Plant Archives Vol. 20, Supplement 2, 2020 pp. 1329-1333 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

CONTRIBUTION OF MAMMALS STUDY IN THE WESTERN RIF (NORTH WEST OF MOROCCO)

Nawal Hichami*, Safaa Bendami and Abdelaziz Mounir
Laboratory of Water, Biodiversity and Climate Change, Faculty of Sciences-Semlalia, Marrakech, Cadi Ayyad University, Morocco
*Corresponding author : nouna.hichami@gmail.com

Abstract

Population of land mammals in the Western Rif has been an assessment of its current state. Species currently existing in the Western Rif are 37 species, Surveys of the region on the dorsal limestone from Oued Lau intel Jbel Moussa, as well as the massive Bou Hashem, allowed us to validate the presence of 22 species. Nine species have been the subject of a detailed study regarding the status of their population, their conservation status and distribution in the study area. Some recommendations related to proposing their conservation measures and their management are made. This is mainly endemic species *Macaca sylvanus* Linnaeus, 1758, the most vulnerable species *Hystrix cristata* Linnaeus, 1758 *Canis aureus* Linnaeus, 1758, *Lutra lutra* Linnaeus, 1758. And the species of economic interest *Sus scrofa barbarus* Linnaeus, 1758 and the noticeable species Linnaeus *Herpestes ichnemon*, 1758, *Felis libyca* Forster, 1780, *Genetta genetta* Linnaeus, 1758 *Mutela nivalis* Linnaeus, 1766.

***Keywords*:** Mammals, western Rif, Distribution, Conservation, vulnerability, threats.

Introduction

Morocco is the only African country that has a double maritime façade that opens onto both the Mediterranean and the Atlantic Ocean with no less than 3,446 km of coastline. Its particular geographical position, its great climatic and geological variety (mountain ranges, plains, deserts) make the country a fairly varied bioclimatic area, ranging from humid to desert favoring a great diversity of ecosystems and natural environments as well terrestrial as aquatic (Znari & Hichami, 2019).

All these particularities have made the country populated by an exceptional fauna and flora biodiversity in terms of wealth and endemism. On the scale of the Mediterranean Basin, Morocco is recognized as one of the richest regions in the world (hotspots) in terms of animal and plant diversity (Myers *et al.,* 2000), Moroccan biodiversity occupies second place after that of the Anatolian region (Turkey), with an overall endemism rate of more than 20%.

Mammals are valuable biological indicators for understanding the ecological status of ecosystems and for proposing sustainable management methods. More particularly the Carnivores are located at the top of the pyramid. Their specific diversity is an indicator of the ecological status and biodiversity of ecosystems.

Despite their importance, mammals are among the groups that have suffered too much from human action and during the past decades at least six terrestrial mammal species are extinct (*Panthera leo*, *Serval constantina*, *Gazella leptoceros, Oryx damnah, Addax nasomaculates* and *Busolophus Busolophus*) and at least 20 species are threatened with extinction, among which 3 species are on the brink of extinction (*Panthera pardus, Acinonnyx jubatus* and *Gazella dama*).

It is certainly obvious that the conservation of biodiversity requires a state of knowledge and an assessment of the current situation of populations before thinking about conservation and management strategies.

In order to contribute to the building knowledge of the mammals of the Moroccan Rif area in general and of its western part in particular, a study relating to the most emblematic sites of the central-western Rif was carried out. These data will constitute a fundamental basis for defining priorities for action and management of mammalian biodiversity in a region of high biological potential, such as the area of the West Rif.

Materials and Methods

Study site

Compared to all the North African mountains, the privileged geographical location of the Rif between the Atlantic and the Mediterranean, give it climatic originality whose combination with the regional topographic and geological diversity favor a great ecological richness (Benabid, 1983). In the western and central parts of these mountains, the altitudinal rise exposed to the humidity and the mildness of Atlantic and Mediterranean climatic influences favor the development of lush forest vegetation. From the Thermo-Mediterranean to the Oro-Mediterranean zone, the terracing of vegetation is very affected by the heterogeneity of exposures and geological substrates (Taiqui, 1997). Most of the geological and geomorphological structures of the Rif are made up of the southern part of the limestone ridge which is practically imposing in this region of the Rif. The highest peaks of the Western Rif are Jbel Lakraa (2,159 m) and Jbel Kelti (1,926 m). (El-Gharbaoui, 1981). The relief of the limestone-dolomitic ridge is formed of acute ridges almost always corresponds to the outcrop of the fronts of the scales which are original because they result directly from the structure (El-Gharbaoui, 1980). The Rif is made up of three main areas: internal zones, flyschs and external zones (Michard *et al.,* 2006) (Fig. 1). The climate of the area is characterized by hot and dry summers and cool and sometimes cold winters. Average annual temperatures vary between 14°C and 20°C, with a minimum in January and a maximum in August. The differences between the annual maximum and minimum averages are around 12°C on the coast (Al-Hoceïma) and vary from 16 to 19°C inside, depending on altitude and orientation.

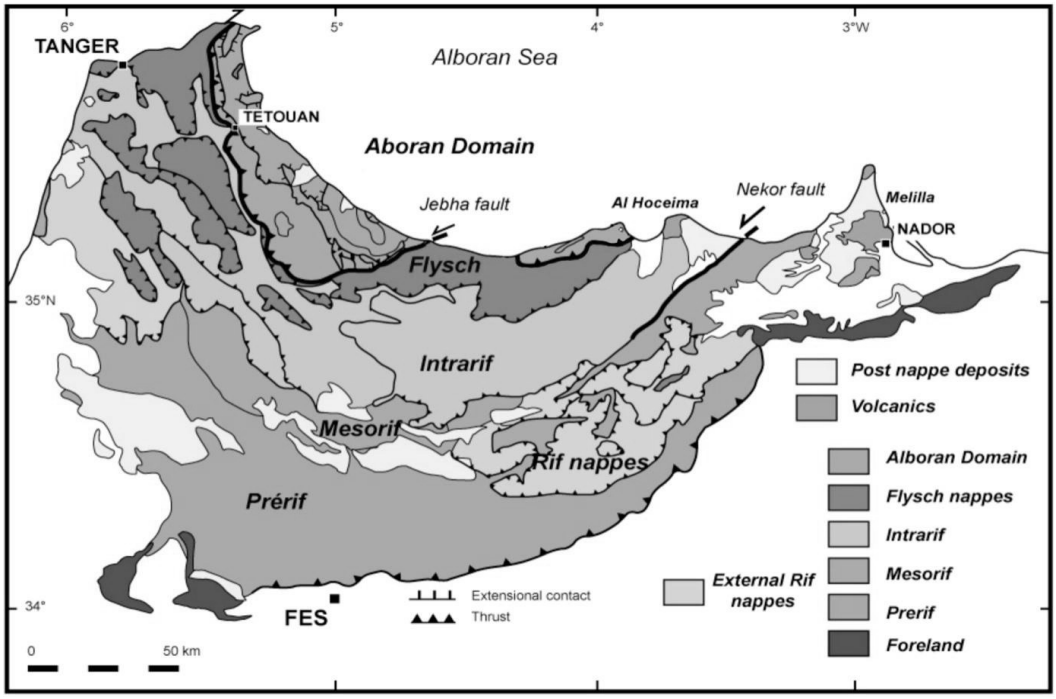

Fig. 1 : Structural map of the Rif chain (Romagny, 2011).

Location of prospecting sites

Our study was conducted in the North West region of Morocco. The study area is spread from Oued Laou to Jbel Moussa. Our surveys mainly concerned the protected areas of the Western Rif: SIBE Jbel Moussa, SIBE Jbel Bouhachem, SIBE Ben Kerrich, Lagune Smir and Jbel Kelti (Fig. 2). These 5 sites are part of the Intercontinental Biosphere Reserve of the Mediterranean (IBRM).

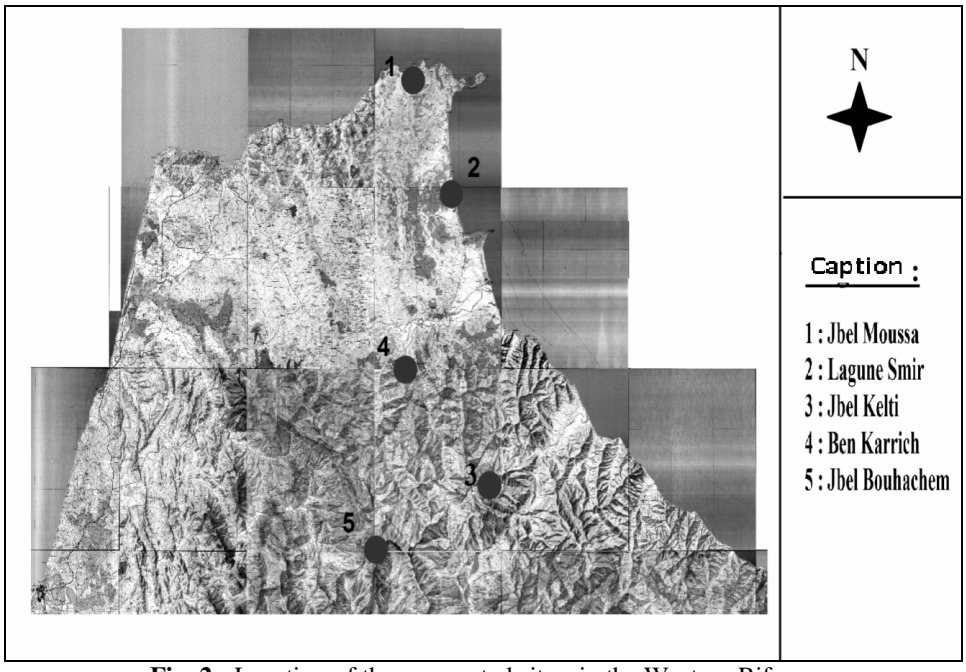

Fig. 2 : Location of the prospected sites, in the Western Rif

Methodology of work

The data underlying this work were collected from several sources. On the one hand, an exhaustive revision of bibliographical citations, field surveys and questionary with water and forest officials, hunters and the local population of the sites visited. The bibliographic study made it possible to identify 37 species of Mammals (Sehhar, 2006a, 2006b, Aulagnier and Thevenot, 1986, 2006, Cuzin, 1996).

Results and Discussions

I. Inventory of West Rif Mammals

The mammalian fauna of the West Rif is made up of 37 species divided into 27 genera, 16 families and 7 orders (Table 1). It represents more than 38% of the mammalogical diversity of the whole of Morocco. Chiroptera and Rodents constitute the most preponderant groups including 15 and 9 species respectively, then come carnivores (7 species), insectivores (2 species), Lagomorphs (2 species), and finally

Artiodactyles and Primates with respectively 1 species each (Table 1).

Surveys of the Western Rif region concerning the limestone ridge from Oued Laou to Jbel Moussa, as well as the Bou Hachem massif, enabled us to validate the presence of 22 species (Table 1). Marine mammals are not treated at the level of this work.

Among the 37 regular mammal species of the Western Rif, it is important to identify 9 species of great interest for national biodiversity, and even of world importance especially for the Magot Monkey. These are mainly the endemic species *Macaca sylvanus* Linnaeus, 1758, the most vulnerable species *Hystrix cristata* Linnaeus, 1758, *Canis aureus* Linnaeus, 1758, *Lutra lutra* Linnaeus, 1758. As well as the species of economic interest *Sus scrofa barbarus* Linnaeus, 1758 and the remarkable species namely *Herpestes ichnemon* Linnaeus, 1758, *Felis libyca* Forster, 1780, *Genetta genetta* Linnaeus, 1758, *Mutela nivalis* Linnaeus, 1766. These species will be the subject of a more detailed study, as regards concerns the state of their population, their conservation status in the region, and finally some recommendations relating to the measures proposed for their conservation and management, are proposed.

Table 1 : Inventory of mammals of the West Rif

Order	Family		Species	Local Call	World Conservation Status
Insectivora	Erinaceidae	**	*Erinaceus algirus* Lereboullet, 1842	Kanfod	LC
	Soricidae	**	*Crocidura russula* Hermann, 1780	Kanfod	LC
Chiroptéra	Rhinolophidae	*	*Rhinolophus ferrumequinum* Schreber, 1774	Tair Ellil, Ouatouat	LC
		*	*Rhinolophus hipposideros* Bechsttein, 1800	Tair Ellil, Ouatouat	
		*	*Rhinolophus euryale* Blasius, 1853	Tair Ellil, Ouatouat	VU
		*	*Rhinolophus mehelyi* Matschie, 1901	Tair Ellil, Ouatouat	VU
		*	*Hipposideros caffer* Sundevall, 1846	Tair Ellil, Ouatouat	
	Vespertilionidae	*	*Myotis emarginatus* Geoffroy, 1806	Tair Ellil, Ouatouat	LC
		*	*Myotis capaccinii* Banaparte, 1837	Tair Ellil, Ouatouat	VU
		*	*Myotis blythi* Tomes, 1857	Tair Ellil, Ouatouat	LC
		*	*Pipistrellus pipistrellus* Schreber,1774	Tair Ellil, Ouatouat	LC
		*	*Pipistrellus kuhli* Kuhl, 1819	Tair Ellil, Ouatouat	LC
		*	*Pipistrellus savii* Bonaparte, 1819	Tair Ellil, Ouatouat	LC
		*	*Nyctalus leisleri* kuhl, 1818	Tair Ellil, Ouatouat	LC
		*	*Nyctalus lasiopterus* Schreber, 1780	Tair Ellil, Ouatouat	LC
		*	*Barbastella barbastellus* Schreber, 1775	Tair Ellil, Ouatouat	NT
		*	*Miniopterus schreibersii* Kuhl, 1819	Tair Ellil, Ouatouat	
Primates	Cercopithecidae	**	*Macaca sylvanus* Linnaeus, 1758	Kerd	EN
Lagomorpha	Leporidae	**	*Lepus capensis* Linnaeus, 1758	Arnab	LC
		**	*Oryctolagus cuniculus* Linnaeus, 1758	Kniya	NT
Rodentia	Gerbillidae	**	*Gerbillus campestris* Levaillant, 1857	Lfar	LC
	Muridae	**	*Apodenus sylvaticus* Linnaeus, 1758	Lfar	LC
		**	*Lemniscomys barbrus* Linnaeus, 1766	Far Laazaf	LC
		**	*Rattus rattus* Linnaeus, 1758	Lfar	LC
		**	*Rattus norvegicus* Berkenhout, 1769	Lfar	LC
		**	*Mus musculus* Linnaeus, 1758	Lfar	LC
		**	*Mus spretus* Lataste, 1883	Lfar	LC
	Gliridae	**	*Eliomys quercinus* Linnaeus, 1766	Lfar	NT
	Hystricidae	**	*Hystrix cristata* Linnaeus, 1758	Derbe	LC
Carnivora	Canidae	**	*Canis aureus* Linnaeus, 1758	Eddib	LC
		**	*Vulpes vulpes* Linnaeus, 1758	Akaab	LC
	Mustelidae	**	*Mustela nivalis* Linnaeus, 1766	Fart lkhayl	LC
		**	*Lutra lutra* Linnaeus, 1758	Kelb lma	NT
	Viverridae	**	*Genetta genetta* Linnaeus, 1758	Mourda ou Taghouda	LC
	Herpestidae	**	*Herpestes ichneumon* Linnaeus, 1758	Serou	LC
	Felidae	**	*Felis sylvestris* Forster, 1780	Ket lakhla	LC
Artiodactyla	Suidae	**	*Sus scrofa barbus* Linnaeus, 1758	Halouf	LC

LC: Least concerned; **NT** :near treated; **VU** : Vulnerable; **EN** : Endangered ; * Cited in the bibliography; ** cited and found

Extinct species

Among the species of mammals of the Western Rif, it is important to highlight the recent disappearance of 3 species. Which are: the panther (*Panthera pardus*), the striped hyena (*Hyaena hyaena*) and the Lynx caracal (*Felis caracal*), (see Table 2).

Table 2 : Species of extinct mammalian fauna in the Western Rif.

Order	Family	Species	Common name	Conservation status in morocco
Carnivores	Felidae	*Panthera pardus* Linnaeus, 1758	Panther	Extinct in Bou Hachem between 1910 and 1920 (Cabrera, 1932).
	Hyaenidae	*Hyaena hyaena* Linnaeus, 1758	Striped hyena	In existence in the Tingitan peninsula until the beginning of the century, extinct in the 1930s (Cabrera, 1932)
	Felidae	*Felis caracal* Scherber, 1776	Caracal lynx	This animal seems to have disappeared from the Rif because it has not been mentioned in these regions since 1984 (Sehhar, 2006).

Threatened species

Among the mammals encountered in the Western Rif, there are 8 animals classified as endangered species, both nationally and globally (Table 3). Among the macromammals it should be noted: *Canis aureus*, *Lutra lutra* and *Hystrix cristata*.

Table 3 : Threatened mammals

Nom Scientifique	Nom commun	Statut de Conservation Mondial
Rhinolophus euryale	Rhinolophe euryale	VU
Rhinolophus mehelyi	Rhinolophe de Méhely	VU
Myotis emarginatus	Murin à oreille échancrée	VU
Myotis capaccinii	Murin de Capaccini	VU
Barbastella barbastellus	Barbastelle	VU
Hystrix cristata	Porc-épic à crête	EN
Canis aureus	Chacal doré	VU
Lutra lutra	Loutre	VU

*__VU__ : Vulnerable; __EN__ : Endangered

Threats and nuisance:

To preserve the diversity of flora and fauna, it is important to know the precise situation of each species, to monitor the evolution of threats and to identify priorities for action. The main threats to biodiversity and mammals in particular are mainly linked to human activities, but also to natural phenomena such as:

- Natural threats and nuisances: climate change, fires and natural disasters, epidemic diseases.
- Anthropogenic threats and nuisances: loss and fragmentation of habitats, poaching and hunting, pollution, road traffic, population pressure, overgrazing.

Conclusion

The geographic location of the Western Rif as well as its geomorphologic structure and it's Mediterranean climate have in fact a mosaic of ecosystems where very diverse flora and fauna evolve. This is how the main mammal species in the study area are well represented, from the rarest to the most common.

Surveys of 16 localities belonging to 5 regions in the Western Rif: SIBE of Jbel Moussa, SIBE of Bouhachem, SIBE of Ben Karrich, Jbel Kelti and the Smir wetland revealed the presence of 22 species of mammals. This list is supplemented by 14 other species of mammals cited in the Western Rif and which were not located during this study. The study area then had 37 species of mammals, representing more than 38% of the mammalogical diversity of Morocco.

Among the 37 species of mammals of the West Rif, 12 species are of primary importance either by their extinction in the wild, by their endemism, by their degree of national and/or international vulnerability or by their economic interest. It is :

- The panther, the striped hyena and the lynx caracal species already extinct in the wild;
- The maggot monkey, an endemic species listed on the IUCN in the category: "in danger";
- The otter, the only freshwater aquatic mammal, vulnerable on a Moroccan scale and at risk of being threatened internationally;
- The golden jackal, although it is classified in the "LC" category on an international scale, its populations are vulnerable on a Moroccan scale.
- The porcupine although it is classified in the "LC" category on an international scale, it is considered "Endangered" on a Moroccan scale.
- The wild boar, a species of economic interest;
- The genet, the ichneumon mongoose, the weasel, and the gloved cat are carnivores presenting a fundamental function of regulating the populations of their prey, whose preservation allows the maintenance of balance within ecosystems.

Various threats of natural and anthropogenic origin harm the existence of these species, mainly the fires which setting the forests of the Western Rif especially during the last years, the fragmentation of habitat mainly because of deforestation and overgrazing.

To ensure their conservation, it is recommended to apply the laws that protect them, to maintain the species as well as its habitat, to encourage scientific research and to educate the local population on the importance of these species.

Thus, it is necessary to organize grazing, to regulate hunting, to reforest the most degraded areas and to ensure rational management of the waters of the dam which takes account of basic needs.

Acknowledgements

We are very indebted to all students who helped during the field works.

References

Aulagnier, S. and Thevenot, M. (1986). Catalogue des mammifères sauvages du Maroc. Travaux Inst. Sci. Rabat, sér. Zool., 41 : 1-163.

Aulagnier, S. and Thevenot, M. (2006). Mise à jour de la liste des mammifères sauvages du Maroc. Go-South Bull., 3: 6-9.

Benabid, A. (1983). Etudes biogéographique et dynamique des peuplements forestiers du Rif (Maroc). Annales de la Recherche Forestière au Maroc, 1.23: 49-129.

Cabrera, A. (1932). Los mamíferos de Marruecos. Trabajos del Museo Nacional de Ciencias Naturales, seria zoologica, Madrid. 363.

Cuzin, F. (1996). Répartition actuelle et statut des grands mammifères sauvages du Maroc (Primates, Carnivores, Artiodactyles). Mammalia 60: 101-124.

El-Gharbaoui, A. (1980). Résumé de thèse : La terre et l'homme dans la Péninsule Tingitane. Revue de Géographie du Maroc, n°4: 87-90.

El-Gharbaoui, A. (1981). La terre et l'Homme dans la Péninsule tingitane. Tr. Ins.Sc, série géologie et géographie physique, n° 31, Tome I (texte et planches) 439 p., tome II (cartes).

Michard, A.; Negro, F.; Saddiqui, O.; Bouybaouene, M.L.; Chalouan, A.; Montigny, R. and Goffé, B. (2006). Pressure temperature-time constraints on the Maghrebide mountain building: evidence from the Rif-Betic transect (Morocco, Spain), Algerian correlations and geodynamic implications. Comptes-Rendus de l'Académie des Sciences de Paris, Earth and Planetary Sciences, 338: 92-114.

Myers, N.; Mittermeier, R.A.; Mittermeier, C.G.; Da Fonseca, G.A.B. and Kent, J. (2000). Biodiversity hotspots for conservation priorities. Nature, 403: 853-858.

Romagny, A. (2011). Evolution de la surrection de la chaine du Rif (Maroc), Mémoire master, Université Nice. 57pp.

El-Sehhar, A. (2006a). Diagnostic en Mammalogie (SIBE du Jbel Moussa), Projet GEF de gestion des Aires Protégées 40pp.

El-Sehhar, A. (2006b). Réserve de Biosphère de la Méditerranée Andalousie (Espagne - Maroc) (RBIM) 76pp.

Taiqui, L. (1997). La dégradation écologique au Rif marocain: nécessités d'une nouvelle approche. Méditerranea. Serie de estudios biológicos. 517.

Znari, M. and Hichami, N. (2018). Biology, Life History Traits and Conservation of the Vulnerable Souss Valley Tortoise in Arid Areas of West Central Morocco. IntechOpen.