

Contributions to knowledge about the macro-mammal fauna in Rodna Mountains National Park (Biosphere Reserve)

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Introduction

Rodna Mountains National Park is a protected area established through Decree no. 7/1990 issued by the Ministry of Environment, Waters and Forests and confirmed through Law no. 5/2000 with regard to the endorsement of the National Territory Arrangement Plan – Section III – protected areas – national parks, for landscape and biodiversity conservation, protection of rare and valuable species, promotion and encouragement of tourism, raising awareness and educating the public to preserve nature and its values.

The whole of Rodna Mountains National Park overlaps with Natura 2000 Sites ROSCI0125 Rodna Mountains and ROSPA0085 Rodna Mountains. The Natura 2000 Site ROSCI0125 Rodna Mountains exceeds the limits of the Park by 711 ha (Gagi Cauldron), while the Natura 2000 Site ROSPA0085 Rodna Mountains exceeds the limits of the National Park by 7.636 ha.

The mammal fauna of Rodna Mountains National Park consists of 44 species, which is 44% of the total number of mammalian species found in Romania (about 100 species). Among these, 20 species are part of the large mammal (macro-mammal) category, and the remaining 24 species belong to the micro-mammal category. Only large mammals were included in the present study.

Research Methods

The study area consists of the Rodna Mountains National Park and Natura 2000 Site (ROSCI and ROSPA, fig. 1).

The study was carried out between 2004 and 2016 and a wide range of large mammal surveying and monitoring methods was employed (table 1).

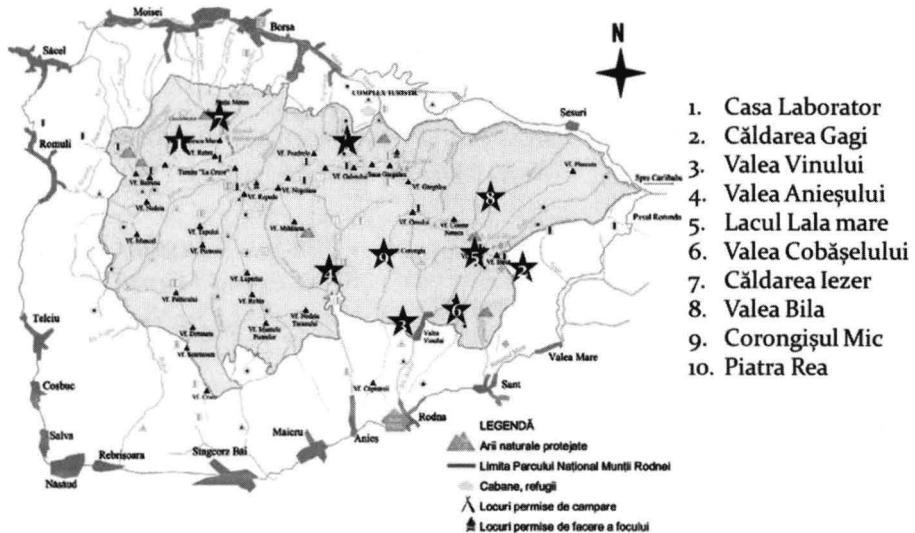


Fig. 1. Map of the survey points used for the monitoring of large mammals in Rodna Mountains National Park and Natura 2000 Site (Biosphere Reserve)

Table 1. Types of methods and techniques employed for the surveying and monitoring of macro-mammals in Rodna Mountains National Park and Natura 2000 Site

No.	Surveying and monitoring method	Surveyed and monitored species
1	Observing natural signs of species presence (snow track and scat surveys, mating call identification)	<i>Sus scrofa</i> (wild boar), <i>Cervus elaphus</i> (red deer), <i>Capreolus capreolus</i> (roe deer), <i>Rupicapra rupicapra</i> (chamois), <i>Vulpes vulpes</i> (red fox), <i>Canis lupus</i> (grey wolf), <i>Ursus arctos</i> (brown bear), <i>Lynx lynx</i> (Eurasian lynx), <i>Felis silvestris</i> (wildcat), <i>Martes foina</i> (beech marten), <i>Martes martes</i> (European pine marten), <i>Mustela erminea</i> (stoat), <i>Mustela nivalis</i> (least weasel), <i>Mustela putorius</i> (European polecat), <i>Meles meles</i> (European badger), <i>Lutra lutra</i> (Eurasian otter), <i>Marmota marmota</i>

No.	Surveying and monitoring method	Surveyed and monitored species
		(alpine marmot), <i>Lepus europaeus</i> (European hare), <i>Sciurus vulgaris</i> (red squirrel), <i>Erinaceus concolor</i> (southern white-breasted hedgehog)
2	Partial survey – direct observations with the naked eye or with binoculars (Nikon 10x50) during the mating season	<i>Sus scrofa</i> (wild boar), <i>Cervus elaphus</i> (red deer), <i>Capreolus capreolus</i> (roe deer), <i>Rupicapra rupicapra</i> (chamois), <i>Lynx lynx</i> (Eurasian lynx), <i>Felis silvestris</i> (wildcat), <i>Martes foina</i> (beech marten), <i>Martes martes</i> (European pine marten), <i>Mustela herminea</i> (stoat), <i>Mustela nivalis</i> (least weasel), <i>Mustela putorius</i> (European polecat), <i>Meles meles</i> (European badger), <i>Lutra lutra</i> (Eurasian otter), <i>Marmota marmota</i> (alpine marmot), <i>Sciurus vulgaris</i> (red squirrel)
3	Photo/video cameras – photography from a distance with a telephoto lens (Nikon D3X camera, 600 mm telephoto lens, 2X teleconverter), wildlife watching from inside hide tents, 6 infrared motion-activated camera traps – Bushnell trail camera 8MP	<i>Sus scrofa</i> (wild boar), <i>Cervus elaphus</i> (red deer), <i>Capreolus capreolus</i> (roe deer), <i>Rupicapra rupicapra</i> (chamois), <i>Vulpes vulpes</i> (red fox), <i>Canis lupus</i> (grey wolf), <i>Ursus arctos</i> (brown bear), <i>Lynx lynx</i> (Eurasian lynx), <i>Felis silvestris</i> (wildcat), <i>Martes foina</i> (beech marten), <i>Martes martes</i> (European pine marten), <i>Mustela herminea</i> (stoat), <i>Mustela nivalis</i> (least weasel), <i>Mustela putorius</i>

No.	Surveying and monitoring method	Surveyed and monitored species
		(European polecat), <i>Meles meles</i> (European badger), <i>Lutra lutra</i> (Eurasian otter), <i>Marmota marmota</i> (alpine marmot), <i>Lepus europaeus</i> (European hare), <i>Sciurus vulgaris</i> (red squirrel), <i>Erinaceus concolor</i> (southern white-breasted hedgehog)
4	Radio-telemetry collars	chamois (<i>Rupicapra rupicapra</i>)
5	Transects	<i>Sus scrofa</i> (wild boar), <i>Cervus elaphus</i> (red deer), <i>Capreolus capreolus</i> (roe deer), <i>Rupicapra rupicapra</i> (chamois), <i>Vulpes vulpes</i> (red fox), <i>Canis lupus</i> (grey wolf), <i>Ursus arctos</i> (brown bear), <i>Lynx lynx</i> (Eurasian lynx), <i>Felis silvestris</i> (wildcat), <i>Martes foina</i> (beech marten), <i>Martes martes</i> (European pine marten), <i>Mustela erminea</i> (stoat), <i>Mustela nivalis</i> (least weasel), <i>Mustela putorius</i> (European polecat), <i>Meles meles</i> (European badger), <i>Lutra lutra</i> (Eurasian otter), <i>Marmota marmota</i> (alpine marmot), <i>Lepus europaeus</i> (European hare), <i>Sciurus vulgaris</i> (red squirrel), <i>Erinaceus concolor</i> (southern white-breasted hedgehog)
6	Den, burrow or shelter survey	<i>Ursus arctos</i> (brown bear), <i>Lynx lynx</i> (Eurasian lynx),

No.	Surveying and monitoring method	Surveyed and monitored species
		<i>Marmota marmota</i> (alpine marmot)
7	GPS tracking	<i>Sus scrofa</i> (wild boar), <i>Cervus elaphus</i> (red deer), <i>Capreolus capreolus</i> (roe deer), <i>Rupicapra rupicapra</i> (chamois), <i>Vulpes vulpes</i> (red fox), <i>Canis lupus</i> (grey wolf), <i>Ursus arctos</i> (brown bear), <i>Lynx lynx</i> (Eurasian lynx), <i>Felis silvestris</i> (wildcat), <i>Martes foina</i> (beech marten), <i>Martes martes</i> (European pine marten), <i>Mustela herminea</i> (stoat), <i>Mustela nivalis</i> (least weasel), <i>Mustela putorius</i> (European polecat), <i>Meles meles</i> (European badger), <i>Lutra lutra</i> (Eurasian otter), <i>Marmota marmota</i> (alpine marmot), <i>Lepus europaeus</i> (European hare), <i>Sciurus vulgaris</i> (red squirrel), <i>Erinaceus concolor</i> (southern white-breasted hedgehog)
8	Live-traps – Foot snare traps	Eurasian lynx (<i>Lynx lynx</i>)

The study was carried out at 10 monitoring points in Rodna Mountains National Park (fig. 1, table 2), through a combination of the methods and techniques listed above. At each monitoring point, observations were made along 2 km long transects. Species identification was achieved with the aid of mammal field guides, fauna fascicles and the scientific works listed in the selective bibliography.

Table 2. Description of the survey and monitoring points in Rodna Mountains National Park and Natura 2000 Site

Code	Monitoring point name	Altitude (m)	Habitat type
CL	Casa Laborator on the southern face of the Pietrosu Mare massif	1.400	Mixed forest fringe
CG	Gagi glacial cirque	1.500	Mountain pine, rhododendron and juniper heath meadows
VV	Valea Vinului (Vinului Valley)	800	Mixed forest fringe, valley
VA	Valea Anieșului (Anieș Valley)	1.200	Coniferous forest fringe, valley, calcareous rocky slopes, meadows
LL	Lala Mare glacial lake	1.500	Mountain pine, rhododendron and juniper heath meadows
VC	Valea Cobășelului (Cobășel Valley)	900	Mixed forest fringe, valley
CI	Iezer glacial cirque	1.700	Mountain pine, rhododendron and juniper heath meadows
VB	Valea Bila (Bila Valley)	1.200	Hygrophilous meadows, mountain streams, rocky slopes, scree
CM	Corongișul Mic	1.500	Calcareous rocky slopes, mountain meadows, juniper bushes, scree, coniferous forest fringe
PR	Piatra Rea	1.300	Calcareous rocky slopes, mountain meadows, juniper bushes, scree, coniferous forest fringe

Conclusions

During the field surveys conducted between 2004 and 2016 with the use of a wide array of surveying and monitoring techniques at the 10 monitoring points, 20 large mammal species were identified. Estimations of the local populations of these macro-mammal species at the monitoring points were made with the seasonal movements of the animals across the 12 years in mind (table 3, fig. 2).

Table 3. Inventory and estimates of the local populations of large mammals at 10 monitoring points located in Rodna Mountains National Park and Natura 2000 Site

No.	Species	Location and estimated number of individuals											
		C L	C G	V V	V A	L L	V C	C I	V B	C M	C M	PR	
1	<i>Sus scrofa</i> (wild boar)	2 1	7	5	2	2	6	0	3	0	0	2	
2	<i>Cervus elaphus</i> (red deer)	3	2	2	1	1	3	0	2	0	0	1	
3	<i>Capreolus capreolus</i> (roe deer)	9	3	7	2	1	7	0	2	0	0	1	
4	<i>Rupicapra rupicapra</i> (chamois)	2	5	0	2	1 9	0	2	0	1	0	0	
5	<i>Vulpes vulpes</i> (red fox)	8	2	3	1	1	2	1	1	1	1	2	
6	<i>Canis lupus</i> (grey wolf)	3	2	4	1	2	3	1	1	1	1	1	
7	<i>Ursus arctos</i> (brown bear)	3	1	2	1	2	3	1	1	1	1	1	
8	<i>Lynx lynx</i> (Eurasian lynx)	2	1	1	1	1	2	1	1	1	1	1	
9	<i>Felis silvestris</i> (wildcat)	1	1	1	1	1	2	1	1	0	0	1	
10	<i>Martes foina</i> (beech marten)	1 8	4	5	3	5	4	2	2	3	2	2	
11	<i>Martes martes</i> (pine marten)	2 3	6	7	4	2	6	1	1	1	1	1	
12	<i>Mustela herminea</i> (stoat)	3	2	2	2	3	2	2	2	2	2	2	
13	<i>Mustela nivalis</i> (least weasel)	2	1	1	1	1	3	1	1	1	1	1	
14	<i>Mustela putorius</i> (European polecat)	0	0	1	0	0	2	0	0	0	0	0	
15	<i>Meles meles</i> (European badger)	2	2	2	1	0	3	0	2	1	1	1	
16	<i>Lutra lutra</i> (Eurasian otter)	0	0	2	0	1	2	0	0	0	0	0	

No.	Species	Location and estimated number of individuals									
		C L	C G	V V	V A	L L	V C	C I	V B	C M	PR
17	<i>Marmota marmota</i> (alpine marmot)	0	1	0	0	2	0	1	1	1	0
18	<i>Lepus europaeus</i> (European hare)	0	0	2	0	0	2	0	0	0	0
19	<i>Sciurus vulgaris</i> (red squirrel)	9	0	6	1	0	9	0	0	0	0
20	<i>Erinaceus concolor</i> (southern white-breasted hedgehog)	0	0	1	0	0	1	0	0	0	0
Total number of species		1	1	1	1	1	1	1	1	1	13
		5	5	8	5	5	8	1	4	1	

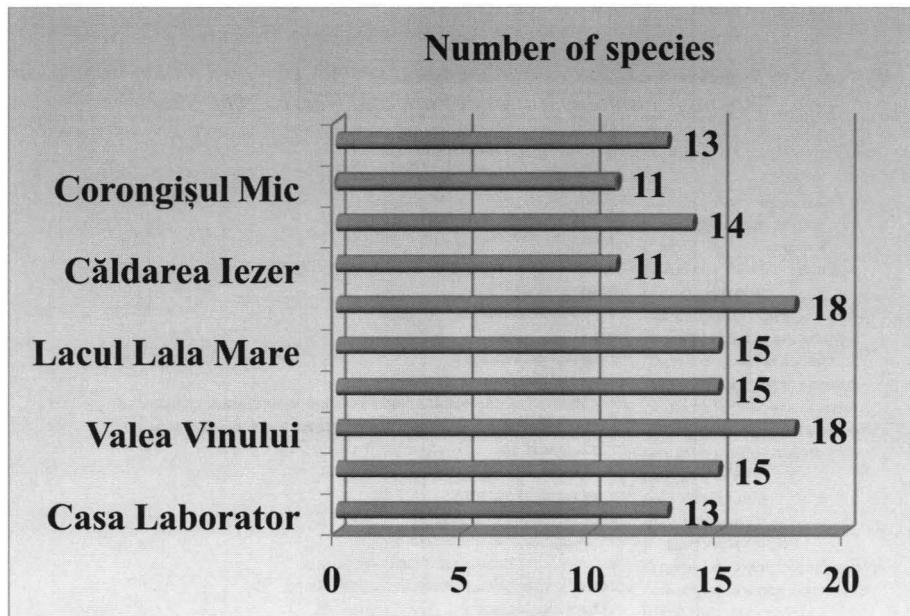


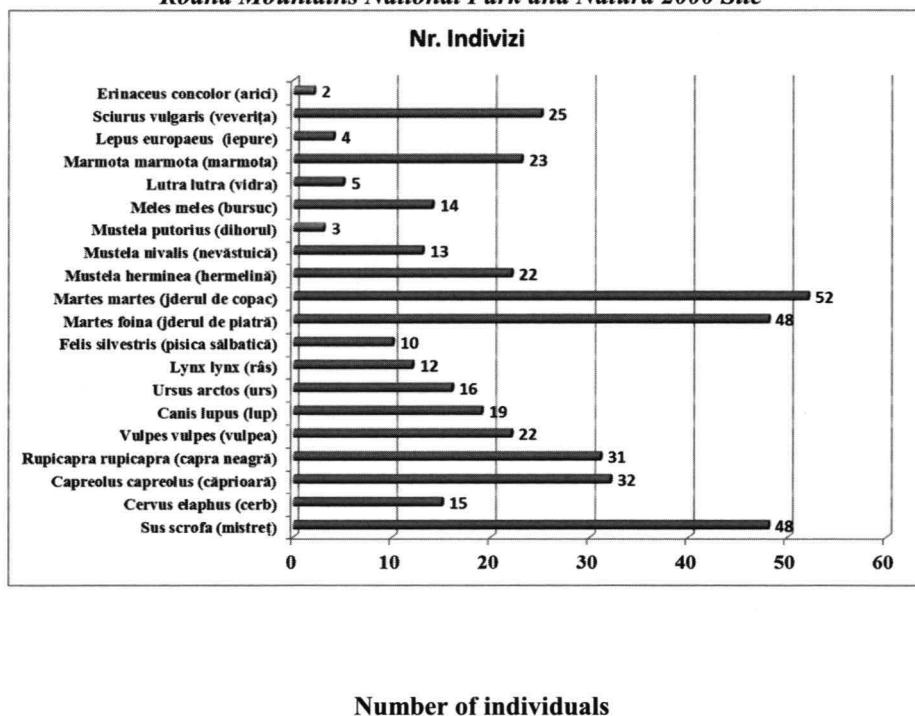
Fig. 2. Macro-mammal species diversity at the 10 monitoring points in Rodna Mountains National Park and Natura 2000 Site

As may be observed in fig. 2, two of the monitoring points (Cobăşel Valley and Vinului Valley) are home to a higher number of large mammal species (18 species), namely 90% of the total number of macro-mammal species in the protected area, owing to their ecosystem diversity, more restrictive management regime and reduced anthropogenic impact. Corongișul Mic hosts a lower number of large mammal species (11 species) because this transect includes rocky slopes, scree and forest fringe habitats which mammals only pass

through. The Iezer glacial cirque also hosts a low number of large mammal species (11 species), because this area contains one of the most visited tourist routes in Rodna Mountains, namely that leading to Iezer glacial lake and Pietrosu Mare Peak (2.303 m), so mammals prefer the shelter provided by the neighbouring glacial cirque (Zănoaga Mare).

As for the number of individuals observed at each monitoring point, it appears (as illustrated in fig. 3) that the most common species are the pine marten – *Martes martes* (52 individuals), wild boar – *Sus scrofa* (48 individuals), beech marten – *Martes foina* (48 individuals), roe deer – *Capreolus capreolus* (32 individuals), red squirrel – *Sciurus vulgaris* (25 individuals), alpine marmot – *Marmota marmota* (23 individuals), red fox – *Vulpes vulpes* (22 individuals), stoat – *Mustela erminea* (22 individuals), chamois – *Rupicapra rupicapra* (21 individuals) etc. The least represented species in terms of the number of individuals observed are: the southern white-breasted hedgehog – *Erinaceus concolor*, the European hare – *Lepus europaeus*, and the European polecat – *Mustela putorius*, because the monitoring plots were located at higher altitudes unfavourable for the presence of these species except for accidental sightings or as passers-by.

Fig. 3. Local population sizes of large mammal species surveyed and monitored in Rodna Mountains National Park and Natura 2000 Site



The level of protection for each macro-mammal species in Rodna Mountains is presented in table 4 and fig. 4. As per Law no. 49/2011 for the passing of the Government Emergency Ordinance no. 57/2007 with regards to natural protected area policy and to the conservation of the natural habitats and of the wild flora and fauna of Romania, out of the present macro-mammals 7 species (35% of the total number of macro-mammal species in Rodna Mountains) are species of community interest, while 11 species are of national importance (55% of the total number of macro-mammal species in the study area).

Table 4. Levels of protection for the macro-mammals in Rodna Mountains National Park and Natura 2000 Site

N o.	Species	Annex 3 (Law no. 49/2011) ⁹	Annex 4A (Law no. 49/2011) ¹⁰	Annex 5A (Law no. 49/2011) ¹¹	Annex 5B (Law no. 49/2011) ¹²
1	<i>Sus scrofa</i> (wild boar)				x
2	<i>Cervus elaphus</i> (red deer)				x
3	<i>Capreolus capreolus</i> (roe deer)				x
4	<i>Rupicapra rupicapra</i> (chamois)			x	
5	<i>Vulpes vulpes</i> (red fox)				x
6	<i>Canis lupus</i> (grey wolf)	x	x		
7	<i>Ursus arctos</i> (brown bear)	x	x		
8	<i>Lynx lynx</i> (Eurasian lynx)	x	x		
9	<i>Felis silvestris</i> (wildcat)		x		
10	<i>Martes foina</i> (beech marten)				x
11	<i>Martes martes</i> (pine marten)			x	
12	<i>Mustela herminea</i> (stoat)				x
13	<i>Mustela nivalis</i> (least weasel)				x
14	<i>Mustela putorius</i> (European polecat)			x	
15	<i>Meles meles</i> (European				x

⁹ Plant and animal species the conservation of which requires designation of special conservation areas and special avifauna protection areas.

¹⁰ Species of community interest. Animal and plant species that require strict protection.

¹¹ Species of community interest. Plant and animal species of community interest, except bird species, for which exploitation and collection from the wild represent management measures.

¹² Animal species of national importance for which exploitation and collection from the wild represent management measures.

No.	Species	Annex 3 (Law no. 49/2011) ⁹	Annex 4A (Law no. 49/2011) ¹⁰	Annex 5A (Law no. 49/2011) ¹¹	Annex 5B (Law no. 49/2011) ¹²
	badger)				
16	<i>Lutra lutra</i> (Eurasian otter)	x	x		
17	<i>Marmota marmota</i> (alpine marmot)				x
18	<i>Lepus europaeus</i> (European hare)				x
19	<i>Sciurus vulgaris</i> (red squirrel)				x
20	<i>Erinaceus concolor</i> (southern white-breasted hedgehog)				

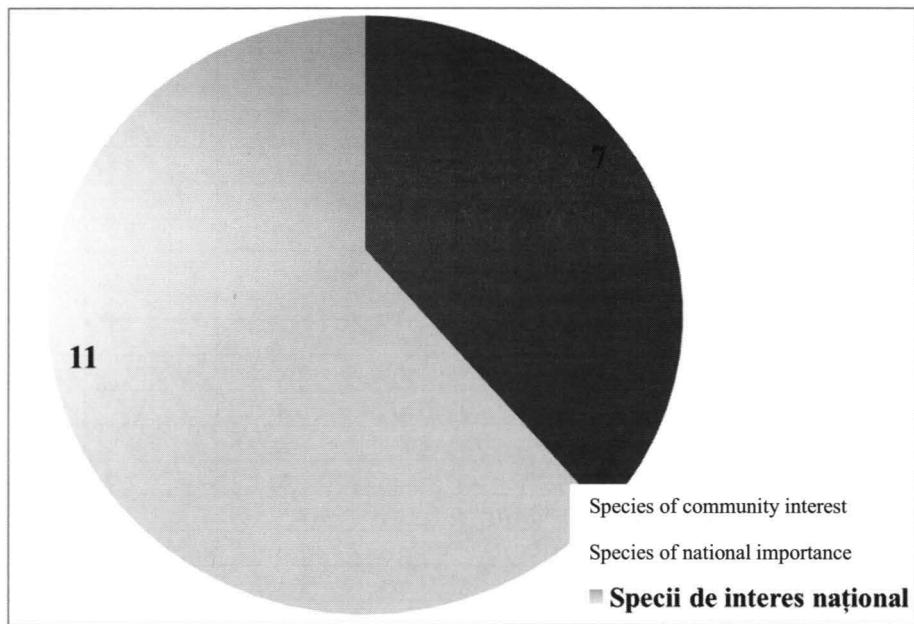


Fig. 4. Categories of protection for the large mammals in Rodna Mountains National Park and Natura 2000 Site

To conclude, surveying and monitoring the large mammal fauna at 10 observation points in Rodna Mountains National Park and Natura 2000 Site between 2004 and 2016 has led to the identification of 20 macro-mammal species. Two of the monitoring points harbour the majority of the macro-mammal species in the protected area (90%), namely Cobăşel Valley and Vinului Valley, owing to the reduced anthropogenic impact and to the restrictive management category (full protection zone). The most common

macro-mammal species are the pine marten (*Martes martes*), the wild boar (*Sus scrofa*) and the beech marten (*Martes foina*), while the rarest are the southern white-breasted hedgehog (*Erinaceus concolor*), the European hare (*Lepus europaeus*) and the European polecat (*Mustela putorius*) due to the fact that the altitude of the monitoring points was too high for these species, leading to sporadic visits only. Two species of large mammal occur at lower densities at a national scale but make up stable populations in Rodna Mountains National Park – the chamois (*Rupicapra rupicapra*) and the alpine marmot (*Marmota marmot*). Out of the 20 macro-mammal species, 7 species are of community interest and 11 species are of national importance.

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