

Population dynamics of bear (*Ursus arctos*), wolf (*Canis lupus*), wild cat (*Felis silvestris*) and lynx (*Lynx lynx*) in Cluj County between 2010 and 2013

¹Ioan G. Oroian, ²Ilie Covrig, ³I. Costel Meseșan,
^{1, 4, 5}I. Valentin Petrescu-Mag, ⁴Claudiu Gavrioloaie

¹ University of Agricultural Sciences and Veterinary Medicine, Faculty of Agriculture Cluj-Napoca, Romania; ² University of Agricultural Sciences and Veterinary Medicine, Faculty of Silviculture, Cluj-Napoca, Romania; ³ Asociația Județeană a Vânătorilor și Pescarilor Sportivi Cluj (County Association of Hunters and Anglers Cluj), Cluj-Napoca, Romania; ⁴ SC Bioflux SRL Cluj-Napoca, Romania; ⁵ University of Oradea, Oradea, Romania.

Corresponding authors: I. V. Petrescu-Mag, zoobiomag2004@yahoo.com;

I. G. Oroian, neluoroian@yahoo.fr

Abstract. This study aims to show the population dynamics for large carnivores species and for brown bear from the Cluj County (NW of Romania) hunting fund, owned by AJVPS Cluj (County Association of Hunters and Anglers Cluj). The analysis is based on 2010-2013 annual centralizers of brown bear, wolf, wild cat, and European lynx, provided to authors by the AJVPS Cluj. The evaluation of hunting herds was made according to the provisions of the Decision no. 10152/ 11.09.1995 of the Ministry of Waters, Forests and Environmental Protection. Statistics show a decrease of animal numbers for brown bear, wolf, wild cat and an increase in number for European lynx. Population of brown bear and wildcat are slightly below the optimum level assessed by the AJVPS Cluj, while the wolf and lynx population have a number of animals superior to those estimated as optimal.

Key Words: population, large carnivores, bear, hunting fund, ecosystem balance.

Introduction. The study of the dynamics of populations of brown bear (*Ursus arctos*), wolf (*Canis lupus*), wild cat (*Felis silvestris*) and European lynx (*Lynx lynx*) has high importance due to the value of these species for the ecosystem balance. Carpathian region of Romania, although it represents less than 2% of the European continent, supports viable and stable populations of large carnivores, specifically 30% of European populations of wolves, 35% of the entire population of brown bears, and 25% of lynx population (Carpathian Wildlife Foundation & ICAS 2011). These large carnivores are symbol species of biodiversity conservation in Europe. They have an important role in the ecosystem through "top-down" control on prey populations, over large territories. The presence of these species indicates natural habitats with high ecological value and functional ecosystems, which can be a model for ecological restoration in other European regions (Carpathian Wildlife Foundation & ICAS 2011).

Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) is one of the main legal acts for nature protection in the European Union countries. EU countries should harmonize their provisions, national legislation in accordance with the European Directives. Brown bear, wolf, lynx and wild cat are listed in Annex II of the Directive, which includes species of wild fauna and flora of Community interest whose conservation requires the declaration of Special Areas of Conservation, areas that form the Natura 2000 ecological network (Petrescu & Petrescu-Mag 2010; Petrescu-Mag 2013). Moreover, these carnivore species are listed in Annex IV of the Ordinance No. 57/2007 as species of Community interest, requiring strict

protection and whose catching, killing and disturbance is prohibited. In compliance with article 16 of the Directive, countries can make certain exceptions to the above provisions on special conditions. Keeping, transport and sale or exchange of specimens listed in Annex IV and taken from the wild is prohibited, unless this is done to prevent serious damage on livestock, to protect the public health and safety, to do research and education activities or to reintroduce and restock specimens of these species (Carpathian Wildlife Foundation & ICAS 2011; Solberg et al 2006). Also, brown bear, wolf, lynx and wild cat are species listed in Annex 2 to the Convention on the Conservation of European Wildlife and Natural Habitats in Europe, adopted in Bern on 19 September 1979, adopted by Romania through the Law 13/1993.

Material and Method. This study aims to show the populations dynamics for large carnivores species and for brown bear from the Cluj County (NW of Romania) hunting funds, owned by AJVPS Cluj (County Association of Hunters and Anglers Cluj). The research included the next hunting funds: Vad, Bobâlna, Mica, Gherla, Cornești 2, Panticeu, Cristorel, Țaga, Sînmartin, Feiurdeni, Chinteni, Sard, Stolna, Florești, Corpadea, Geaca, Cătina, Triteni, Feleac, Valea Ierii, Gilău, Valea Belișului, Huedin and Ciucea.

The analysis is based on 2010-2013 annual centralizers of brown bear, wolf, wildcat and European lynx, provided to authors by the Association mentioned above. The data is statistical significant as AJVPS Cluj manages about 30% of the total Cluj County hunting fund, these areas are evenly spread on Cluj County surface and the data was randomly collected from these areas. The evaluation of game populations was made according to the provisions of the Decision no. 10152/11.09.1995 of the Ministry of Waters, Forests and Environmental Protection.

Results and Discussion. The population of brown bear from the hunting fund owned by AJVPS Cluj in Cluj County diminished between 2010-2013 from 37 to 26 bears (Tables 1, 5 and 9), while the number estimated by AJVPS Cluj as optimal is 28 bears (Table 1). Paradoxically, this value decreased despite the fact that AJVPS Cluj approved the hunting of maximum 2 bears during the hunting seasons 2011-2012 and 2012-2013. Noteworthy is the disappearance of bears from the hunting fund of Stolna.

Population dynamics of wolves from the hunting fund owned by AJVPS Cluj in Cluj County is decreasing since 2010 from 154 to 126 heads. The optimal population number estimated AJVPS Cluj is 44 heads and is correlated with the reference year and with the population number of other species to which it must be in equilibrium (Tables 2, 6 and 10). Compared to optimal number of wolves calculated by AJVPS Cluj, the actual value of 126 wolves shows a temporary abundance.

Population dynamics of wild cat from the hunting fund owned by AJVPS Cluj in Cluj County show a decrease since 2010, from 307 to 220 heads. The actual number of wild cats is lower than optimal one, which is calculated at 247 wild cats (Tables 3, 7 and 11).

Population dynamics of European lynx from the hunting fund owned by AJVPS Cluj in Cluj County show an increase of animal number between 2010 and 2013 from 20 to 25 heads. The optimal number of European lynx estimated by AJVPS Cluj for its hunting funds is 11 animals, so the lynx population increase represents a positive evolution (Tables 4, 8 and 12).

In Romania, currently, wild fauna suffers due to high anthropization (Mertens & Promberger 2001). In Europe, as in other continents, the most affected regions are those intensely urbanized, where direct contact of the animal with man or indirect contact through the change of habitat parameters generate a powerful stress in wild fauna (Caughley & Sinclair 1994; Swenson et al 1998; Profico et al 2010; Fleșeriu 2010; Pop et al 2011). To these disturbing factors we can add poaching and lack of information or misinformation of people (Frazão-Moreira et al 2009; Ziembicki et al 2013; Ulicsni et al 2013). Their behavior can be adjusted to become more environmental friendly under the pressure of the law, but also with appropriate measures for information, awareness raising, active participation, based on the knowledge of their actions, opinions, beliefs. Thus, people concerned with their health, those interested in having a clean environment, in eating organic food etc. can be more suitable for being promoters of a sustainable

behaviour in relation to the protection of the mentioned species and they can also put a social pressure on others for shaping their actions so as to be more protective and appreciative towards wild animals and environment, in general.

Capturing and killing beyond the law can be more effectively combated through supervision and control of hunting and fishing activities by specialized associations authorized to do so (Hunter 1990; Bodmer et al 1994; Bolen & Robinson 2003). They are in charge of informing and raising awareness of hunting passionates of rights and obligations of hunter or fisherman, and of the current situation of animal populations (Knight & Gutzwiller 1995; Szabó & Mark-Nagy 2008). Associations in this field are required to annually evaluate each species populations, to estimate an optimal number of animals based on a history of the species in the area, to determine whether the number of animals of certain species allows hunting or fishing of that species, to establish the number of animals that can be hunted or captured in that year. Thus, hunting and fishing associations can help to maintain normal values of the number of invasive species (Morris et al 2011; Wood et al 2002) and, at the same time, can help protect endangered species or low numbered species (Hartel et al 2008).

Table 1

Records of brown bear population (*Ursus arctos*) assessed in 2011, compared to 2010, within the hunting fund managed by AJVPS CLUJ, in Cluj County

No.	Hunting fund	Optimum population size	Population estimates (heads) 2010	Population estimates (heads) 2011					
				Adults		Subadults	Yearlings		Total (heads) 2011
				M	F		<1year	1-2years	
1	Vad								
2	Bobalna								
3	Mica								
4	Gherla								
5	Cornesti 2								
6	Panticeu								
7	Cristorel								
8	Taga								
9	Sinmartin								
10	Feiurdeni								
11	Chinteni								
12	Sard								
13	Stolna				1	1			2
14	Floresti								
15	Corpadea								
16	Geaca								
17	Catina								
18	Triteni								
19	Feleac								
20	Valea Ierii		20	12	5	3			20
21	Gilau	6	2	2					2
22	Valea Belis		15	2	2	5			9
23	Huedin	16							
24	Ciucea	6							
	Total	28	37	16	8	9			33

Table 2

Records of wolf population (*Canis lupus*) assessed in 2011, compared to 2010,
within the hunting fund managed by AJVPS CLUJ, in Cluj County

No.	Hunting fund	Optimum population size	Population estimates (heads)	
			2010	2011
1	Vad		11	9
2	Bobalna	7	14	8
3	Mica		8	3
4	Gherla	3	4	6
5	Cornesti 2		8	12
6	Panticeu	5	10	10
7	Cristorel	6	14	8
8	Taga		2	2
9	Sinmartin		3	5
10	Feiurdeni		3	3
11	Chinteni		4	4
12	Sard	5	4	3
13	Stolna		12	18
14	Floresti		3	4
15	Corpadea		2	2
16	Geaca		2	11
17	Catina			
18	Triteni			
19	Feleac	2	7	4
20	Valea Ierii		5	10
21	Gilau	4	8	8
22	Valea Belis		10	8
23	Huedin	6	9	10
24	Ciucea	6	11	9
Total		44	154	157

Table 3

Records of wild cat population (*Felis silvestris*) assessed in 2011, compared to 2010, within the hunting fund managed by AJVPS CLUJ, in Cluj County

No.	Hunting fund	Optimum population size	Population estimates (heads)	
			2010	2011
1	Vad	18	20	15
2	Bobalna	16	16	17
3	Mica	10	11	13
4	Gherla	20	21	9
5	Cornesti 2	4	7	12
6	Panticeu	15	15	10
7	Cristorel	10	17	14
8	Taga	10	10	6
9	Sinmartin	6	8	6
10	Feiurdeni	6	8	4
11	Chinteni	6	10	6
12	Sard	20	21	6
13	Stolna	16	19	12
14	Floresti	26	27	10
15	Corpadea	2	5	5
16	Geaca	2	6	9
17	Catina	3	5	11
18	Triteni	1	1	2
19	Feleac	8	15	7
20	Valea Ierii		5	15
21	Gilau	16	19	8
22	Valea Belis		5	9
23	Huedin	12	14	8
24	Ciucea	20	22	8
	Total	247	307	222

Table 4

Records of lynx population (*Lynx lynx*) assessed in 2011, compared to 2010,
within the hunting fund managed by AJVPS CLUJ, in Cluj County

No.	Hunting fund	Optimum population size	Population estimates (heads)	
			2010	2011
1	Vad			
2	Bobalna			
3	Mica			
4	Gherla			
5	Cornesti 2			
6	Panticeu			
7	Cristorel			
8	Taga			
9	Sinmartin			
10	Feiurdeni			
11	Chinteni			
12	Sard			
13	Stolna		4	2
14	Floresti			
15	Corpadea			2
16	Geaca			
17	Catina			
18	Triteni			
19	Feleac			
20	Valea Ierii		5	5
21	Gilau		4	4
22	Valea Belis			8
23	Huedin	6	4	7
24	Ciucea	5	3	6
	Total	11	20	34

Table 5

Records of brown bear population (*Ursus arctos*) assessed in 2012, compared to 2011, within the hunting fund managed by AJVPS CLUJ, in Cluj County

No.	Hunting fund	Optimum population size	Population estimates (heads) 2011	Population estimates (heads) 2012					
				Adults		Subadults	Yearlings		Total (heads) 2012
				M	F		<1year	1-2years	
1	Vad								
2	Bobalna								
3	Mica								
4	Gherla								
5	Cornesti 2								
6	Panticeu								
7	Cristorel								
8	Taga								
9	Sinmartin								
10	Feiurdeni								
11	Chinteni								
12	Sard								
13	Stolna								
14	Floresti								
15	Corpadea								
16	Geaca								
17	Catina								
18	Triteni								
19	Feleac								
20	Valea Ierii		20	11	6	3			20
21	Gilau		2	1					1
22	Valea Belis		9	2	3	1			6
23	Huedin								
24	Ciucea								
Total			31	14	9	4			27

Table 6

Records of wolf population (*Canis lupus*) assessed in 2012, compared to 2011,
within the hunting fund managed by AJVPS CLUJ, in Cluj County

No.	Hunting fund	Optimum population size	Population estimates (heads)	
			2011	2012
1	Vad		9	9
2	Bobalna	7	8	8
3	Mica		3	3
4	Gherla	3	6	5
5	Cornesti 2		12	11
6	Panticeu	5	10	10
7	Cristorel	6	8	6
8	Taga		2	2
9	Sinmartin		5	10
10	Feiurdeni		3	6
11	Chinteni		4	5
12	Sard	5	3	2
13	Stolna		18	12
14	Floresti		4	
15	Corpadea		2	2
16	Geaca		11	2
17	Catina			
18	Triteni			
19	Feleac	2	4	
20	Valea Ierii		10	12
21	Gilau	4	8	8
22	Valea Belis		8	8
23	Huedin	6	10	10
24	Ciucea	6	9	9
	Total	44	157	140

Table 7

Records of wild cat population (*Felis silvestris*) assessed in 2012, compared to 2011,
within the hunting fund managed by AJVPS CLUJ, in Cluj County

No.	Hunting fund	Optimum population size	Population estimates (heads)	
			2011	2012
1	Vad	18	15	15
2	Bobalna	16	17	17
3	Mica	10	13	13
4	Gherla	20	9	24
5	Cornesti 2	4	12	5
6	Panticeu	15	10	20
7	Cristorel	10	14	20
8	Taga	10	6	17
9	Sinmartin	6	6	11
10	Feiurdeni	6	4	8
11	Chinteni	6	6	6
12	Sard	20	6	26
13	Stolna	16	12	23
14	Floresti	26	10	28
15	Corpadea	2	5	5
16	Geaca	2	9	2
17	Catina	3	11	2
18	Triteni	1	2	3
19	Feleac	8	7	17
20	Valea Ierii		15	10
21	Gilau	16	8	17
22	Valea Belis		2	2
23	Huedin	12	8	13
24	Ciucea	20	8	25
Total		247	215	329

Table 8

Records of lynx population (*Lynx lynx*) assessed in 2012, compared to 2011, within the hunting fund managed by AJVPS CLUJ, in Cluj County

No.	Hunting fund	Optimum population size	Population estimates (heads)	
			2011	2012
1	Vad			
2	Bobalna			
3	Mica			
4	Gherla			
5	Cornesti 2			
6	Panticeu			
7	Cristorel			
8	Taga			
9	Sinmartin			
10	Feiurdeni			
11	Chinteni			
12	Sard			
13	Stolna		4	4
14	Floresti			
15	Corpadea			
16	Geaca			
17	Catina			
18	Triteni			
19	Feleac			
20	Valea Ierii		5	6
21	Gilau		4	3
22	Valea Belis		8	2
23	Huedin	6	7	
24	Ciucea	5	6	2
	Total	11	34	17

Table 9

Records of brown bear population (*Ursus arctos*) assessed in 2013, compared to 2012, within the hunting fund managed by AJVPS CLUJ, in Cluj County

No.	Hunting fund	Optimum population size	Population estimates (heads) 2012	Population estimates (heads) 2013					
				Adults		Subadults	Yearlings		Total (heads) 2013
				M	F		<1year	1-2years	
1	Vad								
2	Bobalna								
3	Mica								
4	Gherla								
5	Cornesti 2								
6	Panticeu								
7	Cristorel								
8	Taga								
9	Sinmartin								
10	Feiurdeni								
11	Chinteni								
12	Sard								
13	Stolna								
14	Floresti								
15	Corpadea								
16	Geaca								
17	Catina								
18	Triteni								
19	Feleac								
20	Valea Ierii		19	10	6		3		19
21	Gilau		1	1					1
22	Valea Belis		6	3	1	2			6
23	Huedin								
24	Ciucea								
Total			26	14	7	2	3		26

Table 10

Records of wolf population (*Canis lupus*) assessed in 2013, compared to 2012,
within the hunting fund managed by AJVPS CLUJ, in Cluj County

No.	Hunting fund	Optimum population size	Population estimates (heads)	
			2012	2013
1	Vad		9	8
2	Bobalna	7	8	11
3	Mica		3	5
4	Gherla	3	5	4
5	Cornesti 2		11	7
6	Panticeu	5	10	10
7	Cristorel	6	6	6
8	Taga		2	2
9	Sinmartin		10	5
10	Feiurdeni		6	6
11	Chinteni		5	2
12	Sard	5	2	3
13	Stolna		12	10
14	Floresti			5
15	Corpadea		2	2
16	Geaca		2	1
17	Catina			
18	Triteni			
19	Feleac	2		2
20	Valea Ierii		12	13
21	Gilau	4	8	8
22	Valea Belis		8	3
23	Huedin	6	10	6
24	Ciucea	6	9	7
Total		44	140	126

Table 11

Records of wild cat population (*Felis silvestris*) assessed in 2013, compared to 2012,
within the hunting fund managed by AJVPS CLUJ, in Cluj County

No.	Hunting fund	Optimum population size	Population estimates (heads)	
			2012	2013
1	Vad	18	15	17
2	Bobalna	16	17	19
3	Mica	10	13	14
4	Gherla	20	24	8
5	Cornesti 2	4	5	4
6	Panticeu	15	20	20
7	Cristorel	10	20	20
8	Taga	10	17	17
9	Sinmartin	6	11	8
10	Feiurdeni	6	8	8
11	Chinteni	6	6	4
12	Sard	20	26	2
13	Stolna	16	23	12
14	Floresti	26	28	7
15	Corpadea	2	5	2
16	Geaca	2	2	3
17	Catina	3	2	3
18	Triteni	1	3	3
19	Feleac	8	17	5
20	Valea Ierii		10	12
21	Gilau	16	17	17
22	Valea Belis		2	2
23	Huedin	12	13	6
24	Ciucea	20	25	7
	Total	247	329	220

Table 12

Records of lynx population (*Lynx lynx*) assessed in 2013, compared to 2012, within the hunting fund managed by AJVPS CLUJ, in Cluj County

No.	Hunting fund	Optimum population size	Population estimates (heads)	
			2012	2013
1	Vad			
2	Bobalna			
3	Mica			
4	Gherla			
5	Cornesti 2			
6	Panticeu			
7	Cristorel			
8	Taga			
9	Sinmartin			
10	Feiurdeni			6
11	Chinteni			
12	Sard			
13	Stolna		4	3
14	Floresti			
15	Corpadea			
16	Geaca			
17	Catina			
18	Triteni			
19	Feleac			
20	Valea Ierii		6	6
21	Gilau		3	3
22	Valea Belis		2	2
23	Huedin	6		2
24	Ciucea	5	2	3
	Total	11	17	25

Conclusions. Population dynamics of brown bear, wolf, wild cat and lynx, based on the records of AJVPS Cluj, indicates population decline for bear, wolf, wild cat and an increase for lynx. Populations of brown bear and of wild cat are slightly below the optimum level assessed by the AJVPS Cluj, while the wolf and lynx populations have a number of animals superior to those estimated as optimal.

We consider as an appropriate protection measure for the two low numbered species (brown bear and wild cat), within the current context, to establish hunting quotas closed to zero for the next 1-2 years to prevent their extinction in some geographical areas of Cluj County.

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Authors:

Ioan Gheorghe Oroian, Department of Environment and Plant Protection, Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine, 3-5 Calea Mănăștur Street, 400372 Cluj-Napoca, Romania, e-mail: neluoroian@yahoo.fr

Ilie Covrig, Faculty of Silviculture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Calea Mănăștur Street, 400372 Cluj-Napoca, Romania, e-mail: ilie_covrig@yahoo.com

I. Costel Meseșan, Asociația Județeană a Vânătorilor și Pescarilor Sportivi Cluj (County Association of Hunters and Anglers Cluj), Cluj-Napoca, Romania.

Ioan Valentin Petrescu-Mag, Department of Environment and Plant Protection, Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine, 3-5 Calea Mănăștur Street, 400372 Cluj-Napoca, Romania, e-mail: zoobiomag2004@yahoo.com

Claudiu Gavriloaie, SC Bioflux SRL, Cluj-Napoca, Romania, 54 Ceahlau Street, Cluj-Napoca 400488, Romania, e-mail: claudiugavriloaie@gmail.com

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