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Inventory of wildlife in the Tlemcen Hunting Reserve

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Abstract

The Tlemcen Hunting Reserve (THR) is part of the infrastructure dedicated to the conservation of animal biodiversity. Its objective is to protect and enhance wildlife and to manage the habitats of the species living there. A total of 118 wild species have been inventoried, classified into 19 mammals, 16 reptiles, 5 amphibians, 55 birds, and 23 insects. Among these species, the THR has successfully introduced two wild species: the ostrich (*Struthio camelus camelus*) and the Barbary sheep (*Ammotragus lervia*), through effective breeding and reproduction projects. This experience has demonstrated that such breeding can succeed in Algeria, potentially having significant economic impact and offering the possibility of reintroducing species that have disappeared from our wildlife.

Keywords: Tlemcen Hunting Reserve; conservation; animal; wildlife.

الخلاصة

من اجل الحفاظ على الحياة البرية قامت الجزائر بإنشاء عدة محميات على مستوى التراب الوطني من بينها محمية الصيد في تلمسان التي تعد جزءًا من البنية التحتية المكرسة لحفظ تنوع الحياة البرية في المنطقة. هدفها هو حماية وتطوير الحياة البرية وتهيئة بيئة للأنواع التي تعيش فيها. في إطار هذا العمل الذي يهدف الى احصاء مختلف الحيوانات البرية التي تعيش في المحمية وذلك باستخدام طرق ووسائل مختلفة باختلاف نوع الحيوان بدءا بالملاحظة والتتبع المباشر الي استخدام اليات تصوير ليلية ونهارية جد متطورة بالإضافة الى طرق اخرى، تمكنا من تسجيل 118 نوعًا بريًا مقسمة إلى 19 نوعًا من الثدييات، و16 نوعًا من الزواحف، و5 أنواع من البرمائيات، و55 نوعًا من الطيور، و23 نوعًا من الحشرات. بالإضافة الى الانواع الموجودة تمكنت المحمية من إدخال نوعين بريين، النعامة والايل البربري من خلال مشاريع ناجحة للتربية والتكاثر. أظهرت هذه التجربة أن هذا النوع من التربية يمكن أن ينجح في الجزائر، مما يمكن أن يكون له تأثير اقتصادي كبير وفرصة لإعادة إدخال الأنواع التي اختفت من الحياة البرية في بلدنا.

الكلمات الرئيسية: محمية الصيد في تلمسان؛ الحفاظ؛ الحيوانات؛ الحياة البرية

Introduction

Northwest Africa is one of the regions that deserves investigation through ecological research. On one hand, it serves as a biogeographical crossroads between the Palearctic and Afro-tropical regions (Olson et *al*., 2001). On the other hand, it belongs to the Mediterranean region, one of the world's most significant biodiversity hotspots (Myers et *al*., 2000). Spanning an area of 2,381,741 km², stretching 1,622 km from east to west, and extending nearly 2,000 km from north to south, Algeria stands out as one of the most unique countries in the western Palearctic region, geographically, climatically, and ecologically. Consequently, it is among the richest countries in biological diversity within the Mediterranean Basin. Algeria's bioclimatology and vast geographical range contribute significantly to its diverse ecosystems. The combination of these factors results in a wide variability of environments, reflected in diversity in terms of vegetation physiognomy, habitats, biotopes, landscapes, and natural resources (Abdelguerfi et *al*., 2009). However, this positive assessment needs to be qualified as the current situation appears less favorable. Indeed, despite its exceptional natural richness, Algeria has been subjected to increasing pressures from a rapidly developing society for several decades, exacerbated by the challenges of prolonged droughts. Consequently, it often experiences severe alterations and, like many other countries in the Mediterranean Basin, faces serious threats today.

Conserving different species of wildlife represents a massive undertaking for any state. It requires a significant amount of time, material and financial resources, and qualified personnel. However, ensuring the survival of an animal species doesn't necessarily have to be guaranteed in-situ. Conservation under ex-situ conditions (biological reserves, hunting centers, protected areas, etc.) often benefits the species

and prevents its extinction. The Tlemcen Hunting Reserve (THR) is part of these infrastructures dedicated to wildlife conservation. Its objective is to protect and enhance wildlife and to manage the habitats of the species living there.

Given the significant abiotic richness (terrain, relief, climate) and biotic diversity (vegetation) of THR, which translates into a wide variety of wildlife unfortunately facing several risks, we have initiated this effort aimed at inventorying wildlife within THR to improve protection and conservation conditions.

Material and methods

Presentation of the study area

The Tlemcen Hunting Reserve is located in the northwestern part of Algeria, 26 km southwest of the city of Tlemcen and approximately 10 km from the administrative district of Sabra. The reserve is part of the state forest of Hafir and occupies the highest and most wooded area of the Tlemcen Mountains. It is situated between a latitude of 34°43'45.27"N to 34°47'28.22"N and a longitude of -1°26'32.55"E to -1°30'21.62"N. The reserve covers an area of 2156 hectares and is enclosed by a Zimmerman fence along a perimeter of 25.04 km. Its boundaries are defined as follows:

To the north, it borders agricultural lands of the Sidi Ouriache valley.

To the south, it extends to the ridges and southern slopes of Djebel Ras Moutas, reaching the arable lands of El Menakher.

To the west, it borders Djorf-El-Abiod and the slopes of Djebel Boumedrer, extending to the foothills of the western slope of Djorf-El Guelâa.

To the east, its boundary reaches the summit of Ain-Djadj.

The reserve is one of four critically important reserves established nationwide and currently operational (Zeralda, Djelfa, Mascara, and Tlemcen) (RCT, 2018).

The Tlemcen Hunting Reserve was established by Decree N°83-126 dated February 12, 1983, as a public administrative institution with legal personality and financial autonomy, under the supervision of the ministry of agriculture. Since its creation in 1983 and until now, the missions of the THR has been the inventorying, protection, and development of wildlife and flora; habitat management for the species living there, including the establishment of all necessary equipment and means to ensure optimal living conditions for game animals, such as supplemental feeding through the introduction of additional crops; reintroduction of endangered game species; serving as a site for observation, research, and experimentation on the behavior of existing wildlife.

Study tools according to species

The equipment used and the methods adopted vary depending on the species of wild animals counted and their behavior.

1.Mammals

The class of mammals is so diverse that several methods have been used, with appropriate equipment including specific guides used such as, guide to the mammals of Europe, North Africa, and the Middle East (Aulagnier et *al*., 2008); guide to the mammals of Africa: Over 300 illustrated species (Kingdon, 2006); guide to animal tracks: signs of wildlife presence (Bang and Dahlström, 2001).

Direct observation method

This method relies on direct observations during field outings (Sanderson, 1966) using binoculars, flashlights, and photo camera (Canon EOS 1000D) (Valente et *al.*, 2018).

Indirect observation method

This method is based on signs of presence such as tracks, droppings, dens, burrows, hairs, etc (Valente et *al.*, 2018). It has even been employed to track certain species, although one of the main challenges encountered is the difficulty in identifying certain signs. Therefore, it is primarily used to confirm doubtful observations from other methods.

The equipment most commonly used in this method includes a graduated ruler, tweezers, trays, and water troughs surrounded by sand. Even the arrangement and location of certain signs are interpreted based on animal behavior (e.g., territorial marking behavior in carnivores).

Trapping method

- Cage trapping:

This method has mainly been used for small animals with capture cages placed on both sides within the Tlemcen Hunting Reserve (Caceres et *al*., 2011).

- Camera trapping:

The use of Maginon WK2 HD wildlife camera and photo trap with night vision has improved census management by obtaining photographs of very discreet, twilight and nocturnal species that would be very difficult to see even when on watch (Valente et *al.*, 2018; Garrote et *al.* 2011, Rovero and Marshall, 2009).

2.Birds

The ornithological population is inventoried either through direct observation with the naked eye or with the aid of binoculars, a spotting scope (Swarovski ATS 80), and a photo camera (Canon EOS 1000D). Alternatively, presence indices such as nests, feathers, or the calls and songs emitted by birds recorded on a tape recorder, as well as photographs from camera traps (Maginon WK2 HD), are used.

Identification references include; Heinzel guide to the birds of Europe, North Africa, and the Middle East (Heinzel et *al*., 2004); guide to the birdsong of Western Europe: description and comparison of songs and calls (Bossus and Charron, 2004).

Taking into account the season and meteorological conditions to optimize results, whether for migratory birds, sedentary species, or those active during diurnal, nocturnal, and crepuscular periods.

3.Herpetofauna

For the inventory of amphibian and reptile classes, we utilized either direct observation along transects or trapping using amphibian traps or dip nets. We also employed listening and recording their sounds using a tape recorder. Identification references include, the herp guide: 228 amphibians and reptiles of Europe (Arnold and Ovenden, 2010).

Results

The reserve, as a fenced area, minimizes anthropogenic activity and provides more tranquility to the species it harbors. The hunting facilities implemented within the reserve (water points, watering holes, reservoirs, fodder crops, etc.) have allowed the existing wildlife to find optimal survival conditions. The heterogeneity of the vegetation cover and the geomorphological characteristics of the reserve provide ideal habitats for a rich and diverse fauna. The fauna consists of 118 species distributed as follows: 19 mammals (Table I; Figure 1), 16 reptiles and 05 amphibians (Table II; Figure 2), 55 birds (Table III; Figure 3), and 23 insects (Table IV; Figure 4)

Table 1. List of mammals of Tlemcen Hunting Reserve.

Order	Family	Common name	Scientific name
Carnivores	Canidae	African Golden Wolf	*Canis anthus*
		Red fox	*Vulpes vulpes*
		Striped Hyaena	*Hyaena hyaena*
	Mustelidae	Least Weasel	*Mustela nivalis*
		Common Genet	*Genetta genetta*
	Viverridae	Egyptian Mongoose	*Herpestes ichneumon*
	Félidae	Wildcat	*Felis silvestris*
Artiodactyles	Suidae	Wild Boar	*Sus scrofa*
	Cervidae	European Fallow Deer	*Dama dama*
	Bovidae	Barbary Sheep	*Ammotragus lervia*
		Cuvier's gazelle	*Gazella cuvieri*
		Dorcas Gazelle	*Gazella dorcas*

Lagomorphes	Léporidae	Brown Hare	*Lepus capensis*
		Rabbit	*Oryctolagus cuniculus*
Rongeurs	Muridae	Black Rat	*Rattus rattus*
		Striped Grass Mouse	*Lemniscomys striatus*
	Sciuridae	Barbary Ground Squirrel	*Atlantoxerus getulus*
	Hystricidae	Crested Porcupin	*Hystrix cristata*
Insectivores	Erinaceidae	Algerian Hedgehog	*Erinaceus algirus*

Figure 1. Mammals of the Tlemcen Hunting Reserve (1. *Gazella dorcas*, 2. *Dama dama*, 3. *Ammotragus lervia*, 4. *Lymmiscomys striatus*, 5. *Atlantoxerus getulus*, 6. *Sus scrofa*, 7. *Hyaena hyaena*, 8. *Felis silvestris*, 9. *Canis anthus*).

Tableau 2. List of the herpetofauna of Tlemcen Hunting Reserve.

Classe	Ordre	Sous ordre	Family	Common name	Scientific name
Amphibiens	Anura	Neobatrachia	Hylidae	Mediterranean tree frog	*Hyla meridionalis*
			Bufonidae	Toad	*Bufo bufo*
				Berber toad	*Amietophrynus mauritanicus*
			Ranidae	Sahara frog	*Pelophylax Saharicus*
			Discoglossidae	Painted frog	*Discoglossus pictus*
Reptiles	Testudines	Cryptodira	Testudinidae	Mediterranean spur-thighed tortoise	*Testudo graeca*
			Geoemydidae	Mediterranean Pond Turtle	*Mauremys leprosa*
			Emydidae	European Pond Turtles	*Emys orbicularis*
	Squamata	Sauria	Lacertidae	North African Ocellated Lizard	*Timon pater*
				Wall Lizard	*Podarcis vaucheri*
				Algerian psammodromus	*Psammodromus algirus*
				Spiny-Footed Lizard	*Acanthodactylus erythrurus*
			Gekkonidae	Wall Gecko	*Tarentola mauritanica*
			Agamidae	Bibron's Agama	*Agama impalearis*
				Desert Agama	*Agama mutabilis*
			Chamaeleonidae	Chameleon	*Chamaeleo chamaeleon*
			Scincidae	Ocellated Skink	*Chalcides ocellatus*
			Anguidae	Slow Worm	*Anguis fragilis*
		Serpentes	Viperidae	Levantine Viper	*Macrovipera lebetinus*
			Natricidae	Grass Snake	*Natrix natrix*
		Ophidia	Colubridae	Montpellier snake	*Malpolon monspessulanus*

Figure 2. Herpetofauna of Tlemcen Hunting Reserve (1. *Chamaeleo chamaeleon*, 2. *Podarcis vaucheri*, 3. *Bufo bufo*, 4. *Hyla meridionalis*).

Tableau 3. List of birds of Tlemcen Hunting Reserve.

Order	Family	Common name	Scientific name
Passeriformes	Hirundinidae	House Martin	*Delichon urbicum*
	Paridae	Great Tit	*Parus major*
		African Blue Tit	*Cyanistes teneriffae*
	Emberizidae	Rock Bunting	*Emberiza cia*
		Corn Bunting	*Emberiza calandra*
	Fringillidae	Chaffinch	*Fringilla coelebs*
		European Goldfinch	*Carduelis carduelis*
		Linnet	*Linaria cannabina*
		Serin	*Serinus serinus*
		Greenfinch	*Chloris chloris*
		Hawfinch	*Coccothraustes Coccothraustes*
	Passeridae	House Sparrow	*Passer domesticus*
	Oriolidae	Eurasian Golden Oriole	*Oriolus oriolus*
	Corvidaz	Eurasian Jay	*Garrulus glandarius*
		Raven	*Corvus corax*
		Western Jackdaw	*Coloeus monedula*
		Eurasian magpie	*Pica pica*
	Alaudidae	Eurasian Skylark	*Alauda arvensis*
		Wood Lark	*Lullula arborea*
		Crested-Lark	*Galerida cristata*
	Muscicapidae	European Robin	*Erithacus rubecula*
		Moussier's Redstart	*Phoenicurus moussieri*
		Redstar	*Phoenicurus phoenicurus*
		European Stonechat	*Saxicola rubicola*
		Spotted Flycatcher	*Muscicapa striata*
		Atlas Pied Flycatcher	*Ficedula speculigera*
		Nightingale	*Luscinia megarhynchos*
	Pycnonotidae	Bulbul	*Pycnonotus barbatus*
	Turdidae	Mistle Thrush	*Turdus viscivorus*
		Blackbird	*Turdus merula*
	Acrocephalidae	Melodious Warbler	*Hippolais polyglotta*
	Sylviidae	Blackcap	*Sylvia atricapilla*
		Sardinian Warbler	*Sylvia melanocephala*
		Dartford Warbler	*Sylvia undata*
	Phylloscopidae	Bonelli's Warbler	*Phylloscopus bonelli*
Accipitriformes	Accipitridae	Bonelli's Eagle	*Aquila fasciata*
		Sparrowhawk	*Accipiter nisus*
		Golden Eagle	*Aquila chrysaetos*
Strigiformes	Strigidae	Scops Owls	*Otus scops*
		Tawny Owl	*Strix aluco*
	Tytonidae	Barn Owl	*Tyto alba*
Falconiformes	Falconidae	Peregrine Falcon	*Falco peregrinus*
		Common Kestrel	*Falco tinnunculus*
Galliformes	Phasianidae	Barbary partridge	*Alectoris barbara*
		Quail	*Coturnix coturnix*
Columbiformes	Columbidae	Wood-Pigeon	*Columba palumbus*
		European Turtle-dove	*Streptopelia turtur*
Cuculiformes	Cuculidae	Cuckoo	*Cuculus canorus*
Bucerotiformes	Upupidae	Eurasian Hoopoe	*Upupa epops*
Coraciiformes	Coraciidae	European Roller	*Coracias garrulus*
	Meropidae	European Bee-eater	*Merops apiaster*
Apodiformes	Apodidae	Common Swift	*Apus apus*

Piciformes	Picidae	Levaillant's Woodpecker	*Picus vaillantii*
Caprimulgiformes	Caprimulgidae	Nightjar	*Caprimulgus europaeus*
Struthioniformes	Struthionidae	Ostriches	*Struthio camelus*

Figure 3. Birds of Tlemcen Hunting Reserve (1. *Struthio camelus*, 2. *Carduelis carduelis*, 3. *Garrulus glandarius*).

Tableau 4: List of insects of Tlemcen Hunting Reserve.

Order	**Family**	**Common name**	**Scientific name**
Lepidoptera	Nymphalidae	Little Monarch	*Danaus chrysippus*
		Painted Lady	*Vanessa cardui*
		Two-tailed Pasha	*Charaxes jasius*
		Aetherie Fritillary	*Melitaea aetherie*
		Spanish Gatekeeper	*Pyronia bathseba*
		Spanish Marbled White	*Melanargia ines*
		Wall Brown	*Lasiommata megera*
		Small Heath	*Coenonympha pamphilus*
		Meadow Brown	*Maniola jurtina*
		Cardinal	*Argynnis pandora*
	Lycaenidae	Spotted Adonis Blue	*Polyommatus punctifer*
		Small Copper	*Lycaena phlaeas*
		Common Blue	*Polyommatus icarus*
	Pieridae	Cleopatra	*Gonepteryx cleopatra*
		Southern Small White	*Pieris mannii*
		Clouded Yellow	*Colias crocea*
		Bath White	*Pontia daplidice*
		Moroccan Orange	*Anthocharis belia*
		Brimstone	*Gonepteryx rhamni*
		Black-veined White	*Aporia crataegi*
	Papilionidae	Southern Scarce Swallowtail	*Iphiclides feisthamelii*
		Yellow Swallowtail	*Papilio machaon*
	Hesperiidae	Maroccan small Skipper	*Thymelicus hamza*

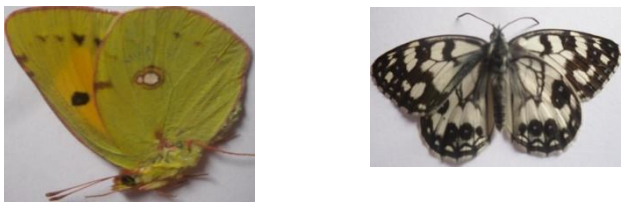

Figure 4. Insects of Tlemcen Hunting Reserve (1. *Colias crocea*, 2. *Melanargia ines*).

Discussion

Despite the importance of Algeria's rich wildlife diversity (Le Berre, 1990; Kowalski et Rzebik-Kowalska, 1991; Ahmim, 2014), it is threatened by several factors, including poaching (Moore et *al*., 2021) and road traffic (Brockie, 2007). Algerian mammalian populations are not exempt from these threats. For example, among the mammals most affected by road traffic are jackals, genets, foxes, and hedgehogs. According to a survey conducted by Derouiche (2016), out of 200 respondents, 160 reported seeing at least one hedgehog killed on the road, meaning that over 80% are killed in this manner. This phenomenon is one of the main causes of hedgehog mortality (Sayah, 2009; Berthoud, 1978, 1980, 1982; Brockie, 1960, 2007; Huijser et Bergers, 2000; Morris et Berthoud, 1987).

Currently, Algeria is home to 108 mammal species (Abdelguerfi et *al*., 2009; Stork and Samways, 1995); according to the decree of 15 Chaabane 1415 corresponding to January 17, 1995, which supplements the list of protected non-domestic animal species under decree N°83-509 of August 20, 1983, published in the official gazette of the Algerian republic on April 12, 1995, page 19, complemented in 2012 by executive decree N°12-235 of 3 Rajab 1433 corresponding to May 24, 2012, in terms of protection of mammalian fauna, 53 species out of the known 108 mammal species in Algeria are protected by Algerian legislation, representing 49.07% of the total. Therefore, it is illegal to capture, transport, trade, or keep these species at home. Violations of this decree are punishable under current legislation and regulations.

Despite these laws, wild fauna remains critically endangered. However, the lists of protected species are expected to be expanded, underscoring the importance of hunting reserves such as the Tlemcen Hunting Reserve.

It is important to emphasize that the geological, pedological, topomorphological, hydrographic, and climatological characteristics contribute to the richness of flora and fauna in the Tlemcen Hunting Reserve. Understanding and protecting the wildlife and wild flora in the THR require a comprehensive understanding of these factors, which have been the subject of numerous studies. The THR is part of the Tlemcen Mountains, primarily composed of Jurassic-age carbonate terrains. Locally, the substrate belongs to the upper Jurassic carbonate series. Geological approaches and studies in the region have defined the series as described by Benest (1985). Regarding soil composition, studies by Bachouche (1989) indicate clay-sandy to sandy-clayey textures. According to a pedological sketch by Bulgarian researchers in 1980, the soil types in the reserve territory include red-brown fersiallitic soil, brown limestone soil, red-brown fersiallitic soil with Moder, Ranker with Moder, Ranker on sandstone, colluvial red-brown soil, Lithosol on limestone, and red-brown soil with vertic characteristics.

The relief in the reserve is typically mountainous, belonging to the Tamaksalet mountain range with significant elevation changes. It includes ridges, rocky peaks, and independent rock summits. The THR is situated in the highest and most wooded part of the Tameksalet mountain range, interspersed with plains, notably the large 85-hectare clearing in the central part. Altitudes range between 1303 meters at Ras Torriche and 1017 meters in the Sidi Messaoud area. The terrain features steep mountain slopes with varying inclines, ranging from 12% to over 25% within the fenced territory, while outside the reserve, slopes become steeper. Water sources are scarce within the reserve, with few streams located near the visitor center. These sources typically flow at moderate rates during the rainy winter and spring seasons but dwindle in summer and autumn. The nearly permanent sources include Ain Djedi, Ain Bhour, and Ain Boumedrere.

Rainfall and temperature are crucial elements of the climate (Bary-Lenger et *al*., 1979); climate is a determining factor that precedes any study related to the functioning of ecological systems (Thinthoin, 1948). Emberger (1930) specifies that ecological data, particularly bioclimatic data, significantly influence the differentiation of vegetation and are directly responsible for the distribution and development of plants. As for the regional climatic framework of the Tlemcen Mountains, it is notable that the northern part, where the Tlemcen Hunting Reserve (Regional Climatic Type) appears, spans from the arid to humid bioclimatic zones within a radius of 100 km. The hunting reserve, located north of the Tlemcen mountains and exceeding 1000 meters in altitude, remains among the wettest areas in western Algeria. The irregularity of rainfall and its reception have implications for the biotope of the forest massif. These implications lead us to observe a predominant impact, on one hand, on the evolution of natural populations exhibiting a highly sensitive vegetation dynamic and severely degraded appearance, and on the other hand, on its animal composition.

Three plant groupings characterize the hunting reserve, two of which are forested: the oak forest (yeuseraie), the zennaie, and grasslands. The forest formations consist mainly of more or less degraded maquis where vegetation density varies from one slope to another. The yeuseraie, dominated by Holm oak (*Quercus ilex*), is the most prevalent species in the reserve, found at all altitudes and exposures. The oak forest (chênaie) appears as a more or less degraded wooded maquis. Some areas are dense and practically impenetrable, while others are degraded, revealing large expanses of *Stipa tenacissima* and *Ampelodesma mauritanicum*. Tree cover ranges from 30% to 90%, with tree heights between 1 m and 5 m (Dahmani Megrerouche, 1997; Bouazza et *al*., 2001). The zennaie (*Quercus faginea tlemcenensis*) occupies the northern slopes of the reserve in more humid areas at altitudes exceeding 1000 m. Trees reach an average height of 7 m, and ground cover can reach up to 70%. The zennaie is typically associated with Holm oak and occasionally with cork oak (Achhal et *al*., 1980; Barbero et *al*., 1981).

Tetraclinaie, represented by *Tetraclinis articulata*, is an endemic species in North Africa, found mainly in Tunisia, Algeria, and Morocco (Boudy, 1955). Tetraclinis occupies a small area in the reserve, localized on slopes facing west and southwest, with low tree cover (Baghli, 1993). The herbaceous layer is nearly absent, with populations either dense and sometimes impenetrable due to the dense undergrowth, or open and degraded, showing extensive areas of herbaceous vegetation. Notably, thermophilic herbaceous plants such as diss, doum palm, calicotome, alfalfa, and rockrose indicate some degradation of these plant formations (Benseddik, 2011). The presence of kermes oak alongside Holm oak indicates a degraded facies. The abundance of *Ampelodesma mauritanicum* and *Calycotome spinosa* indicates a drier and more degraded facies primarily due to anthropozoogenic factors (deforestation, grazing, fire...). In this formation, Holm oak is abundant in its bushy form, with isolated individuals of kermes oak, carob, strawberry tree, and heather at low density. The grasslands are the lowest and most open vegetation formation, exhibiting significant seasonal variability. They are scattered throughout the reserve, interspersed between the dominant formations. The most important grassland is located in the center of the reserve (the Moutas plain), composed of numerous perennial plants such as thyme, lavender, rockrose, and sage. Annual plants include marigolds and thistles. Adjacent to this vegetation grouping are cultivated lands growing crops like wheat and oats, providing essential food for game species inhabiting these environments.

The nature and variety of flora inevitably reflect the richness of fauna, as observed in the Tlemcen Hunting Reserve inhabited by 118 species including mammals, herpetofauna, birds, and insects. Among these species is the striped hyena (*Hyaena hyaena*; Linnaeus, 1758), a carnivorous mammal of the Hyaenidae family, widely distributed in Algeria from the Mediterranean Sea to central Sahara, including semi-arid and arid regions (Derouiche et *al*., 2020). According to the International Union for Conservation of Nature (IUCN) lists, this species is classified as Near Threatened and is also listed among protected mammals in Algeria. This status is due to several factors threatening the hyena, such as habitat loss and fragmentation (Robinson and Bennett, 2000). With its vast area exceeding 2156 hectares, the THR provides a protected environment that allows this animal to live and reproduce; with the use of cameras, we were able to identify populations of hyenas and jackals (Figure 5).

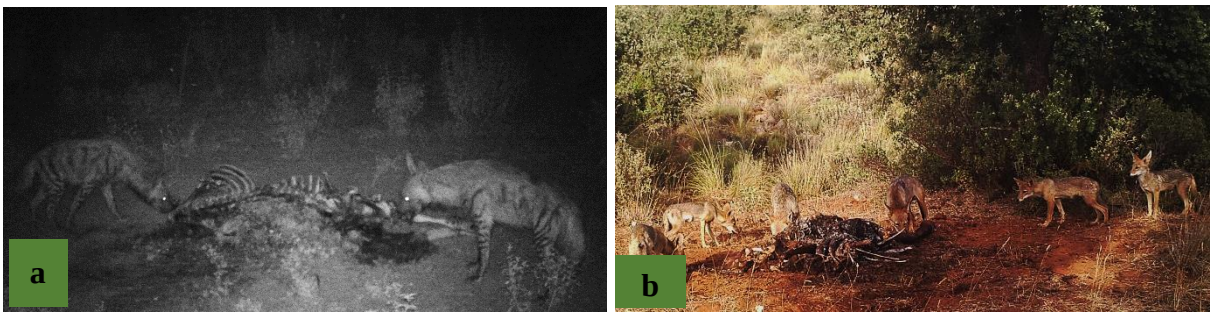

Figure 5. (a): Hyena population, **(**b): Jackal population.

The wildlife of the THR also includes introduced species such as the ostrich (*Struthio camelus camelus*; Linne, 1758), a bird that was once wild in Algeria but is no longer found in the wild. However, successful breeding and adaptation experiments in zoos and reserves have demonstrated its potential in Algeria, including successful introduction efforts at the THR starting in 2007 (Rahmouni and Derouiche, 2020). Breeding and raising these birds serve various economic interests, as they provide a rich source of white

meat and quality eggs. Additionally, ostriches are highly demanded by zoos, natural reserves, and hunting reserves, thus promoting ecotourism development (Ben Romdhane et *al*., 2000).

The Barbary sheep (*Ammotragus lervia*; Pallas, 1777) is another species in the wildlife managed by the Tlemcen Hunting Reserve, aimed at developing populations through in-situ releases to reinforce natural populations. The distribution and population size of this animal have dwindled in the wild due to habitat degradation and poaching, with Barbary sheep now found in small populations in steppe and pre-desert environments (Irzagh et *al*., 2022; Derouiche et *al*., 2020; Benkheira, 2006). After years of effort, the THR has achieved a population of over a hundred Barbary sheep (Rahmouni et *al*., 2018). Developing this population aims to support hunting reserves, thereby promoting scheduled hunting and fostering ecotourism as a sport. Additionally, Barbary sheep provide a nutritious source of red meat and high-quality leather.

Conclusion

The conservation of endangered species is unquestionably a crucial aspect of wildlife management. It is true that for overexploited species, the only chance of survival often lies in the protection offered by hunting reserves, hunting center, and national parks. However, this protection should be a means to an end, not an end in itself. Like all renewable natural resources, including forests which are the primary habitat for wildlife, sustainable conservation of fauna and biological diversity requires management inspired by sustainable use. Wild animals have their habitats in these landscapes and forests. When these habitats are altered, as is currently happening, it is inevitable that the composition and diversity of wildlife will be affected, and entire populations may be threatened.

Therefore, it will be essential to integrate wildlife and habitat management into broader socio-economic development efforts, which underscores the importance of the roles that protection reserves such as the Tlemcen Hunting Reserve can play.

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