodiversity wild Animal Duhok Governorate vulnerable fauna territory	This study was conducted in Duhok Governorate in Iraq's Kurdistan Region and evaluated the mammalian biodiversity within the eighteen rural regions of Barware, Gulli, and Atroshe districts. The five important mammalian taxa with resident populations were identified and quantified such as <i>D. dama</i> , <i>C. lupus</i> , <i>C. aegagrus</i> , <i>U. arctos</i> , and <i>Acinonyx jubatus venaticus</i> . Data analysis examined significant distribution in species and found heterogeneousness in the charted areas, Wild Goat populations displaying remarkably higher prevalence with the n=338 noted observations while Asiatic Cheetah remained remarkably rare with (n=2 recognized findings. This study highlights the considerable biological value of mountainous territory which regarded as vital shelter for vulnerable fauna, the targeted conservation measures require to prevent the fauna from habitat decline and anthropogenetic battle dynamics.
Cite	
Mustafa, A.H., Hussein, N.J. & Owais, M. (2025). Biodiversity Assessment of Wild Animal Species in Barware, Gulli, and Atroshe Areas of Duhok Governorate, Kurdistan Region of Iraq. <i>International Journal of Environmental Science and Green Technology</i> , 1(4), 32-38. doi: 10.5281/zenodo.18641562	
Article Process	
Submission Date: 17.11.2025; Revision Date: 30.11.2025; Accepted Date: 12.12.2025; Published Date: 25.12.2025;	

INTRODUCTION

The Kurdistan Region of Iraq recognized as the noteworthy area of biological variety, dominated landscape rocky foothills and diverse ecologies and supports different groupings of wildlife with the periods of provincial combat and variability (Ndaka, 2025). The northern Iraq areas such as Zagros Mountains successively offers dangerous shelter for numerous endangered vulnerable and species (Kaky *et al.*, 2022). Though, these populations habitat loss due to mounting pressures created by the human activities such as destruction, and prohibited hunting effects climate change which threaten loss of mammals (Al-Obaidi *et al.*, 2023).

Duhok Governorate in the northern part of the Kurdistan Region epitomize important zones with the significant portions of mountain ecosystems such as Barware, Gulli, and Atroshe areas (Al-Obaidi *et al.*, 2023). These areas particularly effected due to the human activities and intersect with wildlife corridors producing coexistence and potential for conflict (Elisa *et al.*, 2024). These ecological regions also contain inadequate organized documentation of wildlife populations and dispersal designs (Gross *et al.*, 2021). The *C. aegagrus* found in the areas of Zagros Mountains areas, which regarded as the ancestor of domestic goats and serves as a keystone species in the ecosystems by preserves wild populations (Al-Sheikhly *et al.*, 2020; Modabbernia *et al.*, 2021).

Similarly, *C. lupus*, *U. arctos* as a large carnivore play vital role in keeping the biological stability but both species face growing terrorizations from human oppression (Farhadinia *et al.*, 2018). The *A. venaticus* widely dispersed in the Middle East but its catastrophic population declines and functionally extinct in Iraq (Farhadinia *et al.*, 2017). The Iraqi local communities accumulated through wildlife generations of coexistence and recognized as the powerful tool for rapid biodiversity valuation (Turvey *et al.*, 2014). The wildlife distributions through community constructed surveys particularly in regions wherever conformist survey approaches face logistical and security encounters (Vaske *et al.*, 2023). This study was designed to determine the presence and abundance of wild animal species in the Barware, Gulli, and Atroshe areas for future conservation development and wildlife organization strategies in the region.

METHODOLOGY

Study Area

This study was designed across eighteen villages situated in the Barware, Gulli, and Atroshe zones of Duhok Governorate, Kurdistan Region of Iraq. The surveyed villages such as Baze, Xshxasha, Ekmale, Betkar, Beduhe, Trwansh, Kani Mase, Tshish, Desheshe, Qomri, Adne, Ora, Binavi, Beguva, Sorrya, Hrore, Mercida, and Blan. These areas categorized by mountainous territory with advancements ranging from 800 to 2,500 meters at the above sea level. These areas characterize slope of human population, the landscape contains oak woodlands, alpine meadows, and rocky ridges with the diverse habitats for wildlife. The climate is Mediterranean with cold winters and hot, dry summers and provide settlements and proximity to endangered uninterrupted natural areas.

Data Collection

The semi-structured interview surveys with local residents' methodologies were carried out to collect the data between March and September 2024. This approach was selected due to efficacy in gathering wildlife data in regions with the direct observation surveys that face logistical constraints (Brittain *et al.*, 2020). In each village, 8-15 respondents' interviews were conducted based on their widespread data of the local location such as shepherds, hunters, farmers, and elderly community members that contain the lifelong experience in the area. The Interview sessions conducted in Kurdish and persisted between 45 and 90 minutes to ensure the clear communication and cultural sensitivity. The five target species selected due to their conservation significance and ancient occurrence in the region such as Wild Goat (*Capra aegagrus*), Grey Wolf (*Canis lupus*), Asiatic Cheetah (*Acinonyx jubatus venaticus*), Brown Bear (*Ursus arctos*), and Fallow Deer (*Dama dama*). The respondents were inquired about detections, encounters, and sign of occurrence (tracks, scat, vocalizations) during the earlier 24 months. To lessen recall bias and data consistency, the photo documentation aids and comprehensive species descriptions was recorded and respondents were asked to estimate the frequency of encounters and maximum group sizes. The information was cross-validated by interviewing numerous independent respondents in each village and without reports that could not be documented or watched unpredictable.

Data Analysis

The descriptive statistics were premeditated into a matrix format that display species occurrences across in the all-surveyed locations, to summarize distribution patterns and to recognize locations of specific conservation significance.

RESULTS

The highest abundances of Wild Goats in the seventeen surveyed villages were documented in Baze (55 individuals), Hrore (45 individuals), and both Beduhe and Desheshe (35 individuals each). The only one village Sorrya reporting no observations. The cumulative total of Wild Goats was 338 that represent large mammal frequently encountered in the study area. Grey Wolves distribution pattern reported in all eighteen surveyed villages with the highest encounter rates was in Baze that represent 14 individuals and Ora that indicated 8 individuals. The total 90 observation reported in all locations relatively stable widespread wolf population Asiatic Cheetah was found rare with the only two reports, one individual in Beguva and the other one was in the Hrore villages. The feasibility of cheetah populations recorded extremely limited remarks and raise questions in this region about the current population, designate extreme rarity with the local extinction with only temporary individuals. Brown Bears with a cumulative total of 24 observations were reported in thirteen villages. The highest numbers were documented in Ekmale, Kani Mase, and Hrore with the 3 individuals each. The absence of bear reports in five villages Xshxasha, Betkar, Beduhe, Ora, and Beguva that indicating the actual dispersal patterns with the habitat. The Fallow Deer reported in only four villages such as Xshxasha with 23 individuals, Mercida with 16 individuals, Blan with 12 individuals, Tshish with 5 individuals indicated notably restricted distribution. The total of 56 observations concentrated in these specific locations with the suitable habitat (table 1).

Table 1. Distribution and Relative Abundance of Wild Animal Species in Selected Villages of Barware, Gulli, and Atroshe Areas, Duhok Governorate

Location	Wild Goat	Grey Wolf	Asiatic Cheetah	Brown Bear	Fallow Deer
Baze	55	14	-	2	-
Xshxasha	5	6	-	-	23
Ekmale	18	4	-	3	-
Betkar	20	2	-	-	-
Beduhe	35	2	-	-	-
Trwansh	30	3	-	1	-
Kani Mase	2	5	-	3	-
Tshish	4	5	-	2	5
Desheshe	35	7	-	1	-
Qomri	25	5	-	2	-
Adne	20	6	-	2	-
Ora	30	8	-	-	-
Binavi	8	4	-	1	-
Beguva	2	3	1	-	-
Sorrya	-	2	-	1	-
Hrore	45	5	1	3	-
Mercida	4	6	-	-	16
Blan	-	3	-	1	12
Total	338	90	2	24	56

DISCUSSION

This study examines the current status of wildlife biodiversity in the Barware, Gulli, and Atroshe areas of Duhok Governorate. It exposes populations of numerous large mammal species by abundance patterns and distribution ranges. The present study indicated the widespread distribution and relatively high abundance of Wild Goats in all the surveyed villages. Yusefi *et al.* (2019) conducted study on Zagros ecosystem and found Wild Goats to the rocky hilly land and described the well-adapted characteristic in areas with moderate human disturbance. However, species found in this study faces threats from overhunting and struggle with inland livestock for fodder resources. Mohammadi *et al.* (2021) described Wild Goat populations declines due to inadequate protection enforcement and high levels of livestock grazing in areas. Capó *et al.* (2022) studied the robust presence Wild Goat populations due to the immediate conservation intervention and effective measures in preventing population declines.

The Grey Wolves in villages indicated the adaptableness and wide environmental tolerance, the distribution imitates wolves' attraction with domestic livestock due to the increasing human-wildlife conflict. Tourani *et al.* (2014) described that wolves in the Middle East face livestock predation, despite their vital ecological role in variable herbivore inhabitants and preserving ecology wellbeing. van Eeden *et al.* (2021) described the ecological value of wolves in the rural communities through initiatives of conservation plans, and found genuine concerns related to livestock, and guard dogs with the recompense plans. Almasieh *et al.* (2019) studied the Kurdistan mountainous regions and found Brown Bears in multiple locations with relatively low numbers with bear populations. Owais *et al.* (2023) described that Bears need widespread household ranges to varied food sources. But in this study the scattered distribution pattern detected with the large spatial requirements at low population capability. Owais *et al.* (2024) examine that the bears face severe threats due to the habitat fragmentation and human persecution. The two Asiatic Cheetah in villages consistent with endangered species distributed in Middle East, the breeding population declines with remain of 50 individuals confined to Iran with confirmed catastrophic population (Khalatbari *et al.*, 2023).

In this study the restricted distribution of Fallow Deer in four villages, these locations such as in Xshxasha, Mercida, Blan, and Tshish contain critical habitat features. Similarly, in the Middle East populations declined dramatically due to habitat loss and hunting pressure with the mixed woodland-grassland mosaics (Masseti, 2024). Marucco *et al.* (2011) described the genetic sampling that enable population assessment by non-invasive methods with the additional validation of species by Track and sign surveys. O'Connell *et al.* (2011) studied habitat features associated with species occurrence with the photographic documentation and the individual identification of species with distinctive markings. Ndaka (2025) described valuable for rapid assessment with the covering large areas and also studied varying abilities to accurately identify species. Pettersson *et al.* (2021) also studied the relative abundance of wild species with the precise population estimates, Additionally, reported numbers for duplicate counting of individuals. These findings described the Barware, Gulli, and Atroshe areas as important refugia for threatened wildlife in the Kurdistan Region, the increasing human pressure poses serious risks to population. It also demonstrated the importance of conservation measure to ensure long-term wildlife survival.

CONCLUSION

This study creates information on wild animal biodiversity of eighteen villages of the Barware, Gulli, and Atroshe areas in Duhok Governorate, Kurdistan Region of Iraq. It found five large mammal species that indicating the valuable wildlife populations and confirmed the presence of conservation importance. Wild Goats and Grey Wolves found widespread while Brown Bears limited at lower densities and Fallow Deer occur to a few critical habitats. The records of Asiatic Cheetah found

imminent risk, these findings highlight the need of targeted conservation actions to prevent further population declines and to support long-term wildlife conservation.

Author Contribution

AHM collected data, NJH wrote the manuscript, and MO proofread the manuscript.

Conflict of Interest

None

Acknowledgements

The authors would like to thank people who helped us collecting data from different areas.

REFERENCES

- Almasieh, K., Rouhi, H., & Kaboodvandpour, S. (2019). Habitat suitability and connectivity for the brown bear (*Ursus arctos*) along the Iran-Iraq border. *European journal of wildlife research*, 65(4), 57. <https://doi.org/10.1007/s10344-019-1295-1>
- Al-Obaidi, R. M., Hussein, R. H., Shaker, A. S., Ameen, Q. A., Ararat, K., Khidhir, Z. K., & Al-Sada, I. H. A. (2023). Conservation Medicine and Biodiversity in Iraq. One Health Triad, Unique Scientific Publishers, Faisalabad, Pakistan, 1, 209-219. <https://uniquescientificpublishers.com/wp-content/uploads/2023/oht-v1/209-219.pdf>
- Al-Sheikhly, O. F., Haba, M. K., Al-Barazengy, A. N., & Fazaa, N. A. (2020). New distribution range of the vulnerable wild goat (*Capra aegagrus Erxleben, 1777*)(*Artiodactyla: Bovidae*) to the south of its known extant in Iraq, with notes on its conservation. *Bonn Zoo. Bull*, 105-110. <https://doi.org/10.20363/BZB-2020.69.1.105>
- Brittain, S., Ibbett, H., de Lange, E., Dorward, L., Hoyte, S., Marino, A., Milner-Gulland, E. J., Newth, J., Rakotonarivo, S., Veríssimo, D., & Lewis, J. (2020). Ethical considerations when conservation research involves people. *Conservation Biology*, 34(4), 925-933. <https://doi.org/10.1111/cobi.13464>
- Capó, M., Cursach, J., Picorelli, V., Baraza, E., & Rita, J. (2022). Eradication of feral goats, not population control, as a strategy to conserve plant communities on Mediterranean islets. *Journal for Nature Conservation*, 65, 126108. <https://doi.org/10.1016/j.jnc.2021.126108>
- Elisa, M., Caro, T., Yon, L., Hardy, I. C., Roberts, S., & Symeonakis, E. (2024). Wildlife corridor degradation and human-wildlife conflict: a case study from Tanzania. *African Journal of Ecology*, 62(2), e13264. <https://doi.org/10.1111/aje.13264>
- Farhadinia, M. S., Johnson, P. J., Hunter, L. T. B., & Macdonald, D. W. (2017). Wolves can suppress goodwill for leopards: patterns of human-predator coexistence in northeastern Iran. *Biological Conservation*, 213, 210-217. <https://doi.org/10.1016/j.biocon.2017.07.011>
- Farhadinia, M. S., Johnson, P. J., Hunter, L. T., & Macdonald, D. W. (2018). Persian leopard predation patterns and kill rates in the Iran-Turkmenistan borderland. *Journal of Mammalogy*, 99(3), 713-723. <https://doi.org/10.1093/jmammal/gyy047>

- Gross, E., Jayasinghe, N., Brooks, A., Polet, G., Wadhwa, R., & Hilderink-Koopmans, F. (2021). A future for all: the need for human-wildlife coexistence. WWF, Gland, Switzerland). Design and infographics by Levent Köseoglu, WWF-Netherlands Text editing by ProofreadNOW. com Cover photograph: DNPWC-WWF Nepal, 3. <https://www.wwf.nl/globalassets/pdf/nieuws/a-future-for-all-the-need-for-human-wildlife-coexistence.pdf>
- Kaky, E. D., Alatawi, A. S., Jaf, A. A., & Gilbert, F. (2022). Predicting current and future habitat refuges for conservation of wild goat (*Capra aegagrus Erxleben 1777*) under climate change in Iraq. *Journal of Arid Environments*, 199, 104699. <https://doi.org/10.1016/j.jaridenv.2021.104699>
- Khalatbari, L., Godinho, R., Abolghasemi, H., Hakimi, E., Ghadirian, T., Jowkar, H., & Brito, J. C. (2023). The persistence of the critically endangered Asiatic cheetah relies upon urgent connectivity protection: a landscape genetics perspective. *Conservation Genetics*, 24(4), 461-472. <https://doi.org/10.1007/s10592-023-01513-6>
- Marucco, F., Boitani, L., Pletscher, D. H., & Schwartz, M. K. (2011). Bridging the gaps between non-invasive genetic sampling and population parameter estimation. *European Journal of Wildlife Research*, 57(1), 1-13. <https://doi.org/10.1007/s10344-010-0477-7>
- Masseti, M. (2024). Towards distant seas and lands: circulation of zoological species and ideas in the Mediterranean region and the Near East during the 1st millennium BC. *Circulations animales et zoogéographie en Méditerranée:(Xe siècle AV. J.-C.-Ier siècle APR. J.-C.)-(Collection de l'École française de Rome 0223-5099; 622)*, 37-72. https://link.springer.com/chapter/10.1007/978-3-030-57570-0_2
- Modabbernia, G., Meshgi, B., & Eslami, A. (2021). Diversity and burden of helminthiasis in wild ruminants in Iran. *Journal of Parasitic Diseases*, 45(2), 394-399. <https://doi.org/10.1007/s12639-020-01314-5>
- Mohammadi, A., Almasieh, K., Nayeri, D., Ataei, F., Khani, A., López-Bao, J. V., ... & Cushman, S. A. (2021). Identifying priority core habitats and corridors for effective conservation of brown bears in Iran. *Scientific reports*, 11(1), 1044. <https://doi.org/10.1038/s41598-020-79970-z>
- Ndaka, F. E. (2025). A Comprehensive Survey on the Natural Resources of Iraq: Insight into Possible Regional Development. *Knowledge-Based Engineering and Sciences*, 6(1), 38-63. <https://doi.org/10.51526/kbes.2025.6.1.38-63>
- O'Connell, A. F., Nichols, J. D., & Karanth, K. U. (2011). *Camera traps in animal ecology: methods and analyses* (Vol. 271). New York: Springer. <https://link.springer.com/book/10.1007/978-4-431-99495-4>
- Pettersson, H. L., Quinn, C. H., Holmes, G., Sait, S. M., & López-Bao, J. V. (2021). Welcoming wolves? Governing the return of large carnivores in traditional pastoral landscapes. *Frontiers in Conservation Science*, 2, 710218. <https://doi.org/10.3389/fcosc.2021.710218>
- Tourani, M., Moqanaki, E. M., Boitani, L., & Ciucci, P. (2014). Anthropogenic effects on the feeding habits of wolves in an altered arid landscape of central Iran. *Mammalia*, 78(1), 117-121. <https://doi.org/10.1515/mammalia-2012-0119>
- Turvey, S. T., Fernández-Secades, C., Nuñez-Miño, J. M., Hart, T., Martinez, P., Brocca, J. L., & Young, R. P. (2014). Is local ecological knowledge a useful conservation tool for small mammals in a

Caribbean multicultural landscape? *Biological Conservation*, 169, 189-197.
<https://doi.org/10.1016/j.biocon.2013.11.018>

van Eeden, L. M., Bogezi, C., Leng, D., Marzluff, J. M., Wirsing, A. J., & Rabotyagov, S. (2021). Public willingness to pay for gray wolf conservation that could support a rancher-led wolf-livestock coexistence program. *Biological Conservation*, 260, 109226.
<https://doi.org/10.1016/j.biocon.2021.109226>

Vaske, J. J., Don Carlos, A. W., Manfredo, M. J., & Teel, T. L. (2023). Evaluating alternative survey methodologies in human dimensions of wildlife research. *Human Dimensions of Wildlife*, 28(4), 320-334. <https://doi.org/10.1080/10871209.2022.2057622>

Yusefi, G. H., Faizolahi, K., Darvish, J., Safi, K., & Brito, J. C. (2019). The species diversity, distribution, and conservation status of the terrestrial mammals of Iran. *Journal of Mammalogy*, 100(1), 55-71. <https://doi.org/10.1093/jmammal/gyz002>