



Ecological Survey of Snakes around Ajdabiya, Eastern Libya, and the Effects of Human Disturbance on Their Populations

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ABSTRACT

This research presents the first detailed examination of snake populations and the threats they face in the vicinity of Ajdabiya, Eastern Libya. A total of five snake species from four families (Elapidae, Viperidae, Colubridae, and *Psammophis sibilans*) were recorded. The conflict between humans and wildlife has long been a pressing issue, exacerbated by urban expansion and the growth of residential areas. Rapid development has made urban sprawl inevitable, leading to increased demand for land not only for agriculture but also for livestock grazing in recent years. As a result, vast areas have suffered severe degradation, contributing to the decline of various ecological communities, including snakes. We strongly recommend immediate action, including support for the Ajdabiya National Reserves Establishment Programme, reinforcement of the Red Line Environmental Conservation Initiative, and the expansion of broader environmental protection programmes to mitigate further ecological harm.

مسح بيئي للثعابين حول أجدابيا شرق ليبيا وآثار التدخل البشري على أعدادها

حسام دخيل

قسم الأحياء، كلية العلوم، جامعة أجدابيا، أجدابيا، ليبيا.

الكلمات المفتاحية:

الأفعويات.
الأفعاعي.
أفعى الرمل.
العربيد.
تغير الموطن
ثعابين ضواحي أجدابيا.

الملخص

يمثل هذا البحث أول دراسة مفصلة للثعابين والتهديدات التي تواجهها في محيط أجدابيا، الواقعة شرق ليبيا. وقد سجلت ثعابين من أربع عائلات (العربيد، الأفعاعي، أفعى الرمل، الأفعويات) وخمسة أنواع. لطالما كان الصراع بين البشر والكائنات الحية الأخرى مشكلة مزمنة، ازدادت حدتها مع التوسيع العمراني ونمو المناطق السكنية. وقد جعل النمو السريع التنمية الحضرية أمراً حتمياً، مما أدى إلى زيادة الطلب على مساحات شاسعة من الأراضي. وقد تستخدمت هذه الأرضي ليس فقط للأغراض الزراعية، بل أيضاً لأنشطة مثل رعي الماشية، خلال السنوات الأخيرة. وقد تدهورت مساحات شاسعة بشكل حاد، مما أدى إلى تراجع في أعداد مختلف المجتمعات البيئية، بما في ذلك الثعابين. نوصي بشدة باتخاذ إجراءات سريعة، بما في ذلك تعزيز برنامج دعم وإنشاء محميات أجدابيا الوطنية، ومبادرة الخط الأحمر للحفاظ على البيئة، وتعزيز البرامج التي تهدف إلى حماية البيئة الطبيعية من الأذى.

1. Introduction

The regions surrounding Ajdabiya specifically AlArbaeen and Al-Brega to the west, Al-Qanin to the south, and Al-Zweitina to the east and north support a growing population, partly due to their proximity and affordable land prices. These factors have encouraged many to purchase property on the city's outskirts. However, land use changes, taxonomic uncertainty, and fluctuations in reptile populations have complicated the assessment of current snake diversity in the region. The population of Ajdabiya is projected to reach approximately 416,000 people by 2025 (Civil Registry Office). Humans are widely regarded as a major contributor to the extinction

of numerous species globally, though the specific causes vary across regions. In this context, many local farmers report the annual loss of livestock, including sheep, due to poisoning and snakebites. Such incidents foster fear among herders and rural residents, often resulting in the deliberate killing of snakes [1]. Both direct impacts—such as urban expansion and land reclamation—and indirect ones, like hunting for trade or sport, have led to the decline of reptilian populations [2,3]. Libya is home to approximately 18 snake species. Of the estimated 3,700 snake species worldwide, five were identified in this study area—three venomous and two non-venomous [4]. Snakes in the region inhabit abandoned animal dens, rocky crevices, caves, trees,

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and sand dunes. Their diet typically consists of rodents, rabbits, small birds and their eggs, lizards, and sometimes other snakes [5]. The likelihood of human-snake encounters in town varies depending on proximity to vegetation, agricultural activity, and human settlement growth [6].

The Egyptian cobra family (Elapidae), which includes approximately 389 species, is represented in the outskirts of Ajdabiya by two species: *Walterinnesia aegyptia* [7] and *Naja haje* [8]. *Cerastes cerastes*, commonly known among locals, is a nocturnal, ground-dwelling viper. These snakes do not climb trees but often bury themselves in the sand. Due to their highly toxic venom, they are classified as extremely dangerous and were found across all surveyed areas in the Ajdabiya outskirts [9].

Among the mildly venomous and non-venomous species recognised by the local population are *Psammophis sibilans* and *Lytorhynchus diadema*. These two species were recorded in this study but were the least widespread, typically found in more vegetated areas [10,11].

Given the substantial ecological variation across Libya especially in climate, terrain, and vegetation the composition of snake species also varies considerably. There is a pressing need to document the basic biology and ecological roles of these reptiles [12,13].

This study aimed to determine whether common snake species in the area have been displaced due to environmental pressures. It also investigated whether biological factors contribute to the disappearance of certain species, and to what extent urbanisation, land reclamation, and increased grazing pressure from camels and sheep contribute to population decline. Ultimately, the research aims to shed light on the status of often-misunderstood or marginalised wildlife.

2. Material and Methods

2.1 Study area

Ajdabiya is located in the far north of Libya, approximately 160 km south of Benghazi, near the Mediterranean coast. Its strategic geographic position has made it a centre of stability and communication since antiquity [14].

Ajdabiya lies at approximately 30.75°N, 20.22°E (30° 45' 20" N, 20° 13' 31" E), at an elevation of 12 metres (39 feet) above sea level. The city sits on flat land at the centre of a vast coastal desert plain, with elevation gradually increasing to the east and southeast.

To the west lies a low, sandy plain with multiple salt marshes. The northern boundary connects to a coastal desert strip extending to Benghazi. To the south, the land transitions into rocky terrain that stretches westward along the southern coastal road to Brega, around 10 km away, followed by expansive desert. To the southwest are the Al-Sham and Al-Shwerif lagoons, both situated 9 metres below sea level. The Al-Hamra and Al-Qanin lagoon areas lie to the southeast, while the Taleb lagoon is located to the northwest [15].

Although snakes are typically observed in remote, uninhabited areas, this does not mean they are absent from more populated regions. Some species previously considered extinct such as the Egyptian snake (*Walterinnesia aegyptia*) have been rediscovered. Snakes are widespread across Ajdabiya's suburbs and have been observed and collected in multiple areas (Fig. 1), including Al-Arbaeen, Brega, Al-Baidhan, Al-Zweitina, and various farms in northern Ajdabiya, particularly those near the sea.



Fig.1: Locations of 266 snake callout records in the Ajdabiya outskirts areas between 2023 and 2024. The primary areas where callouts rural areas outside were frequently attended with scattered records in the densely populated urban areas.

2.2 Snake Data

Field studies involving live snakes are indeed feasible, though they often present considerable logistical challenges. Our research centred on analysing data obtained through snake removals, gathered either via direct observation during our fieldwork or through reports from residents regarding snakes found or captured in their homes. These homes were situated on land repurposed for agriculture, housing, or grazing purposes. Throughout our investigations in 2023 and 2024, we recorded a significant number of snakes, especially on agricultural properties, which were promptly removed and reported for documentation. The data we reviewed included details such as the species, the number of snakes removed, and the specific site of removal. We categorized the identified species based on the

knowledge and experience of the local population. This classification included levels of venomousness (highly venomous or non-venomous) and the degree of threat they posed to humans and pets. Most participants did not document the exact scientific names of the snakes; rather, they used common or colloquial names. For instance, *N. haje* was referred to as "Egyptian cobra," *W. aegyptia* as "black cobra," *C. cerastes* and *P. sibilans* as "cobra-like," and *L. diadema* as "crown-nosed leaf-nosed." The recorded species were subsequently classified using information from the Reptile Database [16].

3. Data analysis

For our data analysis, we utilized Google Earth (version 7.3.6) to visually represent spatial data for the areas surrounding Ajdabiya

across all four directions. Additionally, Microsoft Excel version 21 was employed to graphically summarize the data, including inventory and count locations.

4. Results

The results clearly indicate that population expansion and agricultural land use in the surrounding areas (Fig. 2), are associated with increased snake displacement. A significant number of snakes have been reported as being removed from reclaimed land, road construction areas, and by camel and sheep breeders. While certain species are classified as non-venomous, the limited awareness among residents about these harmless types has resulted in the unnecessary removal of many snakes. The study data add to the known composition of the city's snake community. The four families involved in human snake collisions during 1st January 2023 to 31st December 2024 reporting. Snakes found on farms and in herding areas are promptly

removed due to concerns that they might be venomous, posing a threat to livestock such as camels and sheep. Livestock breeders estimate an annual loss of around 3% sheep because of snake bites. The growing removal of snakes, coupled with the destruction of their natural habitats and the decline of their prey like gerbils and rabbits, has resulted in a significant yearly drop in their population. This signalled the onset of its extinction. Although many assumed *W. aegyptia* was already lost, sporadic sightings rare as they were continued to be reported (Fig 3) (B) *Walterinnesia aegyptia*.

A significant number of snakes were reportedly killed by the local population, and it is no exaggeration to state that over 90% of the snakes encountered were promptly eliminated. Instances of these removals have been documented, with various species being identified and dealt with.



Fig.2: Map illustrating the population growth and land reclamation across in the Ajdabiya outskirts in all directions, focusing on areas such as Al-Arbaeen and Brega to the west, Al-Qanin to the south, and Zweitina to the east and north of the city.

During the study period, a total of 266 snakes from five species (Table 1) were recorded in the suburbs of Ajdabiya. Many species were from the Viperidae family (151), and the smallest number Elapidae (16,17).

Relative abundance data showed that *C. cerastes* (Linnaeus, 1758) was the most abundant $n = 151$, 56.77%, followed by *P. sibilans* (Leopold Fitzinger, 1843) $n = 54$, 20.30%, *L. diadema* (Dumeril, Bibron, and Dumeril, 1854) $n = 45$, 16.92%, the least abundant *N. haje* (Linnaeus, 1758) $n = 10$, 3.76%, and the least abundant *W. aegyptia* (Lataste,

1887) $n = 6$, 2.26%, of the total documented species (Table 1). At the species level, *C. cerastes* was the most frequently observed species with (151) occurrences, and the least frequently observed species, with six occurrences. Three of the total observed species were identified as venomous snakes. The snakes include *C. cerastes*, *W. aegyptia*, *N. haje*, the moderately venomous *P. sibilans*, and the non-venomous *L. diadema* (Fig. 4).

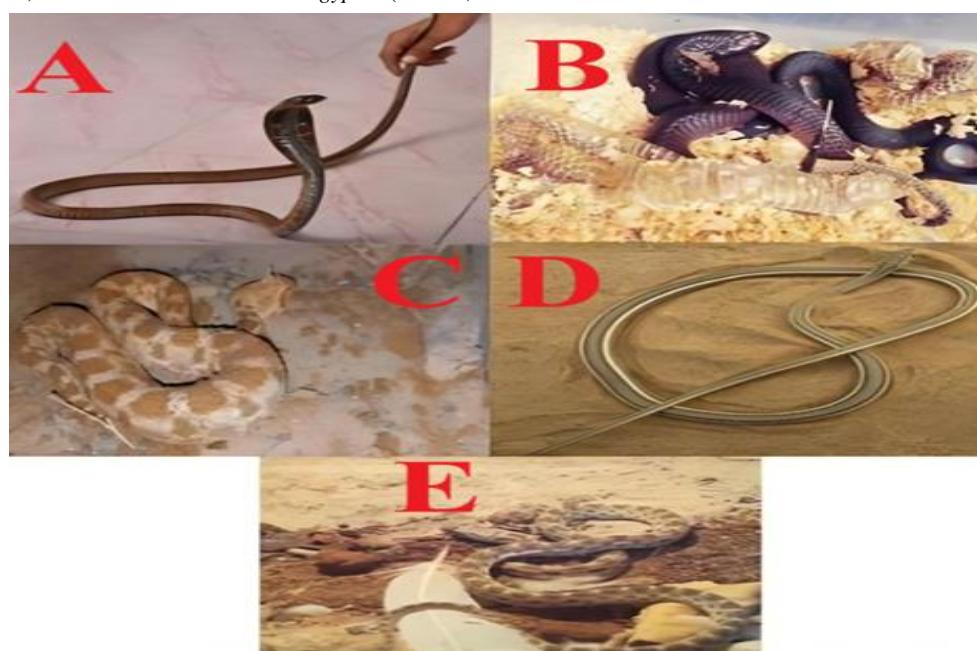
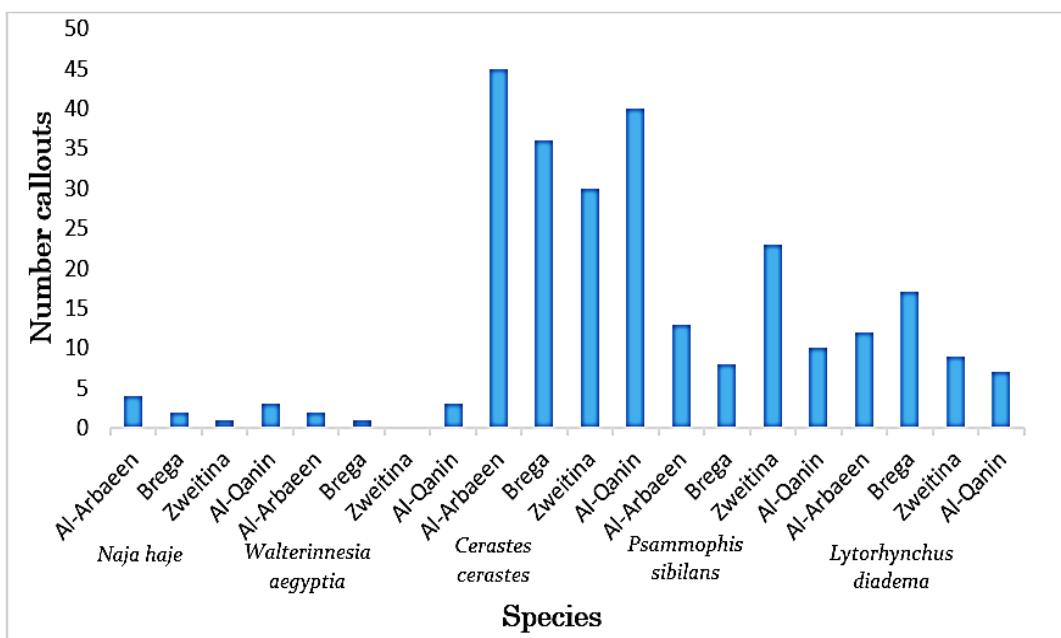


Fig.3: Species of snakes observed in the Ajdabiya outskirts, Libya, during this study: (A) *Naja haje*, (B) *Walterinnesia aegyptia*, (C) *Cerastes cerastes*, (D) *Psammophis sibilans*, (E) *Lytorhynchus diadema*.

Table 1: Types and numbers of snakes found during a two-year period in the Ajdabiya outskirts, Libya.

Family	Species	C. name	N 2023 - 2024	Locality	Venom	IUCN
Elapidae	<i>Naja haje</i>	Egyptian cobra	4	Al-Arbaeen	High	Red List
			2	Brega	High	Red List
			1	Zweitina	High	Red List
			3	Al-Qanin	High	Red List
Elapidae	<i>W. aegyptia</i>	black cobra	2	Al-Arbaeen	High	Red List
			1	Brega	High	Red List
			-	Zweitina	High	Red List
			3	Al-Qanin	High	Red List
Viperidae	<i>C. cerastes</i>	Umm Junaib	45	Al-Arbaeen	High	Red List
			36	Brega	High	Red List
			30	Zweitina	High	Red List
			40	Al-Qanin	High	Red List
Psammophiidae	<i>P.sibilans</i>	Abu Al-Siour	13	Al-Arbaeen	Mild	Red List
			8	Brega	Mild	Red List
			23	Zweitina	Mild	Red List
			10	Al-Qanin	Mild	Red List
Colubridae	<i>L.diadema</i>	Paper crown nose	12	Al-Arbaeen	Non	Red List
			17	Brega	Non	Red List
			9	Zweitina	Non	Red List
			7	Al-Qanin	Non	Red List
Total			266			

C* Common name / N* Numbers collected

**Fig.4:** Number of snake species (venomous and non-venomous) observed during the 2023-2024 in the Ajdabiya outskirts.

The graph shows the residential areas surrounding Ajdabiya (Fig. 4). These areas are mainly inhabited by livestock breeders who rely on the pastures surrounding these villages. Therefore, it was essential to study these areas, not only because of their rich wildlife, but also because of their proximity to human settlements, allowing us to assess how human activity impacts local ecosystems. The Al-Arbaeen area showed the highest *C. cerastes* record, while the Brega area had the lowest record of *W. aegyptia*. while remaining records varied.

5. Population Culture of Snake Species

A study involving 1,705 participants was conducted to assess the local population's awareness of various snake species, their perceived danger levels, and typical responses upon encountering them. Most participants were male (n = 1,600, 93.84%) and belonged to the adult age group (n > 15 years, 82.40%) (Fig. 5). It was observed that most of

the snakes removed from the area were venomous, likely due to certain physical characteristics such as shape and color, which often evoke fear examples include horned snakes or brightly colored species. These traits likely heightened the perception of danger among residents, leading to their removal.

Additionally, higher income levels appeared to increase the likelihood of removing venomous snakes, possibly to protect livestock such as sheep or poultry farms within census areas. In contrast, fewer non-venomous snakes were removed during this process. The study's findings also revealed that awareness of venomous snake species across three distinct types was 83.73%, while knowledge specifically of venomous snakes among residents was 48%, compared to 41% for non-venomous snakes.

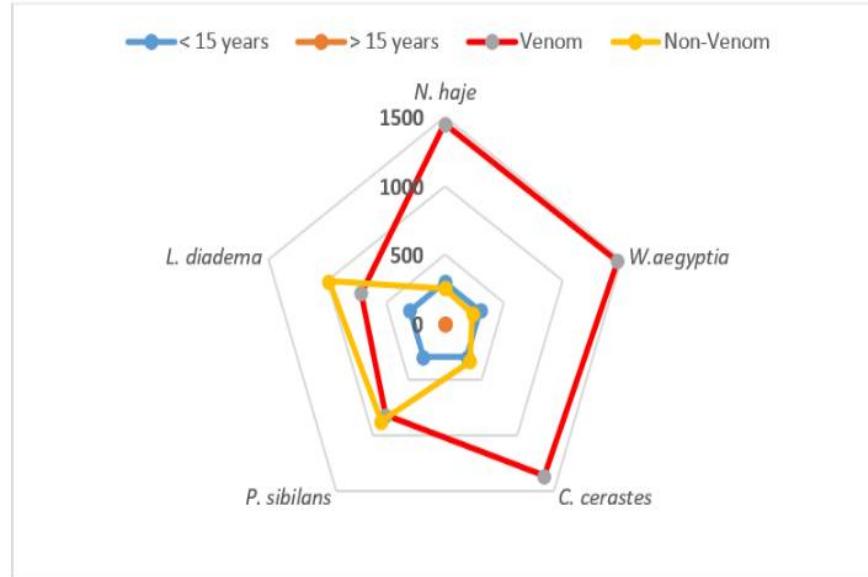


Fig. 5: Duration of residents' knowledge of different types of snakes in terms of toxicity in the Ajdabiya outskirts based on percentage (n=1,705) (2023-2024).

6. Popular culture of snakes among the locals

When participants were asked about their willingness to keep snakes as pets, approximately 5% expressed interest. The reasons given were that they enjoy keeping venomous creatures and feel a sense of excitement. As for non-venomous snakes, no one wanted to keep them. The remaining 95% feared snakes for their children and pets, believing that these creatures' natural habitat is the environment, away from humans and their animals.

Most participants had heard of protected species (70%), but when asked to list their scientific names, none of them knew what they were. However, most of them knew their popular names, including "Egyptian cobra", "black cobra", "umm Junaib", "Abu Al-Siour", and "paper crown noser". When asked about the need to protect snakes from extinction, they did not provide an answer, citing their lack of interest in wildlife, rather, get rid of it and avoid its harm.

7. Discussion

This study underscores the significant impact of urban development and agricultural practices on the displacement of native snake populations in Ajdabiya's outskirts. Between January 1, 2023, and December 31, 2024, 266 snakes belonging to five species across four families were documented. The Viperidae family emerged as the most prevalent, accounting for 151 individuals (56.77%), while the Elapidae family had the lowest representation with just 16 individuals (6.01%). *C. cerastes* dominated species observations (n = 151; 56.77%), followed by *P. sibilans* (n = 54; 20.30%) and *L. diadema* (n = 45; 16.92%). *N. haje* (n = 10; 3.76%) and *W. aegyptia* (n = 6; 2.26%) were recorded less frequently. Notably, three of these species *C. cerastes*, *W. aegyptia*, and *N. haje* are highly venomous, while *P. sibilans* is moderately venomous and *L. diadema* is non-venomous. However, limited public awareness often leads to indiscriminate snake killings, with estimates suggesting that over 90% of snakes encountered by locals are eliminated on sight. This behaviour is particularly prominent in agricultural and herding zones where concern for livestock safety, particularly camels and sheep, drives such actions. Livestock breeders report that snakebites result in an estimated annual loss of approximately 3% of sheep. Moreover, habitat destruction, declining prey availability (such as gerbils and rabbits). This research provides crucial baseline data on the diversity and abundance of snake species in Ajdabiya, declining prey availability (such as gerbils and rabbits), and escalating human-wildlife conflict have collectively fuelled a significant annual decline in snake populations, raising urgent conservation concerns. Some species, such as *W. aegyptia*, were considered locally extinct but occasional sightings indicate they may be critically endangered rather than extirpated. This research provides crucial baseline data on the diversity and abundance of snake species in Ajdabiya. Addressing concerns about snake species is difficult under policies that view snake conservation as an anomaly and require convincing residents, landowners, and farmers of the importance of preserving these peaceful creatures. The study data also provide insights into

the city snake community.

This may also be due to changes in the snake community in the area, although further investigation will require long-term follow-up. The five snake species involved in human encounters are evidence of their presence and confinement during the research period.

8. Conclusion

This study reveals a clear link between anthropogenic land use and the decline in snake populations around Ajdabiya. The heavy concentration of snake-human conflict in agricultural and pastoral areas, combined with widespread misunderstanding of snake species, has resulted in significant ecological damage and the possible local extinction of rare species such as *Walterinnesia aegyptia*.

Immediate steps are needed to educate local communities about the ecological significance of snakes and the critical need to differentiate between venomous and non-venomous types. Furthermore, targeted conservation initiatives should be launched to safeguard vulnerable species, especially in high-risk regions such as Al-Arbaeen and Brega.

Left unchecked, the ongoing destruction of habitats, indiscriminate killing of snakes, and depletion of their prey are likely to result in further biodiversity loss and destabilisation of local ecosystems. To counteract this, future research must prioritise long-term ecological monitoring and the development of sustainable strategies aimed at balancing human livelihoods with wildlife conservation across this semi-arid region.

These findings underscore the importance of community education programmes, robust conservation measures, and continuous monitoring efforts to address human-snake conflicts, safeguard fragile ecosystems, and prevent the extinction of vulnerable snake species in the area. Our initiatives to foster cultural awareness regarding the ecological importance of snakes in the regions surrounding Ajdabiya have yielded promising results. The positive reception from the local community particularly regarding ongoing research, monitoring activities, and educational outreach strongly indicates shared concerns about conservation. This support also affirms a collective commitment to avoid relocating snakes to areas perceived as safer, reinforcing the desire for a localised approach to their preservation.

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