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Coexistence of Large Carnivores and Humans: Threat or Benefit?

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Large Carnivores as added value – economic, biological and cultural aspects

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Abstract. There is a fundamental natural justification for the existence of predators as well as of all other species on the planet. As other creatures, predators have an irreplaceable biological role in authentic and modified ecosystems. The relation of humans toward large predators has however been changing dramatically throughout the long history of human civilization, though not in all the communities of human society. This paper presents the key historical moments of the conflict between humans and large predators, arguments for biological justification of their presence, and existence of still dominant negative attitudes of humans towards predators. It also contains the ideas how it could be possible to solve at least some of the causes of the conflict between humans and certain large wild animals in modern conditions. The paper points out the necessity for changing both the theory and practice of large carnivore hunting to deliver their permanent, appropriate, efficient protection and rational exploitation.

Key words: large carnivores, conflict, change of hunting practice, rationalization of livestock breeding

* * *

We can begin by formally acknowledging that large carnivores have a basic and natural right to live just as well as other creatures.

The question in the title of this meeting 'threat or benefit?' if it was somehow presented to our ancestors, the antediluvian hunters, would probably cause much confusion. In the European area, humans were not the object of predation by any of the great predators, wolf, bear or lynx; for they were the top predator. There was no threat. In those ancient, forgotten times, when our planet hosted much fewer people and much more untouched nature and various game animals, all the greatest hunters hunted without problems – humans, wolves, lynx, and bears. Those were the times of normal, natural coexistence among these most important hunters of Europe.

It is obvious that our ancestors, long before the arrival of Christianity, at the time of pagan beliefs, cultivated quite a different mood toward the large carnivores than today.

For example, if we consider the wolf, in the former complex hierarchy of gods of all ranks and for all occasions, one of the top gods was the god of good, "Dabog" (ŽIVANČEVIĆ 1951, ĐORĐEVIĆ 1958). According to the then existing custom, this "leading" god of dead and alive, the master of the underworld, the international god, man's best friend and helper and the common deity, was presented in the animal form. He was exclusively presented as a lame wolf on a green horse. This good god, riding on its faithful Greeny, was believed to be able to manage to help everybody just in time. He was the god of small livestock and its protector, main god of wolves and their leader (later, in the Serbian orthodox Christianity, the role of protector of wolves was played by St. Sava). The old Slavic world even considered the wolf to be the ancestor of all humankind. On the other hand, Canadian Algonquin people consider

the bear to be their Great Father, while the lynx in the heraldry represents sharp eyes and an alert state, and the Polish considered this species as their ancestor.

The great shift in the awareness and relationship between humans and large predators started with the process of animal domestication, permanent decreases in living space and agriculture. In these altered life conditions, the predators increasingly turned to livestock, and the human-herdsman started to consider them as big pests, especially the wolf. The development and increase in efficiency of modern hunting weapons and the mass character of hunting inevitably led to a reduction in the population numbers of various game animals, which are at the same time the trophic base for the predators. As the most common and most efficient hunter of all large predators in Europe, the wolf became the main unwanted competitor to the human hunter. Therefore in the region of the Balkans the folklore for generations considered the wolves to be overpowering beasts, and they greatly influenced the folk life and spirit. According to one folk belief, the wolf was created by the Devil, so everybody who kills nine wolves is guaranteed an automatic place in paradise (ŽIVANČEVIĆ 1951).

Despite such negative attitude, all large carnivore species, intertwining their lives with human lives for centuries, still survived in our region to the beginning of the 21st century. However, their population numbers had greatly decreased, and their ranges were greatly reduced and fragmented.

For example, in Serbia the range of bear was reduced to a relatively small area in the hilly-mountainous region of the western and southwestern parts of the country (PAUNOVIĆ 2002). The population of the Balkan lynx (*Lynx lynx martinoi*) in southern Serbia in the second half of 20th century represented a natural rarity at the verge of extinction (MIRIĆ 1981, PAUNOVIĆ *et al*. 2001). The spontaneous process of natural immigration from the area of southern Carpathians into northeastern Serbia renewed the population of Carpathian lynx (*L. lynx carpathicus*) in the primeval habitat from which it previously almost completely disappeared (MILENKOVIĆ 1985, MIRIĆ *et* PAUNOVIĆ 1992, 1994, PAUNOVIĆ *et al*. 2001). Here we should certainly mention the expected appearances and possibly re-establishment of lynx populations, also by spontaneous immigration, in the habitats of western Serbia. This population originated in the northern Carpathians and was introduced to Slovenia, where it adapted well and spread widely into many parts of Slovenia, Croatia and Bosnia-Herzegovina.

It is probably not necessary to explain the biological importance of any predator in the nature to biologists, to experienced hunters, or even to observers of nature. They all know very well that the positive impact of predators on prey populations does not have an alternative, and it can never be replaced by man-made selection in hunting areas. Under pristine conditions, the predation of large carnivores never really endangered the survival of prey populations. This can be proved by the presence of various animal bones excavated together with the bones of their predators, in layers of successive geological ages. But it is not necessary to go to the distant past. There is great evidence of quite limited predation effects everywhere around us. For example, at the relatively small distance from the location of this meeting, at Deliblatska peščara sands, province of Vojvodina, Serbia, only fifty or so kilometers from Belgrade, there lives a population of wolves with the highest estimated density on the planet. The estimates are from 5 to 10 individuals per 100 km^2! However we calculate that this strong population of wolves, living in a relatively small territory, did not bring to a standstill the increasing trends of prey populations – wild boar, roe deer and red deer. Although there are numerous similar

examples, the wolves as well as other predators are still considered a synonym for harmful species by a majority of the general public. The questionnaire performed in autumn 1996 on the population of Hunting Societies by the Natural History Museum and the Institute for Biological Research "Siniša Stanković", both from Belgrade, Serbia, very clearly illustrates the still widespread attitude of hunters towards practically all predators (MILENKOVIĆ *et* PAUNOVIĆ 1997). 62% of the participants in this survey suggested that the species presently not being protected by law should remain unprotected, while 9.5% wanted the unprotected species list to include all known carnivores. Only another 9.5% participants believed that all carnivores should be protected by law and managed like all other game species.

My firm belief is, resulting from several years' research on wolf damage to extensive livestock husbandry in the area of former Yugoslavia, that the key element in the origin of damage is the low protection level of domestic animals, especially at night. The daily attacks, and especially the successful ones, in presence of shepherds and dogs, are so rare within the total number of cases, that they may be completely ignored. The good illustration is again the population of wolves at Deliblatska peščara sands, which is well provided with natural food and rarely or never attacks the surrounding grazing livestock herds. Livestock, which is well represented in Serbia as well as in other countries of former Yugoslavia, has represented probably for a long time the main food source for wolves' survival. However, it does not include only attacks on living cattle, but also completely equally use of discarded remains of dead animals and slaughterhouse confiscate, which is in complete agreement with the sanitary function, which is another of the important function of this large carnivore in the conditions of greatly altered nature. It is also important to note that in several places where wolves were regularly provided with the appropriate quantity of slaughterhouse confiscate, the damage of livestock was almost completely absent, while the hunting pressure on game animals at the hunting area was significantly reduced. These are of course the indirect indicators, and unfortunately there were no detailed studies of wolf diet in our area, so the significance of our findings is unknown.

However, this is the opportunity to present some preliminary results of studies on the autumn and winter diet of the golden jackal (*Canis aureus*), a species that in last two decades has been increasing significantly, recolonizing the ancient ranges although immediately proclaimed to be harmful by some unwritten law. Over 140 specimens in great physical condition were analyzed by our team. We concluded that in over 70% of the cases the stomach contents mostly included hides of domestic pigs and a few wild boars. This species is not responsible for any significant predation or damage in the hunting areas or even households. To the contrary, the obvious sanitary character of its diet shows that it is a beneficial species.

By signing the international conventions on the protection of large carnivores, Serbia accepted the obligation of assuring the survival of large carnivores. One of the first steps was to formulate National Action Plans for protection of our three large carnivores – bear, wolf and lynx. These documents, as starting points, through many suggested measurements, would fulfill the historical need to enable a mutually beneficial form of coexistence between humans (especially hunters and livestock farmers) and large predators. Lethal control and hunting as a part of an Action Plan could be acceptable under respective conditions and sometimes could benefit large carnivore conservation (ANONYMOUS 2002).

This situation could then be reached by two means. First, there would be the inevitable rationalization of housing and protecting

livestock during the extensive livestock husbandry (with some other measurements we will not mention here). That would either decrease or almost stop the damage on livestock, doubtlessly leading to possible strengthening of the original way of livestock breeding. Second, the active, controlled and ethically acceptable regulation of population numbers, in situations when it shows to be desirable and properly based, can be performed through highly attractive and highly commercial hunting of large carnivores already rare in Europe – bear, wolf and lynx. There is a serious need to include the golden jackal.

Finally, our diversity of large carnivores represents a natural treasure of Serbia and the Balkans. These animals do not have to always be looked upon by the eyes of passionate hunters. There are many people who only want to see them or photograph them in their natural environment. To bring living nature to the people should not be an unaffordable financial effort for a country. If it succeeds there will be fewer people who think that this country does not have a culture or at least a developed sympathy for the natural world.

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Public perception of large carnivores: A German Survey before and after "Bruno"

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Abstract. The wolf, brown bear and lynx, long extinct in Germany, seem to be increasing again. Against this background the "Deutsche Wildtier Stiftung" (German Wildlife Foundation) did a survey in 2004 and 2006 on the acceptance of carnivores in Germany. Despite all methodological uncertainties coming of any survey or public poll, there are several conclusions: (1) A negative experience with a species of wildlife lowers the acceptance of that wild species; (2) the perception of threat to an individual human is low, although perhaps increasing; (3) the increase and immigration of large carnivores is often not welcome and this situation needs to be improved.
In consequence wildlife conservation needs to be improved. Ongoing public information and protection in harmony with the needs of local people are key issues for the future of large carnivores in Germany and Europe. Hunters are in a unique position to help. A stronger linkage between all interested groups, conservationist, biologists, hunters, politicians and landowners is needed to promote the remaining large carnivores.

Key words: public acceptance, damage, threat, management, conservation

Background

The German Wildlife Foundation (Deutsche Wildtier Stiftung) developed two surveys – one in 2004, the other in 2006 – on the public perception of large carnivores in Germany[1]. Species such as wolf, bear and lynx, long extinct in Germany, seem to be increasing again. The successful reintroduction of lynx in North Germany in 1999 and the immigration of wolves from Poland to East-Germany were the most recent and most popular cases, until the brown bear JJ1 (or "Bruno" as he soon was called by the media) crossed the Austrian-German borderline and appeared in Bavaria. He was the last of Europe's large carnivore species to enter Germany.

Both, wolf and bear created a huge media response. And the public opinion did not come to a consensus.

Against this background the German Wildlife Foundation was convinced that it was useful and necessary to get a more unbiased view on the public opinion. The following deals with natural immigration only. Artificial reintroduction of extinct species must be handled with care using different criteria. Natural immigration takes place however and will continue to take place. This is a challenge for species conservation in Germany as there is not very much experience in managing carnivores; Germany was more or less free of large carnivores the last 100 years.

There is a clear need to change the current approach where the wolf is considered mainly as a threat to livestock and people.

In the end communication is a crucial job for "acceptance by the public" is one of the most important points to guarantee that carnivores can live in peace and harmony in an industrialized and highly populated country like Germany.

[1] The surveys were carried out by the well know EMNID Institute by telephone interviews. In the first survey (10.12. – 19.12.2004) 1023 representative chosen people were asked. In the second survey (30.06. – 09.07.2006) 1069 people participated.

The survey

But what really is the general public thinking? Do the extreme points of view of the German yellow press reflect what people have in mind with respect to large carnivores?

Following this ongoing debate on how to deal with these species, the German Wildlife Foundation (Deutsche Wildtier Stiftung) initiated in 2004 and 2006 representative opinion surveys on the acceptance of large carnivores in Germany, carried out by the well known EMNID Institute.

The main target of the questionnaire had been the general acceptance of wildlife in Germany and the emotional position of people towards bear and wolf. Furthermore, the risk awareness and the readiness to assume the risks, which might come along with the presence of wolves and bears, were part of the survey.

The Results – Acceptance in general

In 2004 49% of the participants in the survey agreed to the general statement that all wildlife, which once inhabited Germany but is now extinct, should have a right to repopulate the country (**Fig. 1**). In 2006 – after the whole "Bruno Story" – this figure dropped down to 41%. Looking to Bavaria where Bruno was wandering around, only 27% was pro wildlife after Bruno. In Saxonia where our couple of wolves are living, the figures are the same as for the whole of Germany.

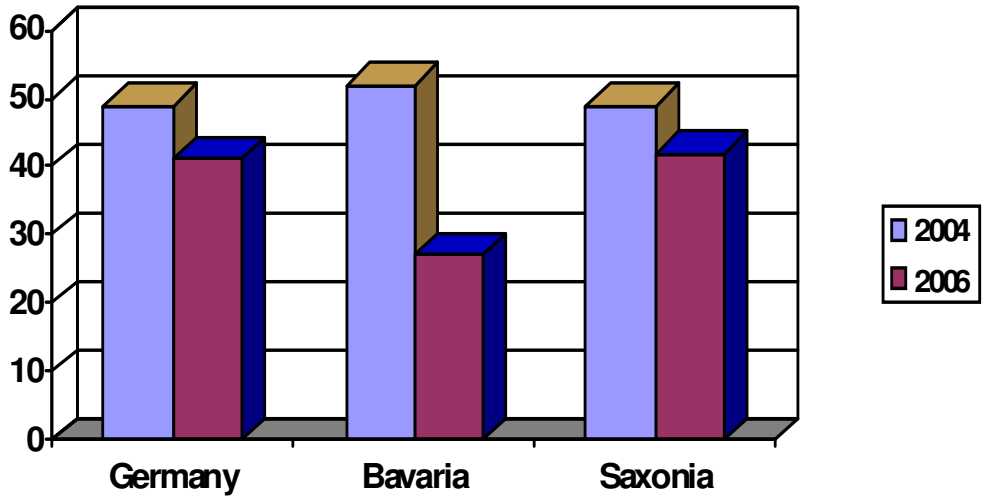

Figure 1. Question: Do you agree with the statement that all wildlife formerly living in Germany has the right to repopulate the country? (in %)

That only a minority of the Germans would welcome species like the brown bear or the wolf must be an alarming result for all experts dealing with species conservation. And it was clear to see that the whole problem with "Bruno" has not improved the image of large carnivores. This is a challenge for every hunter or conservationist; how to work for more acceptance of the large carnivores.

Large carnivores and fundraising

Around 20% of participants would apparently support any organisation aiding the return of large carnivores (**Fig. 2**). But looking to the results in Bavaria and Saxonia it might be advisable to raise the funds where people have not been directly confronted with the existence of a wolf or a bear.

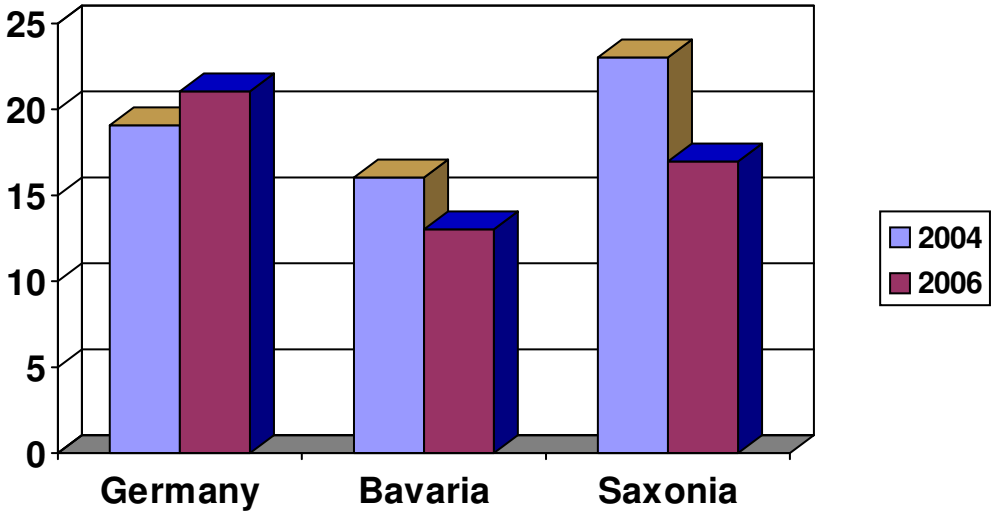

Figure 2. Question: Yes, I would support an organization, which is engaged in the return of wolves and bears to Germany. (in %)

How to deal with "Bruno"?

In 2006 some specific questions were added to the survey on how to deal with "Bruno" (**Fig. 3**). Bruno was shot in June 2006 being assessed from all German and Austrian experts as being too dangerous to stay free. The statement that bears should not be killed in any case was agreed by 45% with a lower agreement in Bavaria where only eighteen percent agreed with this. The statement that damage should be compensated by the public – again found a lower agreement in Bavaria. And finally: "Do you think that it is better to shoot a wild bear than to catch and lock him up?" An absolute minority of just 9% answered with yes.

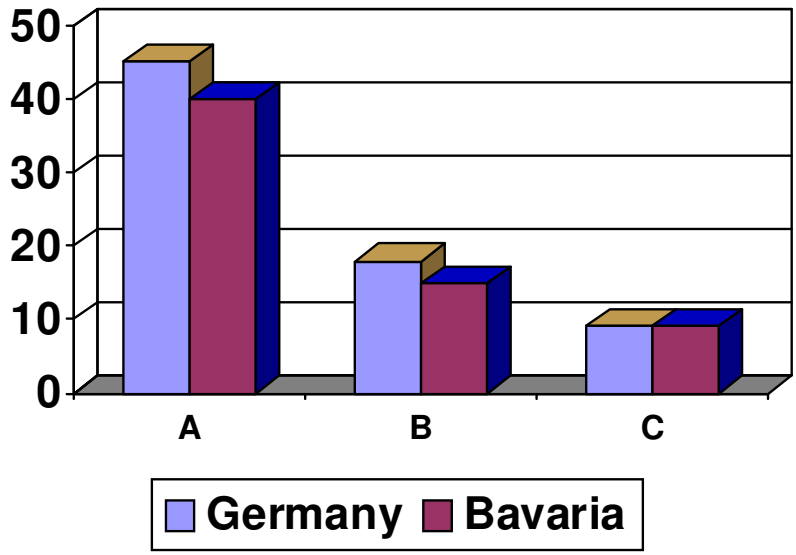

Figure 3. **A:** Bears should not be killed in any case. **B:** Bears have a right to live in Germany. Damage should be paid by the public. **C:** It is better to shoot a bear than to catch and lock him up.

Conclusions

Despite all methodological uncertainties coming along with any survey or public poll, these figures show really impressively that the German public is divided: many people do not want large carnivores and many would not agree with shooting a large carnivore like Bruno; even if experts say, that it is too dangerous to keep him alive.

In conclusion it can be stated that negative experiences with wildlife do lower the acceptance towards any wild species and damage caused by large carnivores like wolves or bears do have the potential for undermining conservation matters in general.

Secondly the feeling of individual threats due to the presence of large carnivores is however rather low, even if they increase when negative incidents are happening.

Professional management of damages, established structures for financial compensation and proactive public relations are necessary to prevent negative experiences with wildlife to strengthen the acceptance of reintroduced animals and wildlife in general. Only then one can provide a chance for a sustainable introduction of large carnivores like lynx, wolves or bears.

Thirdly, the general acceptance of the immigration and presence of large carnivores still needs to be improved.

The survey shows that up to 60% of the people do not actively support large carnivore conservation in Germany nor the idea of the reintroduction of former extinct animals. Strong advocates for our wildlife are needed.

Acceptance follows knowledge, knowledge follows experience, and experience follows information. Ongoing public information and a stronger lobbying to establish lasting protection in cooperation with local people are key issues for the future of large carnivores in Germany and similar countries. Hunters are in the position to provide their special abilities and knowledge to encourage and support these actions. A stronger linkage between all interested groups, conservationist, biologists, hunters, politicians and landowners is needed to promote the remaining large carnivores and to provide a way for future generations to open their eyes, hearts and consciousness to the beauty of nature and its large carnivores.

Management of Large Carnivores in Europe
CIC Position Paper

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Abstract. Large carnivore management and conservation are controversial issues of central interest for the CIC. A position paper must reflect the opinion of the organization and its members. The following points will be stressed. All five species of large terrestrial carnivores should be managed for long term viability in Europe. These are: Wolf (*Canis lupus*), brown bear (*Ursus arctos*), wolverine (*Gulo gulo*), Eurasian lynx (*Lynx lynx*) and Iberian lynx (*Lynx pardinus*). Legislation and management practice must reflect the great variation in distribution and abundance. It is often necessary to have cooperation amongst nations in managing shared populations. It is important to involve hunters and local stakeholders to obtain social acceptance of the carnivores. Communication, not only information is required. Hunting is an acceptable and necessary tool for managing large carnivores, hunting can be an opportunity and provide important revenues. There is a conflict between hunters and large carnivores through competition for game and the killing of hunting dogs. Programs teaching hunters special skills for hunting these species should be encouraged. Participation in monitoring, tracking, etc. gives the hunter "ownership" of the best knowledge of the large carnivores, which is the basis of proper management.

Key words: large carnivores, conservation, management, position paper, big game

Introduction

Throughout Europe the biological, legal and socio-cultural status of the large terrestrial carnivore species – Wolf (*Canis lupus*), Brown bear (*Ursus arctos*), Wolverine (*Gulo gulo*), Lynx (*Lynx lynx*) and Iberian lynx (*Lynx pardinus*) – has changed significantly in recent decades. From that of unprotected vermin, whose eradication was often encouraged through a system of bounties, they have become "protected" species. International conventions, such as the *Convention on the Conservation of European Wildlife and Natural Habitats* ("Bern Convention") and the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES), as well as the *Habitats Directive* of the European Commission and national laws form the foundation for the conservation and management of large carnivores in Europe today.

A number of international conventions are very much oriented toward species protection, and often lack the flexibility needed to meet the challenges for conserving and managing the increasing large carnivore populations.

There is a great variation in the distribution and abundance of each species, and their associated habitats and prey within Europe. Practices relating to animal husbandry, land-use, and recreation vary greatly from region to region, as do levels of socio-economic development. Social traditions and attitudes towards large carnivores also differ from state to state and from region to region.

Hunting is increasingly restricted, in some countries even forbidden, mainly by the European Union, although scientific analysis shows that a sustainable take-off would perfectly be possible and desirable.

At many places the conflicts grow between large carnivores and local population. As a result, carnivores are often killed illegally. Their future is consequently increasingly uncertain or even endangered. This would not be necessary, if proper management strategies, including sustainable hunting were put in place.

Management Objectives

The CIC is of the opinion that large carnivore populations must be managed for long-term viability and acceptance in Europe. Local involvement of stakeholders and minimization of conflicts are vital for acceptance of these species and associated management priorities. Populations must be managed so that the quality of life in rural communities and the activities of local residents are not degraded, although the activities of local residents must sometimes be modified, if there is no other solution, to reduce the level of conflict and ensure viability of the carnivore population. It is further important that proper monitoring of the populations is supported and that the management is adaptive.

Carnivore management must be based on scientific knowledge regarding species populations and human attitudes. Guiding principles as advised through the *Convention on the Conservation of Biodiversity (Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity)* and the *European Charter on Hunting and Biodiversity* should be applied to ensure empowerment of local stakeholders in the management of natural resources where possible and appropriate. However, although local involvement in management is important and essential for human acceptance, large carnivores must be managed at different scales to ensure their long-term viability. Since many European states are too small to contain viable populations of large carnivores on their own, a trans-boundary approach will often be required. Management strategies and plans should be formulated for species population or sub-population, with close cooperation between the countries that contain them. This international cooperation among governments and non-governmental organisations is essential for the wise and proper management of regional populations. Such cooperation also gives the necessary flexibility for local decisions within previously agreed upon goals.

Local involvement of stakeholders and minimization of conflicts is vital for acceptance of these species and associated management priorities. Populations should be managed so that the quality of life in rural communities and the activities of local residents are not degraded. It is further important that proper monitoring of the populations is supported, that the management is adaptive and that a trans-boundary approach is applied.

It is important to point out that the frames for management can be set at the international, national and regional levels in order to carry out strategic and integrated management actions. Such management plans should take into account available habitat and potential or existing conflicts with local inhabitants, as well as other factors which might restrict the abundance of large carnivores, such as lack of prey. Management strategies should have a clear framework in time and space in order to allow for greater predictability and stability. Within the framework of conventions and legislation, there must be provisions to change the listing status of a species regionally on the basis of scientific data regarding population size and status.

Local involvement and conflict reduction

Potential conflicts between humans and large carnivores include:

1. the impact of predation on agricultural interests, including livestock, reindeer and beekeeping industries;

2. conflicts with hunters through competition for larger game and depredation on hunting dogs, which in turn impact traditionally popular hunting forms;

3. general fear and anxiety for personal safety, which can lead to decreased outdoor recreation and life quality;

4. conflicts between groups of people with different attitudes towards large carnivores.

Management plans based only on biological considerations, ignoring social aspects, are bound to fail. Local residents must be allowed to participate in the management process. Unidirectional information from central authorities often creates, rather than solves conflicts with local inhabitants who coexist with large carnivores; on the other hand, dialogue among local inhabitants, managers and researchers is a critical element in the process of finding remedies and solutions. Conflicts must be resolved through building mutual trust and respect among government authorities and different interest groups at all levels.

Schemes for preventative measures and/or compensation must be designed to effectively reduce losses and conflicts to acceptable levels for agriculture, hunting and other interests. Local residents must be given the trust and possibility to influence their own situation regarding large carnivores. To be more successful, payment of compensation should be dependent upon the use of reasonable preventive measures. It is also of paramount importance to give local residents the possibility to defend their stock. This is an effective tool to foster the acceptance of large carnivores.

CIC has a conservative approach to the reintroduction of large carnivores. The Bern Convention gives a set of criteria which should be fulfilled when reintroduction of a species is considered.

CIC stresses the need for local involvement and acceptance regarding any future reintroductions of large carnivores in Europe.

The role of hunters in large carnivore management

Hunting is an acceptable and necessary tool for managing large carnivore populations and biodiversity, as emphasized by the Bern Convention in the European Charter on Hunting and Biodiversity. Hunting can be used to control carnivore populations or to remove problem animals and thus make the carnivore conservation more sustainable. It must be recognized that fear, anxiety and social conflicts can arise where large carnivores and local people coexist. In this regard, hunting can be used as a tool for increasing and maintaining natural wariness of large carnivores toward humans. Slowing the rate of population growth through hunter harvests may also contribute to long-term acceptance of these species.

Furthermore, large carnivores hold potential or real resource value as game species. This represents both recreational and economic opportunities. Legalized hunting of large carnivores helps reduce poaching, because it allows local residents an opportunity to be involved in management and benefit directly from them as recreational and economic resources.

The involvement of skilled, local hunters in problem animal control is an important aspect in the overall management of large carnivores. Hunters, who use conventional and accepted methods, rather than the sometimes “unethical” control means by government personnel, can have positive effects both in terms of acceptance of carnivores and control of their populations by society at all levels.

In order to ensure humane and safe hunting practices, programmes teaching hunters the special skills needed for hunting these species should be encouraged.

Last, but not least, for efficiency, the hunter community should be involved in monitoring, tracking and research concerning large carnivores. Such cooperation enables an open dialogue between scientists, managers and hunters and can reduce data conflicts since hunters actively contribute data to scientific monitoring and research. In that way, hunters become "owners" of the acquired knowledge regarding large carnivores in their localities. This participation in scientific adaptive management is an important criterion for the acceptance of large carnivores at the local and regional levels.

Conclusions

Management of large carnivores should be based on broad involvement and acceptance within society at all levels. Management strategies must take into account scientific data regarding population status and dynamics, ecology, and interaction with other species and humans.

CIC stresses that hunting is a valuable, and in many cases necessary, tool for managing large carnivore populations. Hunters represent a large body of skilled and knowledgeable volunteers and as such are invaluable as partners with government authorities in large-scale monitoring and active management of large carnivores.

In Europe the status of regional large carnivore populations varies greatly regarding their conservation status. Therefore, it is important that international conventions and national legislation regarding these species and their management reflect regional variations in population viability and human needs.

Conservation Status of Large Carnivores in Europe and the Freedom within Frames Approach

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Abstract. The European populations of brown bear, Eurasian lynx, wolf and wolverine have increased in the last two decades. The only European large carnivore (LC) that has not seen an increase in its range is the Iberian lynx, which is the most endangered cat in the world. The reason for this general trend is to be found in a series of factors that span from a shift in land use patterns to a series of national and international legislations that regulate the management of habitats and species. Despite all these, the relationship between humans and LCs is not yet secured, and it is currently the main cause for controversial management approaches. A range of management schemes are in force in Europe for mitigating the conflicts between humans and LCs. They are applied under different levels of local participation and responsibility, and all of them are suited to local conditions. Nevertheless, LCs can cover large areas and long distances, often forming populations spread over more than one country. Thus the need for applying a regional view when acting at local scale is strong: the way ahead appears to be that local actions should be taken with a view at population level.

Key words: large carnivores, conflicts, populations, management, conservation.

Introduction

Europe hosts an outstanding diversity of cultures and landscapes, some of which are highly influenced by human presence and activities that would not exist naturally. One of the most surprising characteristics of this continent is that in spite of having such a high human impact on the landscape, megafauna (large carnivores and large ungulates) are still present and able to reach viable population levels. The populations of large carnivore species such as bear, lynx and wolf have persisted in Europe and are locally expanding their distributions. They represent a valuable part of the European natural heritage and as such they are included in the lists of strictly protected species (in the sense that the killing of them is prohibited or at least regulated) in nearly all European countries as well as in international treaties and legislations. The diversity of Europe is at least in part due to many national borders that crisscross the landscape. The resulting small size of many states or countries however poses severe challenges for the conservation of large carnivores because they have enormous area requirements. Few countries are able to house viable populations within their own borders. Therefore, the future of these species in Europe is dependent on different states and countries cooperating in a coordinated manner to ensure the sustainable management of populations. International legislation like the EU's Habitats Directive currently presents a paradox because on one hand its purpose is based on the need for international cooperation, yet in operation it puts the responsibility onto individual countries to achieve Favourable Conservation Status. Realising this the EU has commissioned the Large Carnivore Initiative for Europe (http://www.lcie.org) to conduct an assessment of the distribution of populations of bears, lynx and wolves and to make a tentative identification of *populations* as *management units*[1] (LINNELL *et al.* 2007) according to environmental barrier and/or legislation/management situations. The management approach on this scale considered to be the best possible management solution, considering the conflicts that these species are associated with when they re-occupy areas with high human presence. The main outputs of this whole exercise were a document entitled "Guidelines for Population Level Management Plans for Large Carnivores" (www.lcie.org) and an Online Information System for the four species

[1] For a comprehensive discussion on the definition of population or management unit, please refer to Linnell et al. 2007.

which is publicly available (www.kora.ch/sp-ois). The work only includes information from European countries west of 35°, including part of Russia and Ukraine.

The distribution of bears, lynx and wolves in Europe

Across all 32 countries an effort was made to collect the most up-to-date information on species distributions and management status, identify threats to their conservation and the main conflicts that occur with humans. In each country, one or more experts were contacted, requesting their contribution to the project. Maps for depicting detailed information on the distribution of each species in the different countries were produced. For this purpose, maps of each country with a superimposed grid of 10x10 km cell were prepared in order to ask each country contact to fill in the cells with a 5-class code (permanent presence, occasional confirmed presence, single observation not confirmed, absence, no information). Data were requested for the period 2000–2005.

The distribution maps, as integrated for the whole area considered by the study, were made available to experts for each of the four species considered in order to suggest population boundaries and descriptions. The authorities were the following:

Prof. Jon Swenson and Prof. Djuro Huber for brown bears;
Prof. Urs Breitenmoser and Dr. Christine Breitenmoser-Würsten for Eurasian lynx;
Prof. Luigi Boitani for wolves;
Dr. Arild Landa for wolverines.

The drafted population descriptions were then circulated among the members of the LCIE in order to allow their contribution and if necessary to modify suggested figures and information. When discussed and modified as appropriate, the population descriptions were used for drafting the document "Guidelines for Population Level Management Plans for Large Carnivores" and developing the Species Online Information System (SP-OIS).

Bears

The brown bear (*Ursus arctos*) had a continuous distribution throughout Europe in historical times (SWENSON *et al*. 2000). Following intensive extermination activities in many countries, together with a significant reduction of forested areas, their distribution reached critical levels in the middle of the 20th century, when most countries declared it a protected species. Nowadays bears are expanding their distribution across Europe. This process is also being assisted through re-introduction projects (e.g. in the Pyrenees and the Italian Alps).

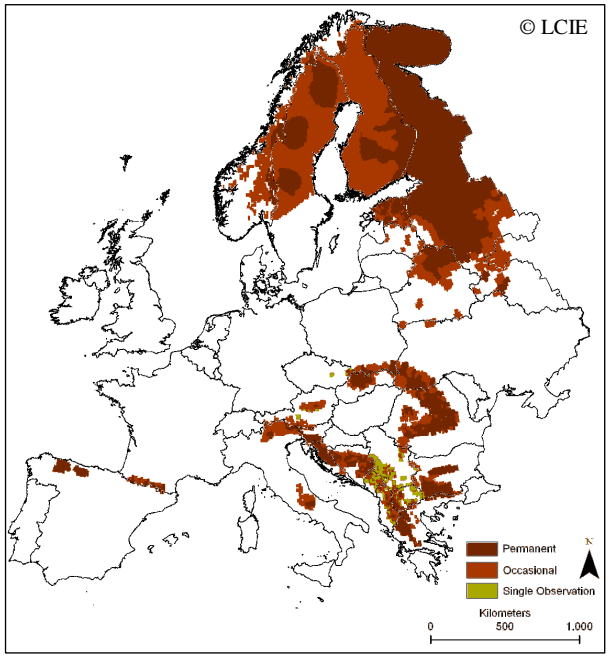

Figure 1. The current distribution of brown bears in Europe resulting from a country-based survey done in 2007 through information provided by country experts (modified from *www.kora.ch/sp-ois).*

The distribution of bears (**Fig. 1**) appears to be relatively continuous in Northern Europe, connecting to the large Russian population. In other parts of Europe there are two large nuclei in the Carpathian Mountains and the Dinaric Arc. Other small nuclei can be found in the Alps, in the Central Apennines, in the Pyrenees, in the Bulgarian/Greek mountains, and in the Cantabrian Mountains.

Many of these nuclei are hosted by countries signatory to the Bern Convention (*Convention on the Conservation of European Wildlife and Natural Habitats*, 19.9.1979) where bears are listed as a "strictly protected species" (Appendix II), and the European Council *Directive on Conservation of Natural and Wild Fauna and Flora* of the European Union (known as the Habitats Directive 92/43 of 21.5.1992), although exceptions have been granted to many countries.

These distributions, suggests that European bears are subdivided into a series of populations separated by more or less clear physical habitat barriers. In the light of these considerations a total of 10 populations can be identified. **Table 1** reports the different populations suggested and the countries where they are distributed. The figures reported for the population sizes are non-confirmed estimates, produced with a variety of methods and over different periods, thus are only indicative of order of magnitude. Nevertheless they indicate a total of over 25,000 bears.

Table 1. Overview of the population structure of brown bear in Europe (from LINNELL *et al.* 2007)

Region	Population	EU countries	Non-EU countries	Population segments	Size
Iberia	Cantabrian	Spain[1]		Western / Eastern	120
Pyrenees	Pyrenees	France, Spain[2]	Andorra	Western / Central	15-21
Apennines	Apennines	Italy[3]			40-50
Alps	Alps	Italy[4], Austria, Slovenia	Switzerland	Trentino Central Austria[5] Southern Austria[6]/ Slovenian Alps	30-50
Dinaric Pindos	Dinaric Pindos	Slovenia, Greece	Bosnia & Herzegovina, Croatia, Serbia, Montenegro, FYR Macedonia, Albania	Northern Dinaric[7] Central Dinaric[8] Pindos[9]	2,800
East Balkan	East Balkan	Bulgaria, Greece	Serbia	Rila Rhodope Stara Planina Eastern Serbia – northwest Bulgaria	720
Carpathian	Carpathian Mts	Czech Republic, Poland, Slovakia, Romania	Ukraine, Serbia	Western[10] Main chain[11] Apuseni mts.	8,000
Scandinavia	Scandinavia	Sweden	Norway	Southern/Central/ Northern	2,600
Northeastern Europe	Karelian	Finland	Norway, Russia[12]		4,300
	Baltic	Estonia, Latvia	Russia[13], Belarus		6,800
Total					25,220

1. The distribution covers that of 4 autonomous regions – Asturias, Cantabria, Castilla y Leon and Galicia.
2. The distribution covers 3 autonomous regions – Navarra, Aragon and Catalonia.
3. In the Apennines the distribution covers that of 3 regions: Lazio, Abruzzo, Molise.
4. The distribution covers that of 5 autonomous areas: Province of Trento, Province of Bolzano, Regions: Veneto, Lombardia, Friuli.
5. The Austrian states of Lower Austria, Styria and Upper Austria.
6. The Austrian state of Carinthia.
7. Southern Slovenia, Croatia, Bosnia & Herzegovina, western Serbia, Montenegro.
8. Northern Albania – the distribution of bears in this region is not well known hence the exact location of the discontinuities is poorly known.
9. Eastern Albania, FYR Macedonia, northern and central Greece.
10. Includes south-central Poland and central Slovakia.
11. Includes south-eastern Poland, far eastern Slovakia, Ukraine and the main chain of the Carpathians through Romania and into eastern Serbia.
12. Russian oblasts of Leningrad, Novgorod, Pskov, Tver, Smolensk, Bryansk, Moscow, Kaliningrad, Kaluzh, Tula, Kursk, Belgorod & Orel.
13. Russian oblasts of Murmansk, and Karelia. The southern and eastern border coincides with the natural geographic structures of Lakes Onega and Ladoga and the White Sea.

Lynx

The Eurasian lynx (*Lynx lynx*) is the largest felid present in Europe (though with possible exception of leopard, *Panthera pardus*, possibly present in Turkey, and confirmed for Georgia and Armenia). Lynx were present throughout Europe in historical times with the exception of the Iberian Peninsula, where it is replaced by the Iberian lynx (*Lynx pardinus*) (BREITENMOSER *et al.* 2000). As a consequence of human activities (direct persecution, loss of prey and forest cover), the distribution range shrank significantly and reached its minimum most probably in the 1930s to 1950s. The range is currently expanding, mostly due to legal protection and harvest regulation of the species and re-introductions of individuals into Central Europe. The current distribution of lynx is depicted in **figure 2**.

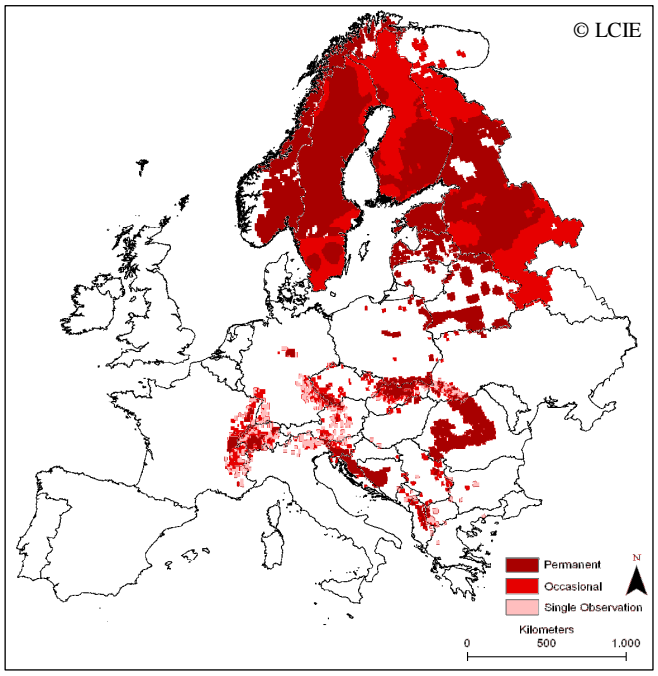

Figure 2. The current distribution of Eurasian lynx resulting from a country-based survey obtained through information provided by country experts (modified from *www.kora.ch/sp-ois*).

The major nuclei are the ones in Fennoscandia and Russia, the Carpathian Mountains and the Dinaric Arc. Smaller, though significant populations can be identified in the Alps, the Jura mountains, the northern Dinaric mountains and in the Bohemian-Bavarian area. The naturally occurring population in the southern Balkans is critically endangered. Many European countries secure total protection for the lynx, although it is not listed as priority in the Annex II of the Habitats Directive (Directive 92/43 of 21.5.1992), while in some countries it is considered as game species. Generally, the levels of conflicts with human activities are lower for lynx than for bears and wolves.

According to the distribution data available we can recognise a total of 11 populations. They are reported in **table 2**. The numbers reported should be considered non-confirmed estimates, produced with inconsistent methods and over different periods, thus are only indicative of order of magnitude. They indicate a total population just short of 10,000.

Table 2. Overview of the population structure of Eurasian lynx in Europe (from LINNELL *et al.* 2007)

Region	Population	EU countries	Non-EU countries	Population segments	Size
Bohemian – Bavarian	Bohemian – Bavarian	Germany, Austria, Czech Republic			75
Vosges	Vosges	France, Germany		South/Central Vosges, North Vosges/ Palatinian forest	30-40
Jura	Jura	France	Switzerland		80
Alps	Western Alps	France, Italy, Germany (?)	Switzerland		90-110
	Eastern Alps	Italy, Austria, Slovenia			30-40
Dinaric	Dinaric	Slovenia	Croatia, Bosnia & Herzegovina		130
Balkans	Balkans	Greece (?)	Albania, FYR Macedonia, Serbia, Montenegro		<100

Region	Population	EU countries	Non-EU countries	Population segments	Size
Carpathian	Carpathian Mts	Poland, Slovakia, Czech Republic, Romania, Hungary	Ukraine, Serbia		2,500
Scandinavia	Scandinavia	Sweden Finland	Norway,		2,000
Northeast Europe	Karelian	Finland	Russia[1]		1,500
	Baltic	Estonia, Latvia, Lithuania, Poland	Russia[2], Belarus, Ukraine		3,400
Total					<9955

1. Russian oblasts of Murmansk, and Karelia. The southern and eastern borders coincide with the natural geographic structures of Lakes Onega and Ladoga and the White Sea.
2. Russian oblasts of Lenningrad, Novgorod, Pskov, Tver, Smolensk, Bryansk, Moscow, Kalinigrad, Kaluzh, Tula, Kursk, Belgorod and Orel.

Wolves

Wolves (*Canis lupus*) historically occupied the whole Northern hemisphere north of 20° N. Following extermination efforts by man, wolves disappeared from many European countries and in the mid 1900s the presence in Europe was highly fragmented (BOITANI 2000). It is currently recovering due mainly to improved legislation and conservation campaigns that allowed the wolf to naturally re-colonise areas from where it had disappeared. **Figure 3** shows the current distribution in Europe. Wolves are present almost continuously across Eastern Europe from Finland to Greece. Other significant nuclei are present in the Iberian Peninsula, in continental Italy and in Norway/Sweden. The legal status of the wolf varies throughout Europe, ranging from game species to strictly protected species. Within the Habitat Directive it is listed as priority species in Annex II, but it is also listed in Annex IV, with some countries having made regional exceptions.

A total of 10 wolf populations have been identified in Europe. They are reported in **table 3**. The numbers reported are to be considered non-confirmed estimates, produced with inconsistent methods and over different periods, thus are only indicative of order of magnitude. The total population size approaches 18,000 individuals.

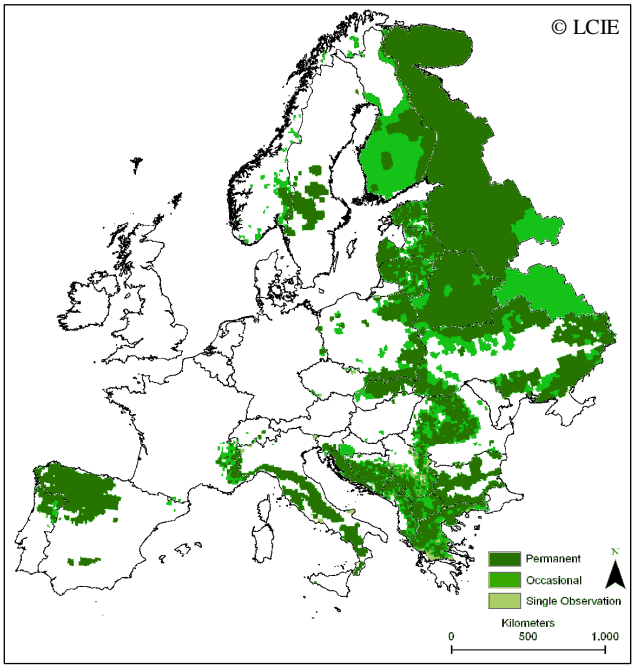

Figure 3. The current distribution of wolf resulting from a country-based survey done in 2007 through information provided by country experts (modified from *www.kora.ch/sp-ois*).

Table 3. Overview of the population structure of wolf in Europe (from LINNELL *et al.* 2007)

Region	Population	EU countries	Non-EU countries	Population segments	Size
Iberia[1]	Northwestern	Spain, Portugal		North of Duero, South of Duero in Portugal and Spain	2400
	Sierra Morena	Spain			50

Region	Population	EU countries	Non-EU countries	Population segments	Size
Alpine/ Italian	Western Alps	France, Italy[2]	Switzerland		130-160
	Italian peninsula	Italy[3]			500-800
Dinaric – Balkan	Dinaric Balkan	Slovenia, Greece, Bulgaria	Croatia, Bosnia & Herzegovina, Serbia, Montenegro, FYR Macedonia, Albania		5,000
Carpathian	Carpathian Mts	Czech Republic, Slovakia, Poland, Romania, Hungary	Ukraine, Serbia		5,000
Northeast Europe	Scandinavia	Sweden	Norway		130-150
	Karelian	Finland	Russia[4]		750
	Baltic	Estonia, Latvia, Lithuania, Poland	Russia[5], Belarus, Ukraine		3,600
	Germany/ Western Poland	Germany/ Poland			<50
Total					17,785

1. The distribution area covers 8 autonomous regions – Galicia, Asturias, Cantabria, Castilla y León, País Vasco, La Rioja, Castilla-La Mancha and Andalucia.
2. The distribution area covers 3 regions: Val d'Aosta, Piemonte, Liguria.
3. The distribution area covers 11 regions: Lombardia, Emilia-Romagna, Toscana, Marche, Lazio, Abruzzo, Molise, Campania, Basilicata, Puglia, Calabria.
4. Russian oblasts of Murmansk, and Karelia. The southern and eastern borders coincide with the natural geographic structures of Lakes Onega and Ladoga and the White Sea.
5. Russian oblasts of Leningrad, Novgorod, Pskov, Tver, Smolensk, Bryansk, Moscow, Kalinigrad, Kaluzh, Tula, Kursk, Belgorod and Orel.

Wolverines

Wolverines (*Gulo gulo*) are distributed across the entire arctic region and in Europe; they range north of the 60°N. Their distribution was much wider in historical times until it was reduced due to human persecution and disturbance. It is currently found in Fennoscandia and Russia. The species causes conflicts with human activities, mainly due to predation on livestock (sheep and reindeer). The current distribution is represented in **figure 4**. In terms of management approaches, it is represented by two populations shared by four countries.

Table 4. Overview of the population structure of wolverine in Europe (from LINNELL *et al.* 2007)

Region	Population	EU countries	Non-EU countries	Population segments	Size
Northern Europe	Scandinavian	Sweden, Finland	Norway	South Norway, Scandinavian, Swedish forest	750
	Finnish Russian	Finland	Norway, Russia[1]	Karelian, Western Finland	450

Table 4 reports on countries involved and the estimates of population sizes. The numbers reported are to be considered non-confirmed estimates, produced with inconsistent methods and over different periods, thus are only indicative of order of magnitude. The total population size is only 1,200 individuals.

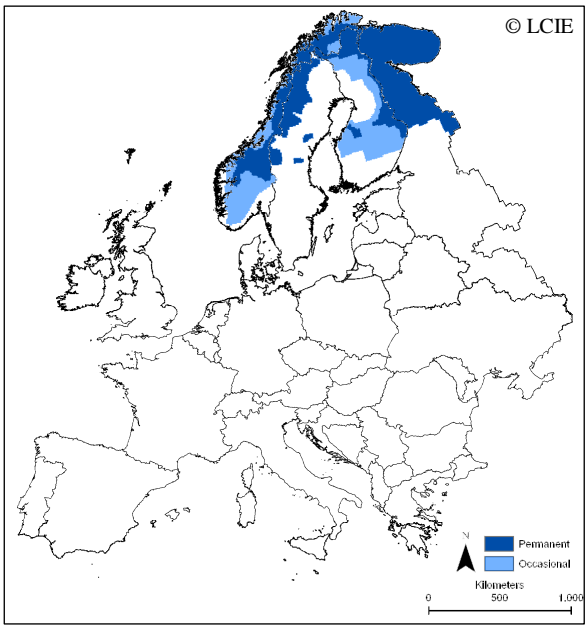

Figure 4. The current distribution of wolverine resulting from a country-based survey done in 2007 through information provided by country experts (modified from *www.kora.ch/sp-ois*).

Opportunities and Conflicts

In general the four European large carnivore species are currently expanding their distribution ranges. This is due to a variety of factors, spanning from legislation, an increase in human awareness of environmental issues, the abandonment of rural areas, the increases amongst prey species, re-introductions and the ability of the species to adapt to changing environments. The European environment has undergone some significant modifications over the last century. At the socio-economic level, the post-war development has caused a shift of economy from rural to industrial and technological, which has reflected in a general abandonment of the rural areas. Such areas, previously dominated by human activities and small scale agricultural practices, have re-gained their natural status, through the succession of vegetation, and a general increase in forest cover has resulted (FALCUCCI *et al*. 2006).

Most of the legislation that affords the large carnivores some degree of protection from extermination is dated from the second half of the 20th century (e.g. Bonn Convention, Bern Convention, Convention on Biological Diversity, Habitats Directive). This, coupled with a strong environmentalist movement worldwide, has given the small populations of large carnivores the chance to recover. Finally, the same environmentalist movement has also shifted human attitudes towards more positive values. This is particularly true for those sections of the human populations that live far from rural areas (in many countries this represent the majority of the population for the reason explained above) (BATH 2001). The picture is not always and everywhere so positive: there are cases where the large carnivores are still struggling to survive and are not able to expand their range, due to illegal killing activities (e.g. the brown bears in central Italy and northern Spain). Some populations are extremely small and so isolated, that they run the risk of inbreeding and low viability. This is the case, for example, of the Cantabrian population of brown bear; and the Sierra Morena and the German-Polish wolf populations.

The conflicts between large carnivores and livestock farmers can sometimes be extremely intense with the predators having significant effects on family incomes. There are a number of schemes and programmes that can be used for mitigating such conflict: from preventing the damage before it happens to compensating the loss once it has been suffered. The removal/ translocation of the so-called “problem animals” and the preventive control of the carnivore populations expanding into areas of high conflict with very high costs in economic terms and in public opinion.

Other types of conflicts include (a) habituated bears that approach villages and cities posing a risk to humans who are most frequently not aware of the risk they are running (e.g. people offering food to bears in Braşov, Romania); (b) the killing of hunting dogs by wolves that are of high economic and personal value; (c) conflicts between interests groups with different sets of values; (d) competition with hunters for valuable game species.

There are a series of solutions available for tackling many of these conflicts, and they imply a change in both human and wildlife habits. Among

them are (1) modification of the distribution area of the species through translocation / lethal control and introduction of a zoning system; (2) modification of the public habits in disposal of garbage; (3) modification of human land-use patterns and husbandry methods, (4) modification of attitudes through information campaigns and local public involvement, (5) promotion of coexistence through sustainable hunting of carnivores. All of these involve different costs and different level of resource investment (both human and financial). There is a large literature available for these solutions, and experience tells us that no "perfect solution" exists, but rather a combination of approaches may be adapted to different situations in particular to the local status of the predator concerned. Some conflicts may remain very hard to mitigate and some level of conflict may persist under all situations.

Ways ahead for the future conservation of large carnivores in Europe

Large carnivores have shown an amazing ability to adapt to the crowded, modified landscapes where humans live, work and play. In the light of the different local situations that all have in common the same species with biological characteristics that require a broad scale approach the most appropriate management questions to address should be "What level of conflict can be tolerated? Where can it be tolerated?" These are pragmatic questions that require an integrated approach to management and conservation which are now dependent on the social and economic carrying capacity of the environment where large carnivores occur. Local solutions may differ even between relatively close areas and the participation of local people has proven more successful than externally imposed top-down approaches.

There are a total of 19 countries in the European Union that host large carnivores and some of them share the same populations. Some countries share the populations of bears, lynx, wolves and wolverines with non EU countries. In relation to a buffer of increasing size around national borders, the percentages of large carnivore distribution area that can be considered to be influenced by proximity to a border range from a minimum of 5% up to 49% (**Tab. 5**).

For the intrinsic ecology of the species, it is relevant to note that a distance of 50 km can easily be covered by dispersing individuals for each of the four species within one day. Scientific evidence exists showing how wolves cross national borders within short periods of time (CIUCCI and BOITANI pers. com.).

Table 5. The portions of large carnivore population distribution within different distances to an international border.

	Bear	**Lynx**	**Wolf**	**Wolverine**
Total area (km^2)	2,087,000	3,181,000	2,866,000	1,438,000
Within 10 km buffer	187,830 (9%)	222,670 (7%)	286,600 (10%)	71,900 (5%)
Within 50 km buffer	584,360 (28%)	699,820 (22%)	917,120 (32%)	201,320 (14%)
Within 100 km buffer	897,410 (43%)	1,049,730 (33%)	1,404,340 (49%)	316,360 (22%)

It is clear that the current situation calls for international collaboration. There is no point in one country investing resources in one direction if it shares the same population with a neighbouring country that does not apply coordinated approaches.

Although the Habitats Directive requires the EU countries to manage the large carnivores for maintaining "*viable populations*", what this means is far for being clear in practical terms.

The implementation of the EU Habitats Directive at national level needs to be discussed and the possibilities for taking international approaches to population viability should be considered. The European Commission is well aware of such a situation and is considering encouraging member states to adopt a population approach to management. For this reason the EU has issued a tender that was won by the Large Carnivore Initiative for Europe (an IUCN SSC working group, www.lcie.org) to prepare the document "**Guidelines for population level management plans for large carnivores**" (available at www.lcie.org/project1.htm). The document provides a thorough analysis of the current legislation at EU level and explains how the requirements from the EU Habitats Directive can be met in the management of large carnivores. The innovative character of the approach is represented by the consideration of biological populations as management units, so that the viability of a population may be assessed at the scope of the population instead of the Member State – provided only that a formalised management plan exists for the whole population. In most cases this would remove the burden of single Member States having to achieve favourable conservation status on their own. The potential to apply the subsidiary principle generally endorsed by the EU Directives, which aims at reaching a community-wide objective while allowing for local adoption of best suited methods, is emphasised and strongly supported. It would give the Member States and neighbouring countries the possibility to share the costs and the benefits of having large carnivore populations, without sacrificing the freedom of applying the best locally adapted solutions. We call it the "freedom within frame" approach (LINNELL *et al.* 2007).

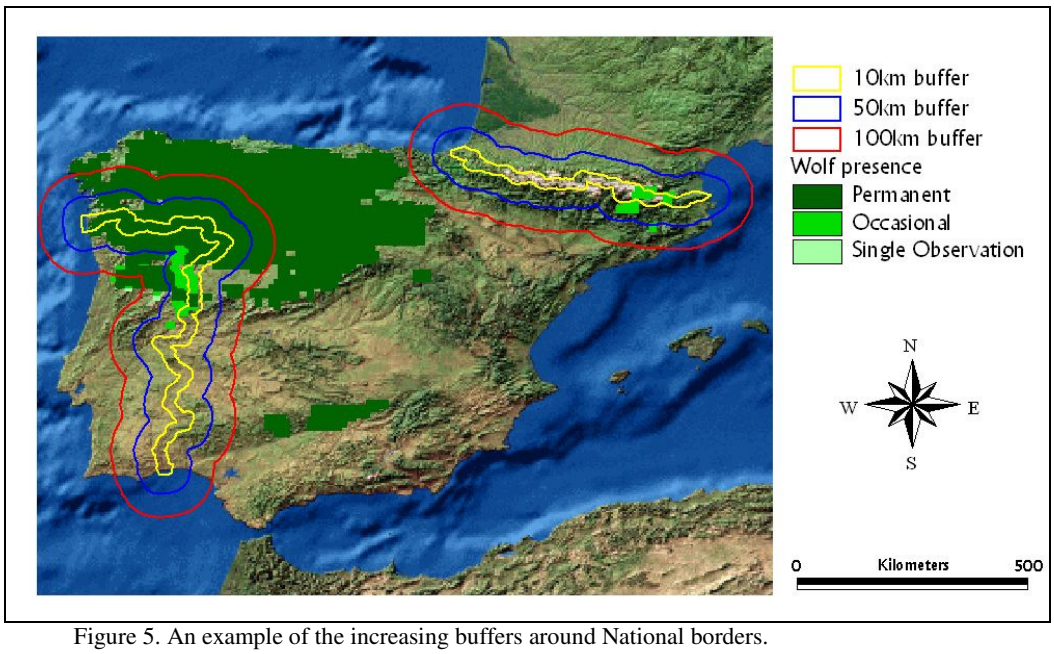

Figure 5. An example of the increasing buffers around National borders.

To briefly summarise the main points supported by the LCIE document, the population level management approach would include:

- **Aiming to have (more) large carnivores in wider ranges – i.e. maximizing distribution rather than density, and accepting that not all available needs to be occupied;**
- **using good science to inform political decisions;**
- **establish the scale of management and assessment on the scale of biological populations rather than on administrative borders;**
- **accepting that hunting and lethal control of carnivores can be compatible with their conservation and may promote coexistence;**
- **that it is important to work for conservation with local people's support;**
- **apply the "freedom within frames" approach to balance the demands of large scale coordination with adaptation to diverse local conditions.**

The draft guidelines have been discussed at several meetings of the Habitats Committee and its Scientific Working Committee and their potential implementation will be discussed through a series of workshops that will be held throughout the EU during 2007-2008. Their potential implementation will require periods of negotiation between neighbouring countries and will present many challenges. However, it should secure the long term maintenance of the large carnivore populations in Europe as we move from a phase of preventing extinction to a phase where we seek to establish stable forms of coexistence.

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Man-Eaters, Witchcraft and Poison: Carnivore Problems Unsolved in Tanzania/East Africa

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Abstract. Tanzania has the largest lion population on the continent and it is mostly stable, in particular within the extensive network of protected areas (30% of the country). Exact data are lacking, but lion numbers have most probably been reduced during the last decades in areas with high human population growth, expansion of agriculture and livestock husbandry.
As a consequence of this relatively good conservation record, lions have become a major source of conflict with the human population. I estimate that around 200 people are killed in Tanzania every year by dangerous animals, of which around one third could be by lions. This paper presents details of one recent case where not less than 35 people were killed by a single man-eating lion. Nine lions had to be killed before the man-eater was killed. Man-eating is on the increase and is endangering the very existence of lions.
The paper discusses management strategies for lions and other dangerous carnivores, comparing the situation in Kenya and Tanzania. The incomes from trophy hunting and community involvement are particularly important and the problems can best be solved locally. External animal welfare policies and hunting bans neither solve the problem nor benefit carnivores.

Key words: Lion, man-eater, carnivore, Tanzania, hunting

Conservation Strategy for Lions: Tanzania

Tanzania has the largest lion population on the African continent. The number is estimated between 14,000 and 18,000. One third of the country consists of protected areas, where lion numbers are considered stable. There is probably a slow decline elsewhere (BALDUS 2004).

Wildlife including lions is also conserved outside protected areas, which are all unfenced for the lion is a protected species. The only exemption is tourist hunting which is organised on the basis of a strict quota system in the game reserves and outside protected areas. Inside national parks lions or other game are not hunted. Problem lions, which have attacked people or livestock are hunted and killed by Government game scouts, but only outside protected areas.

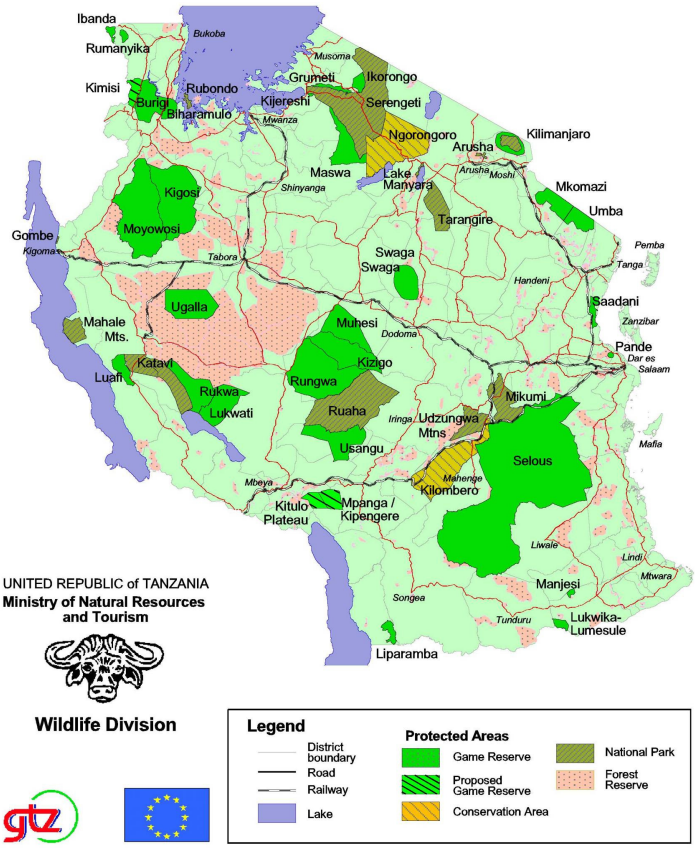

Figure 1: Map of Tanzania with protected areas

Wildlife has a value and is used on a mostly sustainable basis by photographic and hunting tourism, resident hunting and local consumption. A Community Based Natural Resources Management Programme is in place by which rural communities benefit from the wildlife which lives on village land that has been given the status of Wildlife Management

Areas. This creates income for Government and communities. Part of this income is reinvested into conservation and protected areas. Revenues serve as an incentive to conserve.

The lion conservation record can be regarded as relatively successful.

Alternative Strategy: Kenya

The Government of Kenya has banned all hunting except for game birds since 1977. Despite many efforts by landowners who do not have incentives any more to conserve wildlife on their land this ban has remained in power, mainly due to the influence of international protectionist and anti-hunting groups.

Wildlife thus has a tourism value only. There is practically no benefit sharing for rural communities. The Government has followed a "mega-zoo concept". Wildlife protection takes place only in state owned national parks or on some private game ranches. On unprotected land the Government has given relatively little attention to the wildlife, including lions.

Richard Leakey, the former Director of the Kenya Wildlife Service, summed up the policy towards lions as follows: "It is unacceptable to expect people to live cheek by jowl with animals that so adversely affect their livelihood. We have something like twenty-five thousand square miles of protected land in this country, which should be enough to keep the lions' gene pools intact. There's no reason that they should be kept on private land." (SWARA 2001)

This strategy has, however, failed. The lion conservation record can best be termed as unsuccessful. Lions have greatly been reduced and are partly extinct, even in national parks, e.g. Nairobi National Park. The loss of wildlife since 1977 is estimated as approximately 60 to 70 % including the national parks (NORTON-GRIFFITHS 2007, WESTERN *et al.* 2006).

Kenya has obtained foreign funds for wildlife conservation in the range of one billion US$ (author's calculations). This is more than any other country in Africa has received for this purpose. The conservation strategy has, however evidently failed the lions. Nevertheless, it is hailed by wildlife preservationists, animal rightists and anti-hunting groups worldwide. As this is not based on facts, this must be mainly for ideological reasons.

Human-Lion Conflict and Man-Eating

The killing of people by lions is a historical problem, in particular in Southern Tanzania. Approximately 200 people were killed annually by lions in the 1950s in the area between the Rufiji and Ruvuma rivers (NICHOLSON 2001).

According to my own research and estimates around 200 people are currently killed per year by lions (ca. 35%), crocodiles (30%), elephants, hippos, leopards, buffaloes and hyenas. The attacks by lions are probably on the increase. As before, the problems mainly exist in Southern Tanzania. The killings by lions are highly variable. Often they occur in big numbers. Examples are 42 people killed in Tunduru District in 1986 or 24 people killed in several hamlets near Lindi airport in 1999–2000. Killings occur within towns (Tunduru) or as close as 50 km from the Dar es Salaam city centre. Lions clearly are a threat, a nuisance and a cost for rural people

The following are some headlines from local Tanzanian newspapers to illustrate a few cases, in which the public took great interest:

- *Lion pounces on loving couple and devours woman* (2002)
- *Hungry lion devours timber dealer* (2004)
- *Lion drives man into pit latrine* (2004)
- *Wife's remains help man to poison killer lion* (2004)

Conservationists see more the positive side of lion conservation, as the following quote from Prof. Bernhard Grzimek's award winning book "Serengeti Shall not Die" (1959) shows: "When a lion emerges from the bushes in the red dawn and lets out a booming roar, then even in fifty years humans will stand in awe." To demand the full protection of lions and other dangerous big game in Africa is easy for people who live in European cities. Distance correlates with the love for dangerous beasts. Africa's rural population holds a different view.

Case Study: Osama – the Rufiji Man-Eater

In the following a rather extreme case is described. I researched the events during my work for the Tanzanian Wildlife Division. It is probably the case with most lion victims ever described. Thirty five people were killed and 46 injured by one three-year-old lion in an area of 350 km² just 150 km south-west of Dar es Salaam within 20 months (from August 2002 until April 2004). Especially at the beginning this lion might have been accompanied by others. However, nine lions were killed (mainly snared) by game scouts in the area and the killings continued unchanged. It only ended after a particular lion, locally called "Osama", had been shot.

The most frequent type of attack by this lion was when it forced its way through the mud wall or the straw roof of a hut at night and grabbed a victim. The animal jumped also onto platforms on high sticks (locally known as "dungu"), where people sleep in fields in order to chase away crop raiding wild animals. Victims were also caught outside houses, mainly at night.

The reasons for man-eating are a matter of debate, but they remain mainly unsolved. According to local people the usual explanation is witchcraft. Mostly no particular reason can be established apart from the fact that people constitute normal prey for lions. This may particularly be valid if they get used to it at young age. In this particular case the lion was disabled. It had a serious abscess at a broken tooth. The animal must have suffered from very bad toothache. This may have played a role.

Tanzanian Lion Mortality 1: Safari Hunting

Approximately 250 lions per year are killed in Tanzania by foreign licensed hunting tourists. In the Selous Game Reserve (50,000 km²) for example, 80 to 90 lions are shot annually out of a population of 3–4,000, or about 2.4%. Hunting has been restricted recently to lions of a minimum age of six years. This is good conservation policy and would safeguard sustainability. However, it is difficult to age lions in the field, and it even needs scientific analysis of the teeth to determine the exact age after the lion has been killed. The age limit will be difficult to enforce.

This lion hunting with around 2% killed per annum is not only sustainable overall, but it also contributes financially to lion conservation. If the Government would implement its own Wildlife Policy and make the planned Community Based Conservation a reality, rural communities would benefit financially more from hunting tourism, incl. lion hunting. This would serve as a powerful conservation incentive.

A lion safari costs 40.000 to 90.000 US$, and this includes the license fee to take a lion of 5.000 US$ (increased to 12.000 US$ in July 2007). On an average only one out of five hunting tourists hunts for lion, and it normally needs two to three safaris to bag a good trophy lion.

Hunting earns around 10 million US$ per year for the Government with 10% attributed to lion hunting. The total turnover of the industry is 27 million US$ and lion hunting is responsible for a quarter of this sum.

It can be concluded that lion hunting is sustainable, does not endanger the population and it serves as a powerful conservation incentive.

Lion Mortality 2: Destruction of Problem Lions

In cases of lion-human conflict villagers often help themselves and hunt jointly for lions in the traditional way with muzzleloaders, spears, wire snares and poison. The districts also send government game scouts. Such official lion

destruction is as we have seen at Rufiji, non-selective. The methods applied are tracking, baiting, night shooting with the aid of torches and setting wire snares. The latter is in line with the law. Lion hunting by the Wildlife Department is rather ineffective and could be improved professionally. Around the Selous Game Reserve Wildlife Management Areas are being established. A total of about 300 village game scouts are selected and employed by the villages. They are in general more effective in the control of problem animals.

There are no data existing on how many lions are killed this way. My own estimate is that less than 50 lions are killed by scouts per year. This is not threatening the lion population.

Lion Mortality 3: Poaching and Revenge Killings

Poaching for meat is widespread and common in the country. Poaching for trophies has been greatly reduced since the early 1990s, but is on the increase again. There is however very little lion poaching in general. Lions are caught by accident in wire snares, which are set for meat animals. Little trade in lion parts takes place (on a small level for witchcraft and traditional medicine), and there is no international trade in lion products.

One notable exemption is that young Maasai men traditionally spear lions as part of their culture and rituals as well as to obtain trophies for social ceremonies. This is illegal but nevertheless continued, probably on a large scale. Data are unknown and any figure between 30 and 500 lions per year may be killed.

Revenge killings are common and on the increase. The poisoning of lions by herdsmen is widespread. The public is less and less tolerant towards lion problems. Again, no data exist about how many lions are killed by local people in revenge or as a general pre-caution. The lions are mostly poisoned with freely available agricultural insecticides. Such killings can reduce and even endanger local lion populations and constitute presently the major threat to lion survival. Reducing human-lion conflict is therefore the most important lion conservation need.

One conservation strategy is “Community Based Natural Resources Management” in order to create positive conservation incentives through revenues from hunting and tourism. A national policy exists but implementation has been delayed and obstructed by bad governance and corruption in the top wildlife administration for more than a decade.

Damage limitation

Presently no effective remedies exist. The fencing of lion areas is not possible in Tanzania, and it would be detrimental to conservation. Other "scientific" proposals like reducing the food supply of lions by exterminating bush pigs do not make sense or do not work in practice like the fortification of rural houses. In livestock areas certain improved methods of herd management are known to reduce conflicts, but are difficult to introduce or enforce. Official destruction of problem lions must be continued, but on a more professional basis. Safari hunting usually cannot help being in the wrong place at the wrong time.

The main mitigation could be compensation. In reality general payments for damages by wild animals cannot be administered even if the funds were available due to weak administrative structures and financial malpractices. However if a greater share of the income from hunting tourism could remain with the rural communities this would reduce the widespread dissatisfaction.

Conclusions

- Wildlife cannot be conserved in mega-zoos only; it can be protected only with ecosystem approach;
- A hunted lion population (Tanzania) is better off than an unhunted lion population (Kenya);
- Hunting has not reduced the lion population, but generates revenues for financing conservation and serves as conservation incentive;

- Lion conservation strategies have however led to serious conflicts in Tanzania: man-eating is on the increase and coexistence of lions and people is less and less acceptable;
- Man-eating will endanger lion populations due to political demands to destroy problem lions outside protected areas;
- This might lead to a situation where lions will be confined to protected areas;
- Presently no remedies exist; community wildlife management schemes are useful, but their implementation is delayed in Tanzania due to bad governance;
- The interests of rural human populations are a major factor and must not be ignored;
- Rural communities should benefit from wildlife use and should be involved in conservation and wildlife management;

In general: Effective Community Based Natural Resources Management would be a powerful tool for successful coexistence between lions and humans. The control of problem lions works best, if local village game scouts are on service instead of any nationally administered system. Revenues from community based wildlife use would act as some kind of compensation for the disadvantage of living side by side with dangerous and destructive beasts.

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Monitoring as Basis for Management – Stakeholders and Examples from Spain

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Abstract. Monitoring large carnivore numbers and trends may be difficult and expensive, but it is essential to proper management. There are many methods of monitoring carnivores, and the selection of any one depends on the objectives, the carnivore species, the population size and the landscape characteristics as well as the availability of funds and other resources, such as previous accurate information, trained wardens, etc. The simplest methods are hunting or sighting statistics and the monitoring of the distribution area. To obtain approximate numbers, we generally must count family units. Monitoring activities are also a good opportunity for cooperation among different partners involved in large carnivore management such as wardens, researchers, managers, hunters, etc. The article shows some examples from Spain, where wolves are monitored by counting the approximate number of breeding packs, which are detected by interviewing local people, looking for wolf signs and using simulated howling. Bears are monitored by counting the number of distinct females with cubs of the year. Iberian lynx populations are monitored by using camera-traps (minimum number of individuals and capture-recapture methods) and genetic analysis of scats.

Key words: monitoring methods, carnivores, population numbers, trends

Introduction

Large carnivores are in general scarce, living at low densities, sometimes in remote areas and they are nocturnal and elusive. Because of these characteristics, surveying large carnivores is expensive and difficult. Sometimes it is not necessary to obtain accurate numbers, and detecting whether they are increasing, stable or decreasing is enough for management purposes. But even this apparently modest goal may be difficult in some circumstances. The selection of appropriate methods for surveying large carnivores depends on many factors, including the objectives of the research, the fund availability, the approximate size of the target population, the duration of snow cover in large areas, the availability of wardens or volunteers, and of other logistical constraints and opportunities (LINNELL *et al.* 1998).

In Spain, there are three large carnivore species: Wolf (*Canis lupus*), brown bear (*Ursus arctos*) and Iberian lynx (*Lynx pardinus*), although some scientists do not consider the Iberian lynx as a "large" carnivore (they are much smaller than European lynx, *Lynx lynx*, they do not kill livestock or ungulates, and do not cause conflicts like other large carnivores). Until the late 1980s, the range, approximate numbers and trends of these three species were almost unknown. But during the last two decades, a number of projects have been devoted to collect data on distribution, population size, trends and ecology of these species, and today we have information enough to begin sound management. The object of this report is to show the methods that the Spanish biologists have used to achieve this goal using the examples of the wolf and brown bear, the Iberian lynx is not considered here.

This report is not a methodological manual that can be used to monitor large carnivores in other countries with different ecological and political conditions. Other authors have prepared excellent reviews, which give much insight into the methods and the difficulties of surveying carnivores

(LINNELL *et al.* 1998, KARANTH & NICHOLS 2002, SADLIER *et al.* 2004, KUNKEL *et al.* 2005). The object of this report is to show that large carnivore monitoring may be difficult, time consuming and expensive, but it is crucial to obtain proper knowledge and carry out sound management of the populations. This is particularly important regarding endangered populations, as is the case of the brown bear and Iberian lynx in Spain.

Wolf survey in Spain

In Spain there is a large wolf population, which makes it difficult to obtain accurate data on numbers. The first detailed survey was carried out in 1987 and 1988 in a project sponsored by ICONA, the former agency in charge of wildlife within the Ministry of Agriculture (currently depending on the Ministry of the Environment) (BLANCO *et al.* 1992).

The fieldwork was devoted to search for data on wolf packs, killed wolves and damage to livestock, and was carried out by 18 biologists divided into six teams. In total 900 man-days were spent surveying 1,430 municipalities, covering the whole wolf range in Spain. In order to estimate population size, breeding pairs were recognized by the presence of pups in spring and summer. Pups are rather conspicuous and are often seen, trapped or hunted by country people. Most of the fieldwork consisted of interviews with naturalists, wardens, shepherds and other local people in rural areas regarding the presence of pups. Data were checked by interviewing independent informants, and when possible footprints were examined at dens and rendezvous sites. In large areas, where wolves were permanently seen, but the presence of pups was not confirmed (mainly in rough mountain areas), the existence of a minimum number of breeding packs was estimated. In total, the presence of pups was confirmed in 233 (79.3%) breeding packs from the 294 estimated. The number of wolves was estimated by multiplying the number of breeding pairs by 5 and 7, the first giving the total population size in early spring, before births, and the second, the number of wolves in the middle of the annual cycle, in autumn. Obviously, this method provides approximate numbers only. The results gave an optimistic picture on the wolf situation in Spain. Wolves regularly occurred over 100,000 km^2, mainly in the northwestern quarter of the country, with an estimated 294 breeding packs, i.e. 1,500-2,000 wolves (BLANCO *et al.* 1992).

But perhaps most important is that the work showed the feasibility of a national wolf survey. Today, the counts of wolf packs are routine in many provinces and regions of Spain. In order to confirm the presence of pups, we do not rely on local people information anymore but we rather prefer to observe the pups or to detect them using the simulated howling methods developed in America (HARRINGTON & MECH 1982, FULLER & SAMPSON 1988). For instance, in 2000 and 2001 we conducted a large survey to assess wolf range in the Castilla y León Autonomous Region, to locate breeding packs and determine population trends since 1988 (LLANEZA & BLANCO 2005). Involving 9 biologists, the study analysed 330 mail enquiry responses by wardens and 1,258 by hunters. In addition, on 557 field working days, 2,778 personal interviews with local people were conducted, 7,787 km were searched for wolf signs, and 209 sit-and-wait sessions and 879 simulated howling sessions carried out. Moreover, data on 11 radio-collared wolves were used. In 2001, the wolf range covered around 75,200 km^2, i.e. 80% of the region. The methods were much more sophisticated than in previous surveys but even so, we detected a number of constraints that prevent a precise calculation of wolf numbers in a large study area.

Nevertheless the results were once again optimistic. Since 1988, the range of the breeding population has expanded by 35%, mainly south of the River Duero and in Soria province. Densities have apparently remained stable in the north and west of the region (66% of the 1988

wolf range) and have noticeably increased on the agriculturally used plain (19,000 km^2, i.e. 34% of the 1988 wolf range). To the contrary, the packs breeding in the Sierra de Gata (Salamanca) area (1,500 km^2, i.e. 2.7% of the 1988 wolf range) have disappeared. As a whole, these data showed that the wolf population of Castilla y León increased from 1988 to 2001. We located 149 packs, 107 of which were considered as definite and 42 as probable (LLANEZA & BLANCO 2005).

Estimating trends of brown bears in the Cantabrian Mountains

In the Cantabrian Mountains, there are two brown bear populations that apparently have been separated since the beginning of the 20th century and now show genetic differences. Today, they are separated by 30–50 km of mountainous terrain and interchange between the populations is thought to be unlikely, mainly due to unsuitable habitat and a transport corridor formed by roads, railways and a motorway.

In order to estimate the population trend, the bear biologists have tried to count all the females with cubs of the year (COY) in the population during a 16 year period, assuming that the number of family groups is a good index of the total bear population (KNIGHT *et al.* 1995). The scientists attempted to detect and characterize all of the groups of females with COY throughout the area covered by the populations in every year, according to the method described by PALOMERO *et al.* (in press). A monitoring team that mainly consisted of rangers and technicians from wildlife agencies of the regional governments, the "Fundación Oso Pardo" (Brown Bear Foundation) and other NGOs collected field data throughout the entire area in the Cantabrian Mountains, where brown bears could potentially reproduce. The 16 year study period was divided in 4 four-year periods to be able to have enough sample size to analyze distribution patterns. Assuming that the effort applied by occasional qualified observers (mainly other rangers in their vigilance work) has remained more or less constant in the study period, we used the number of totally dedicated qualified observers per year as an index of effort.

To locate females with COY, a two-step procedure was used. First, the team obtained information from hunters and other local people within the areas occupied by the bear populations. Second, the most skilled members of the team carefully prospected the areas where females with cubs or their signs were observed and where females had reproduced in previous years. In the western population, the main method for detecting females with COY was to look for family groups by scanning from elevated vantage points using telescopes. In the eastern population, detecting bears through direct sighting was more difficult because of the greater forest and shrub cover; therefore, the main method for detecting females with COY was to search for footprints.

The groups of females with COY were discriminated by four criteria (KNIGHT *et al.* 1995):

(i) Number of cubs
Most groups were observed for several days (in 2004, every group was observed an average of 11.1 days; range: 1–22), during prolonged periods, which give a high probability of determining the number of cubs. To avoid duplications, when a female with cubs is sighted in the same area where other female with more cubs had been previously observed, it was assumed that both sightings corresponded to the same female, which may have lost some cub(s), unless there was evidence to indicate otherwise.

(ii) Distance between sightings
Just one native family group with COY has been radio-monitored in Spain, in the November-April season (the bears did not den); the mean straight-line distance between 144 daily consecutive locations was 550 m (NAVES *et al.* 2001). In addition, 90% of the straight-line movements during 7 days of the two

native family groups with cubs radio-monitored in south-central Europe were less than 3 km in spring and 7.25 km after spring (ORDIZ *et al.* 2006). To be conservative, the average maximum travel distance was estimated as twice this figure, i.e. 14.5 km, and used this distance in judging, whether two females with the same number of COY were distinct. In addition to the straight-line distance, the sighting history of every female during the season was considered.

(iii) Concurrent sightings
In case of doubt the team of researchers tried to perform concurrent sightings by different groups of observers connected by radio. This helps especially where the family groups are clumped.

(iv) Physical features
To discriminate family groups, the researchers searched for distinctive, clear and durable physical features in the female and the cubs, such as characteristic colour patterns, spots or marks, being aware that bears can gain and loss weight fast and that colour perception depends on light conditions. When possible, the family groups were videotaped or photographed by digiscoping.

In 2004, for example, 11 females with COY were located in the western population (WP) and two in the eastern population (EP). The nearest family groups in the WP and the EP were 119.5 km apart. The two females of the EP were discriminated by the number of cubs (one and two). In the WP there were two females with three cubs of the year, 8 with two cubs and one with one cub. The nearest sights of the females with three cubs were 16.1 km apart, in different slopes of the Cantabrian Mountains. The females with two cubs were less than 14.5 km apart from each other, except in six cases. In all these cases, the groups were discriminated by the distinct features both of females and cubs. For instance, the female 2 (F2) was very light-coloured with a distinctive dark strip along the back and the hump; F1 was uniform dark brown, and cubs had not distinctive features; F4 had one cub with distinctive white collar and the other with a white spot in the neck; F7 was dark brown with light spots in the neck; one cub was light- and the other dark-coloured.

The estimated number of family groups was conservative and, therefore, represented a minimum estimate. Females with COY for which there was too much uncertainty to confidently classify as either unique or a duplicate observation were excluded from the analyses. Using the field observations, an estimation of the true number of F-cub was performed using Chao's non-parametric procedure, described by KEATING *et al.* (2002), which allows calculation of females with COY never detected. This procedure has the advantage of providing an estimate that is independent of sampling effort (PALOMERO *et al.* in press).

The results of this 16-year monitoring period have both a positive and a negative side. In the western population, the number of females with COY is clearly increasing, showing that the bear population is recovering in number. In the eastern population, the bears seem to be stable. Nevertheless, the area occupied as of 1989–1992 was reduced in subsequent years and had not been completely re-colonized by 2001–2004. The occupied area was 11% and 37% smaller in the western and the eastern population, respectively, than in 1989–1992. The areas apparently abandoned by breeding females were situated in the middle of the two populations, so the gap between them was wider in 2001–2004 than in 1989–1992. We conclude that brown bears in the Cantabrian Mountains may be recovering, but the isolation of the two populations is jeopardizing the overall recovery. Both populations are still *critically endangered*, especially the eastern population, for which only 0–3 breeding females per year were estimated. Conservation priorities include promoting the recovery of the range previously occupied by breeding females and increasing contacts between the two populations (PALOMERO *et al.* in press).

Conclusions

After analyzing the experience on large carnivore monitoring in Spain and in other European countries, I would like to stress a few conclusions.

The monitoring is crucial for a sound management of large carnivore populations. Many of the monitoring methods are time consuming and expensive. However, in the long term, the most expensive way of managing a large carnivore population results from a lack of scientific knowledge.

There are many methods to monitor large carnivores. The selection of the most appropriate depends on the goal of the research, on the logistical opportunities and challenges, and on the ecological and political characteristics of the country.

To start a monitoring plan with modest objectives is much better than avoiding monitoring.

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Problems with Large Carnivores in the Western Carpathians

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Abstract. The Carpathians are the largest continuous distribution area occupied by large carnivores in Central and Eastern Europe with numerous populations of brown bear, wolf and lynx in the Eastern Carpathians. In the Slovak Western Carpathians the owners of hunting grounds register a highly overestimated population size of 1400 brown bears, 1160 wolves and 1050 lynxes in an area of ca. 20.000 km^2, of which 13.000 km^2 is forest. According to our findings only ca. 600-800 bears and 250-300 wolves and lynxes live in this area. An improvement in the monitoring system is urgently needed. The biggest problems are caused by bears (damage on livestock and pets, beehives, attacks on people), followed by wolves (damage on livestock and pets), whereas lynxes very rarely take domestic animals. Complete compensation should be provided everywhere but so far, this is too bureaucratic and not satisfying in the Western Carpathians. The predation pressure of all three large carnivore species on ungulates is considerable and synergistic; thereby hunters have strongly diminished bags. If large carnivores are controlled in a sustainable way, the ecological harvesting management of ungulates is also possible. These regulations should not be hindered by too many bureaucratic obstacles, as it happens in the Western Carpathians. A total ban of hunting is for a stable population of large carnivores clearly counter-productive and provokes illegal culling. The population growth of bears in the Western Carpathians reaches in Summer more than 20%, for wolves ca. 50% and it is very high also for lynx, as we have seen this in case of the introduced lynxes to the Czech Republic and to Slovenia. The establishment of a network of large carnivore populations in Central Europe is inevitable. Conservationists and hunters should cooperate better in the conservation of the large carnivores. The illegal killing of a protected animal is not an act of heroism, but on the other hand, bear, wolf and lynx should not be considered as "holy Indian cows". Each and every country should work out management plans for large carnivores such as happened e.g. in Croatia.

Key words: Carpathians, large carnivores, coexistence, damage, compensation, management

Introduction

The brown bear, the wolf and the lynx have been heavily persecuted in the past and in many countries exterminated. Nowadays we can see their recovery across the whole northern Hemisphere. Consequently, there is a growing problem between fundamental environmentalists and some archaic thinking hunters. The largest populations in Central and Eastern Europe occur in the Carpathians, mostly in the east part. None of the three species became extinct in the Carpathians.

Slovakia has a hunting ground of approx. 44,524 km², from which 19,886 km² is forest. In 2004 the registered bag was 12,000 red deer, 17,450 roe deer, 23,260 wild boar and, in addition 34 brown bears (out of 67 permitted, however, often hindered through insuperable bureaucratic obstacles) and 86 wolves. The population of lynx has slightly decreased (but now increasing again), and this species is fully protected. The distribution area of all three large carnivore species is in the Western Carpathians almost identical. (**Fig. 1**)

Brown bear *(Ursus arctos)*

In the first third of the 20th century there were only 20–40 bears in the Western Carpathians. In Slovakia 1400 bears are registered today, but in reality "only" 600–800 individuals. In the period 1962–2001 1203 animals were legally hunted (HELL & SLAMEČKA 1999).

The brown bear causes the biggest problems, because it:

- attacks people (2–6 injuries per year);
- takes livestock (180 sheep and 12 cattle in 2004);
- destroys beehives (237 in 2004);
- damages fruit trees, crop fields and buildings;
- often gets too close to houses posing a risk to inhabitants.

The population size of the brown bear has to be controlled; its increase is in summertime 20% (HELL & SABADOŠ 1995). Approximately 10% of the population should be taken yearly from the nature. The improvement of the monitoring is necessary, because the bag statistics assume a bear population of 1400; however, the real size is maximal 600–800. The legal hunting is based on special permission, but should not be hindered by bureaucratic obstacles. Today, the spring hunt on bears (in the time, where it is the easiest) is banned, only small bears up to 100 kg can be taken (it is not allowed to interfere with the reproductive part of the population) and it is only allowed to bait with vegetable feeding material.

The bear feeds primarily on plants (**Tab. 1**), the damages on livestock and beehives are increasing slightly (**Fig. 2**). Bears take ungulates, and not only young or weak animals, nevertheless have bears almost no impact on the hunting management of ungulates (**Fig. 3**).

Table 1. Overview on the feeding of bears based on 68 excrements from the Western Carpathians (JAMNICKÝ 1988)

Food	Remnants found in	
	% of the samples	% of the biomass
Flowers and grass	63,2	49,7
Blueberry – leaves	1,5	0,1
Blueberry – fruits	11,8	10,4
Raspberry – fruits	2,0	2,9
Lingonberry – fruits	4,4	0,4
Mountain ash – fruits	11,8	9,1
Dogrose – fruits	8,8	7,4
Guelder-rose – fruits	4,4	1,2
Beech – leaves	2,9	1,2
Beech-nuts	1,5	1,5
Others	5,9	2,4
Plant material in total	92,6	86,3
Ants	13,2	6,5
Bees ans wasps	4,4	2,8
Red deer	2,9	2,1
Sheep	2,9	2,2
Others	1,5	0,1
Animal material in total	20,1	13,7

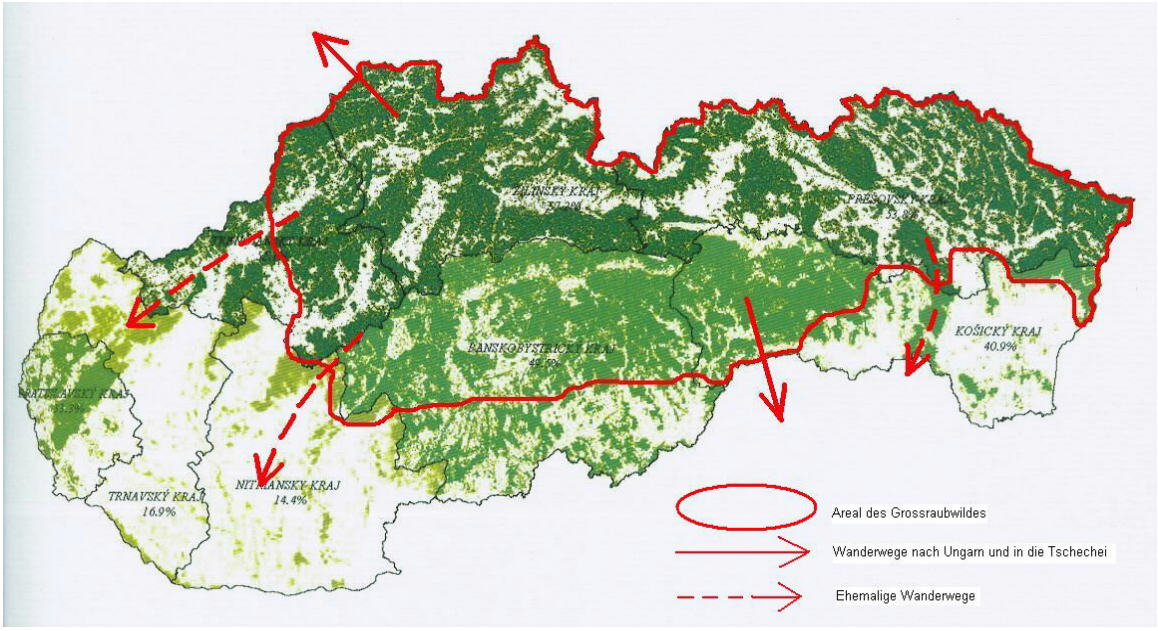

Figure 1. Distribution of large carnivores in Slovakia (red line). Green shows the forest areas.

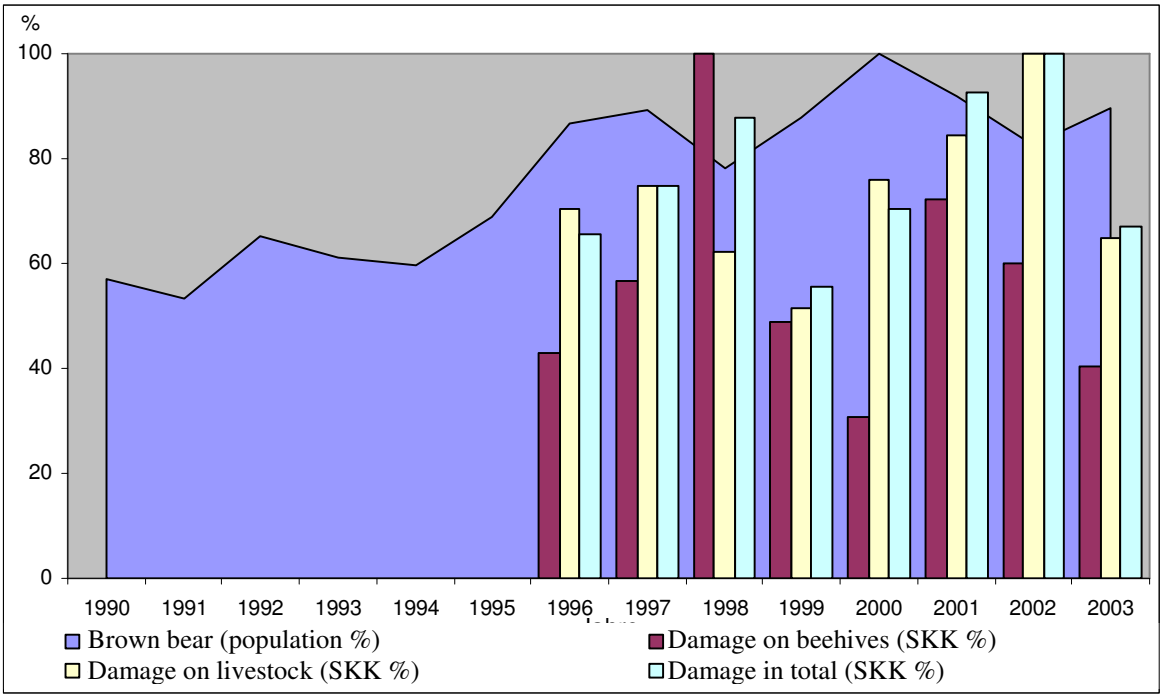

Figure 2. Spring population of the brown bear and the damage caused to livestock and beehives in Slovak Crowns

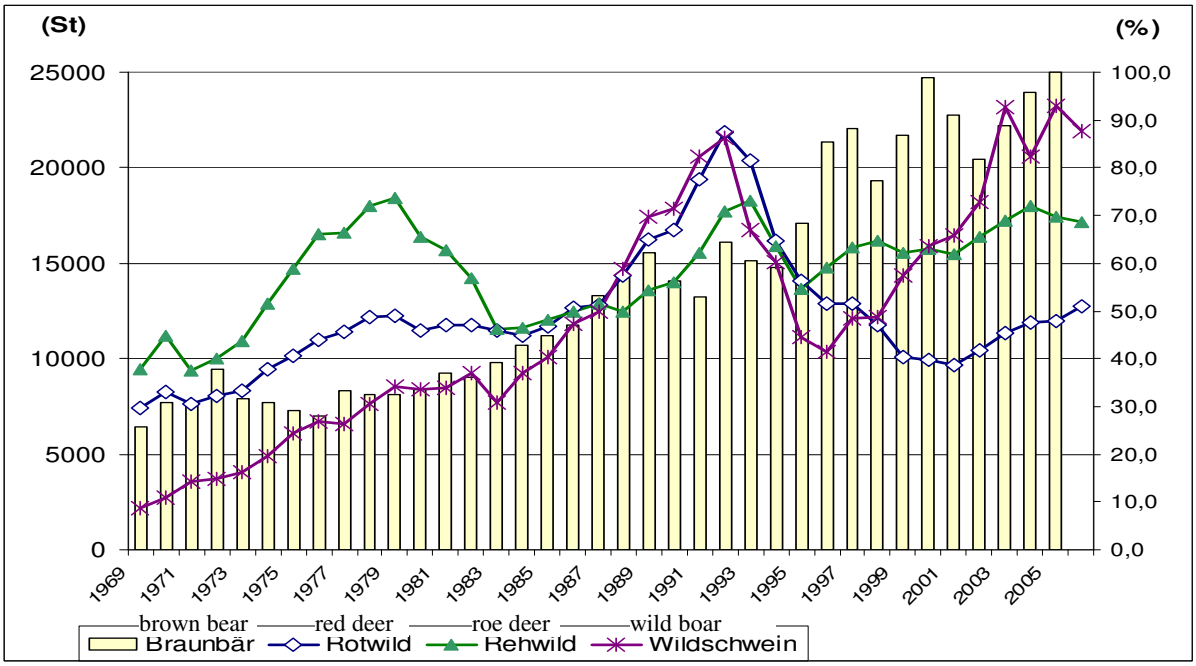

Figure 3. Dynamics of the spring population of brown bears (in %) and the red deer, roe deer and wild boar bag (head) in Slovakia

Wolf *(Canis lupus)*

The second rank "troublemaker" is the wolf, because it:

- takes ca. the same number of livestock as the brown bear;
- takes a lot of ungulates (based on BIBIKOW (1988) a wolf eats 500–800 kg meat yearly);
- the population of the wolf is estimated to be at 200–300 in Slovakia (the hunting statistics notify a strongly increased number of 1160 animals), which consume 180 tons of meat from ungulates; the main prey (**Tab. 2**);
- though there are no recent attacks on humans registered in our region, one attack of a healthy wolf on a shepherd was documented in the post-war period (HELL *et al*. 2001). However, wolves with rabies can be very dangerous. URSINY and STOLZOVÁ-SUTORISOVÁ (1970) describe the big damages on livestock caused by wolves with rabies. Also 4 people were bitten, two of whom died. More attacks of healthy wolves on children, as described e.g. for the former UdSSR by PAVLOV (1990) are unknown in our region;
- The summer increase of the population is about 50% and a regulation is needed.

Table 2. Overview on the stomach contents of 205 wolves from the Western Carpathians

Type of prey	Remnants found in	
	% of stomachs	% of biomass
Roe deer	40,9	22,5
Red deer	30,2	41,5
Wild boar	21,4	26,4
Mouflon	1,0	0,4
Ungulates in total	93,3	91,0
Sheep	2,8	2,3
Calve	0,5	1,3
Swine	0,5	0,9
Horse	0,4	4,4
Livestock in total	4,2	8,9
Hare	0,5	0,07
Mice and voles	0,9	0,03
Fruits	0,9	

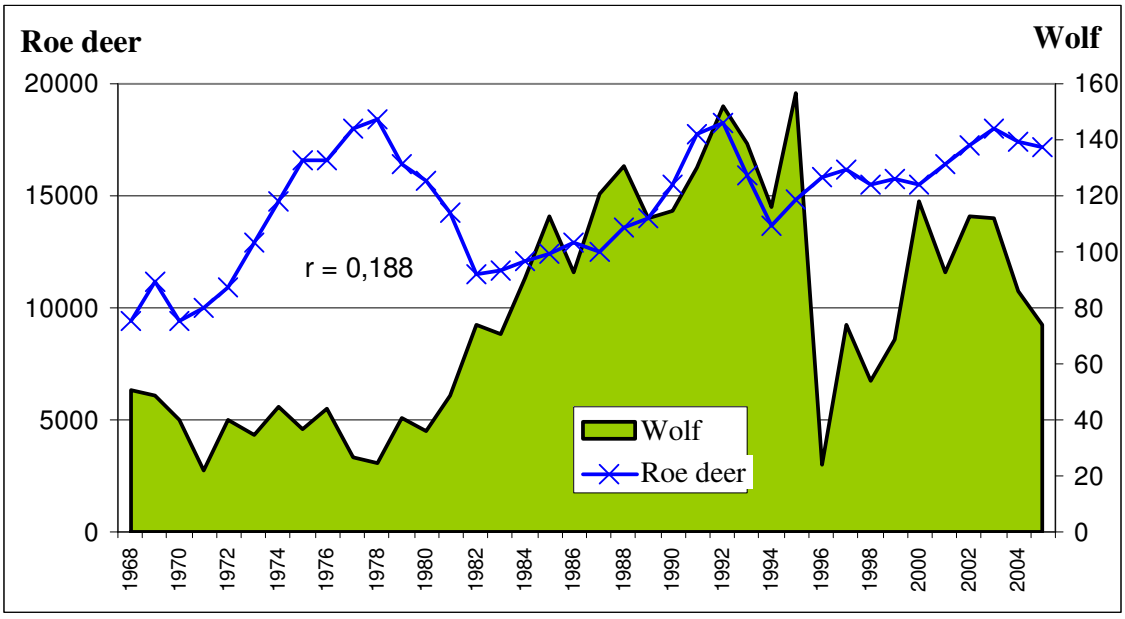

Figure 4. Dynamics of the roe deer bag in correlation with the development of the wolf bag (head).

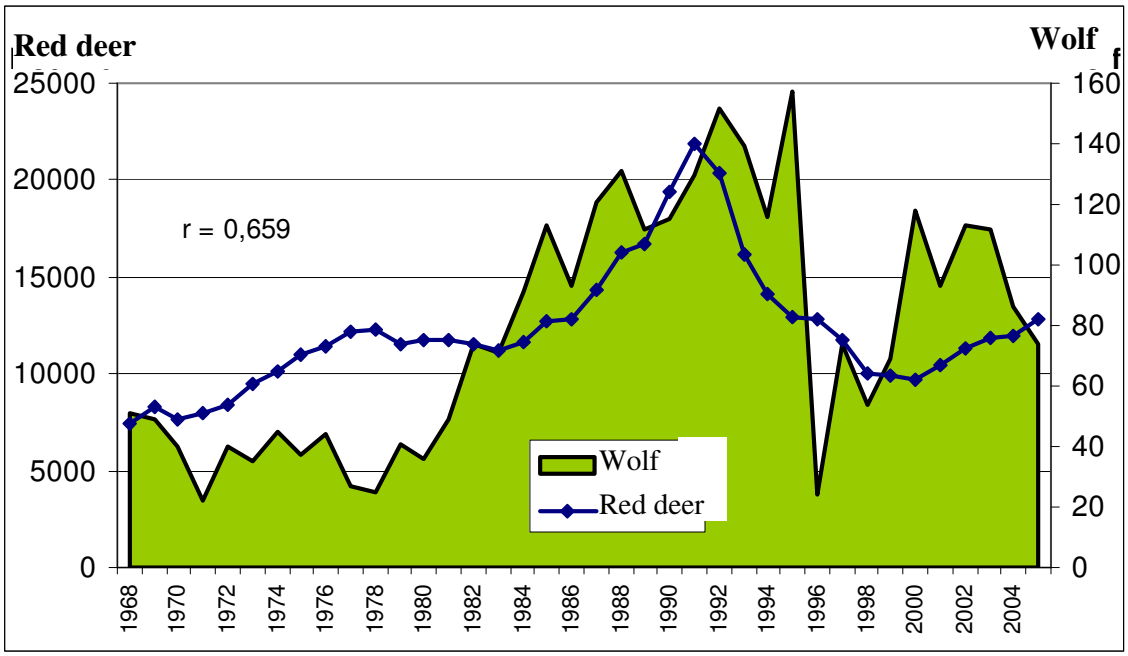

Figure 5. Dynamics of the red deer bag in correlation with the development of the wolf bag (head).

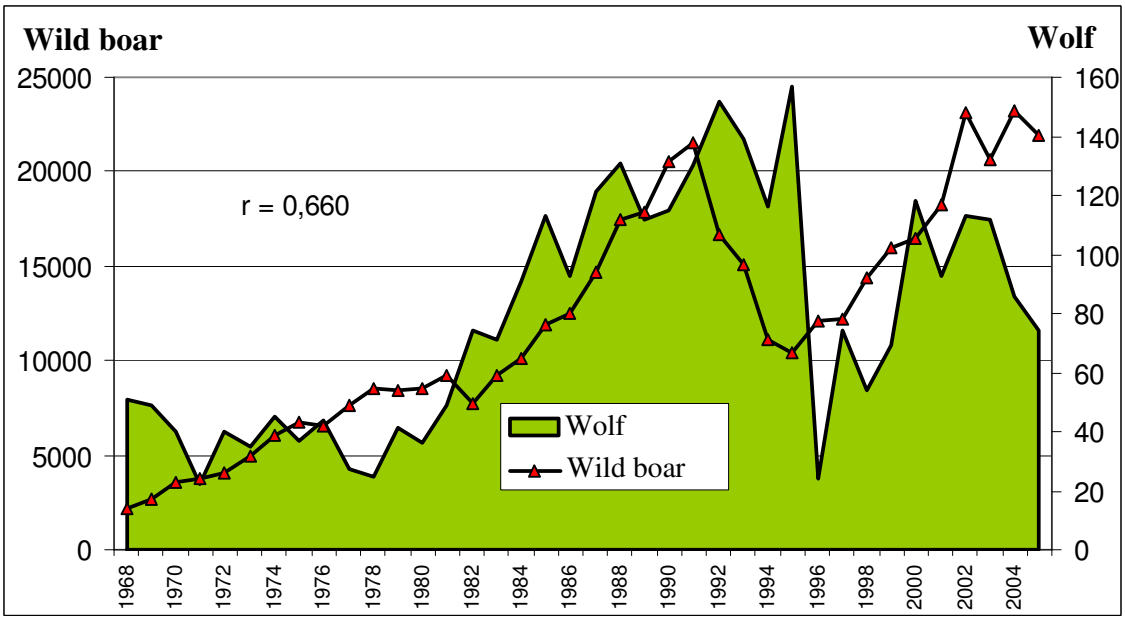

Figure 6. Dynamics of the wild boar bag in correlation with the development of the wolf bag (head).

The wolf takes a large number of ungulates, of which in the Western Carpathians the biggest part of is red deer and wild boar, roe deer is only the third. Should the wolf be controlled, a reasonable management of ungulates would be possible, as shown in Figures 4–6 (the wolf bag decreased in 1996 because of legal issues, not because of population decline). Wolves regularly control feeding places. In high mountains, such as the Alps, it is possible that wolves scare off ungulates from feeding places into areas, where they are not welcome because of high damage sensitivity of the forest. Today, in the Western Carpathians there are no winter enclosures, where big game could be at risk of large carnivores.

Lynx *(Lynx lynx)*

Lynx causes the least problems, because it:

- rarely attacks livestock, mainly sheep if they are not guarded by shepherds and dogs;
- is shy and does not attack people;
- takes mainly roe deer (**Tab. 3**), red deer calves etc., ca. 60–70 a year (HALLER 1992);
- ca. 250–300 lynx live in Slovakia (not 1050, as given in the hunting statistics) and consume ca. 16,000 ungulates each year;
- the increase rate is high, as the released lynxes have shown in Slovenia and in the Bohemian Forest (Šumava).

Between the bag of roe deer and lynx there is a negative correlation (**Fig. 7**), if you look at the roe bags of all regions. Using the roe bags only from the lynx distribution area, is this correlation as r=-0,450 very distinctive (HELL *et al*. 1997).

Table 3. Overview on the stomach contents of 65 lynx from the Western Carpathians

Type of prey	Remnants found in	
	% of stomachs	% of biomass
Roe deer	52,3	66,9
Red deer	12,3	17,8
Wild boar	1,5	1,7
Sheep	1,5	1,7
Undetermined ungulate	1,5	1,7
Ungulates in total	69,1	89,8
Hare	3,0	2,5
Red fox	1,5	1,7
Mice and voles	32,3	2,6
Fat dormouse	1,5	0,1
Rat	1,5	0,4
Hazel grouse	3,0	1,1
Capercaillie	1,5	1,7
Fruits	4,5	0,1
Insects	4,5	

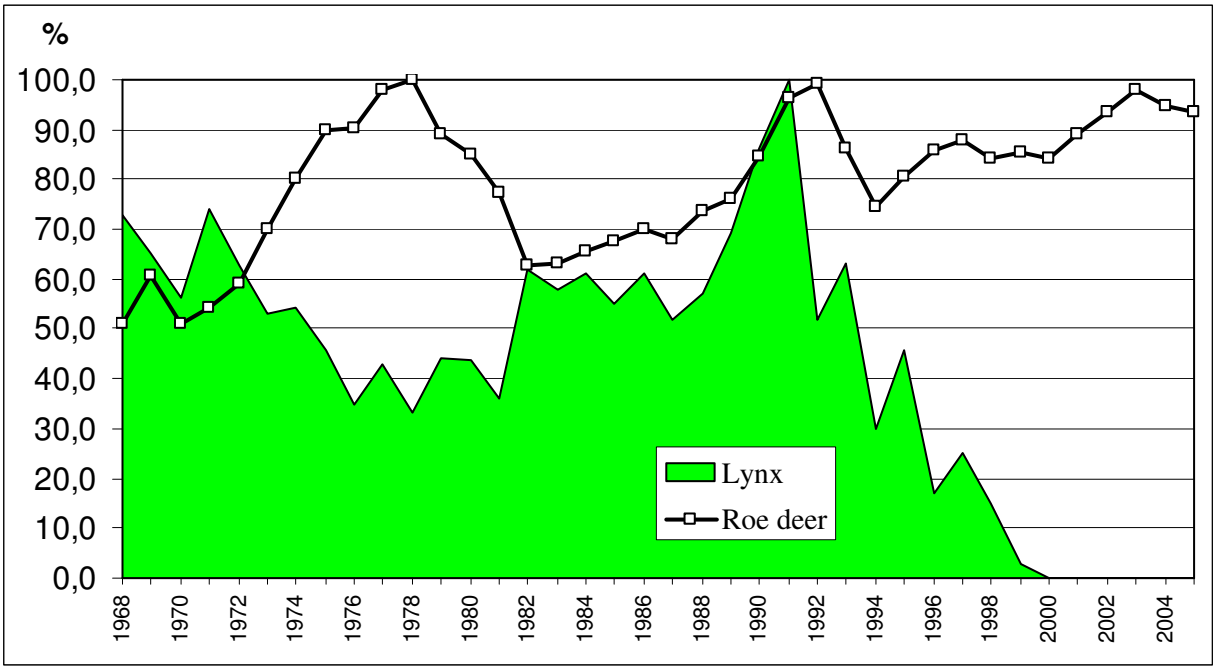

Figure 7. Dynamics of the lynx and roe deer bag in Slovakia (r = -0,333). Hunting lynx is today prohibited.

In the 1950s there was a "supreme increase", and many animals immigrated to the Czech Republic, Hungary, Austria and even to Germany. Young lynxes often entered yards or villages, where they killed poultry and were stoned to death (HELL *et al*. 2004). Lynx controls regularly the game-feeding places and can easily enter game enclosures. Our lynxes from the Western Carpathians were exported for release (reintroduction) to the Czech Republic, Slovenia, Austria, Germany, France and Italy. The most successful was the reintroduction to Slovenia and the Czech Republic.

Conclusions

- The establishment of a large European network of the isolated large carnivore populations is necessary to have continuous distribution area, which includes all suitable habitats.
- The predation pressure on ungulates of all three large carnivore species appears synergistic. The hunting bag in Slovakia has accordingly decreased by ca. 30–40%.
- If there is a sustainable regulation of large carnivore populations, then also a reasonable management of ungulates would be possible, however, the hunting bag will have a slight decrease.
- Total hunting bans are not a solution and are for the protected species counter-productive for their conservation.
- Bear, wolf and lynx have a sanitary role in the nature, through taking some ill or weak animals, though not as many as sometimes stated.
- Large carnivores can contribute to the reduction of forest damage caused by game animals.
- In the distribution area of large carnivores no mouflon and fallow deer should be kept, because it would be endangered by the high predation pressure.
- Damages caused by large carnivores on livestock and people have to be compensated generously and without unnecessary bureaucracy; protective measures should be supported.
- Large carnivores habituated to human settlements are not wanted.
- Instead of controversies, cooperation is necessary between hunting and nature protection for the conservation of large carnivores.
- It is important to educate people, especially livestock breeders and hunters, how to accept large predators and tolerate the damages caused – as long those are bearable.

People should also know how to behave when encountering a bear to minimize the risk of a direct controversy.

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Lynx, Wolf and Bear: Germany´s "Big 3"?

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Abstract. This paper presents the history of large carnivores in Germany, their present status as well as main threats and future possibilities for lynx, wolf and brown bear is discussed.
Lynx were reintroduced into two national parks (Bavarian Forest and the Harz), where the populations today are stable. Wolves were spotted occasionally in the last 20 years, but a pair is living now permanently in Germany since 2000. Today two packs are established in the Eastern part of the country. The first brown bear seen after 170 years of extinction was "Bruno" and this individual was shot after several attempts of catching it alive.
Hunters have a special role in the conservation of large carnivores, because of their unique knowledge of habitats and species, their commitment and experience, and also because of their political influence and financial back-up.
Germany has to face the challenge of managing the "Big 3". Stronger efforts are needed to provide the financial and structural network for the return of large carnivores. Hunters may play a vital role in the process, if their internal obstacles can be overcome.

Key words: "Big 3", status, future, role of hunters

Background

Wolf, bear and lynx, long extinct in Germany, seem to be on the rise again. The successful reintroduction of lynx in the Harz Region in Lower Saxony 1999 (North-Germany) and the immigration of wolves from Poland to Saxony (East-Germany) were the most recent and most popular cases, until the brown bear JJ1 (or "Bruno" as he soon was called by the media) crossed the Austrian-German borderline and appeared in Bavaria. He was the last of Europe's large carnivores entering Germany.

Lynx in Germany

The lynx was more or less exterminated in 1850 and was reintroduced to two National Parks, the Bavarian Forest and the Harz after the 1970s. The small remaining population in Bavaria, overlapping with the population in the Czech Sumava National Park, was strengthened by releases in Bavaria and the Czech Republic during the 1970s and 80s. As some of the releases in Germany were done without proper public participation, the local acceptance of lynx had been rather low, and losses due to poaching had been a main threat to the population. The Harz population was reintroduced by a project in 1999 as a close cooperation of the federal ministry of environment, the National Park Harz, the ministries of environment and of agriculture and forestry of Lower Saxony and with strong support of the hunters association in Lower Saxony. 24 lynx have since been released in the Harz region and in 2002, the first births of wild lynxes on German territory was announced. A couple of lynxes had given birth to the young and repeated their success in the following years. Today, due to a lack of data, the population of lynx in Germany can only be estimated. Excluding sights of single lynx in Hessen, Baden-Württemberg or Rhineland-Palatinate, hard evidence can be found for a population of approximately 50 lynx, mainly living in Bavaria.

The main threats for the lynx in Germany are genetic isolation, poaching and traffic accidents. That there are suitable habitats for lynx in Germany was shown by SCHADT *et al.* (2002) (**Fig. 1**). She identified six up to seven rural areas – mainly forests – in the south and northeast of Germany being big enough and free of the main traffic roads. In the regions of Germany were lynx are appearing, a network of lynx-consultants was established being responsible for providing information and training to local stakeholders and for monitoring as the lack of data is still a big problem. In addition, local conflicts with farmers and hunters are in a couple of regions still not solved due to a lack of a transparent mechanism for the compensation for killed livestock.

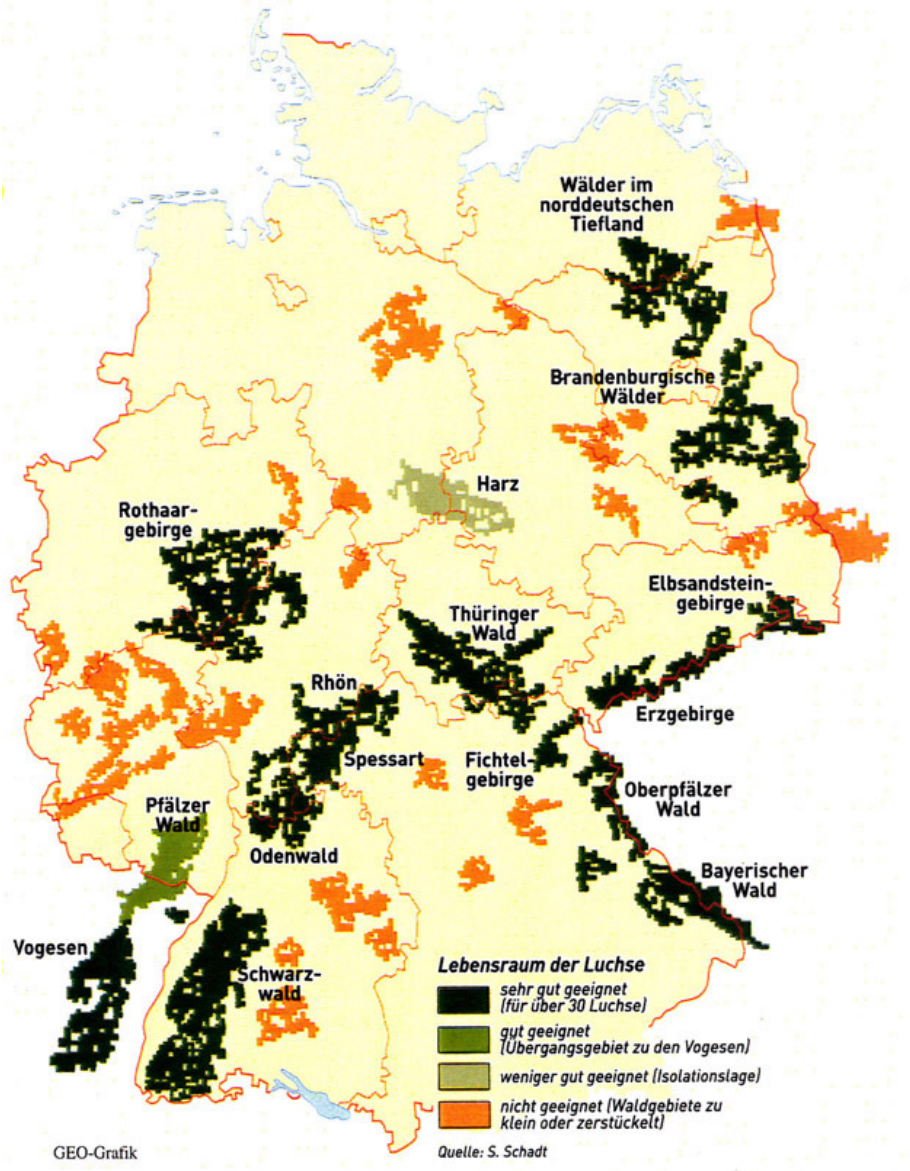

Figure 1. Suitable habitats for lynx in Germany. (Source: Schadt *et al.* 2002)
Legend: ■ - highly suitable (for more than 30 lynxes); ■ - suitable (crossover to the Vosges); ■ - less suitable (isolated); ■ - not suitable (too small forests or fragmented)

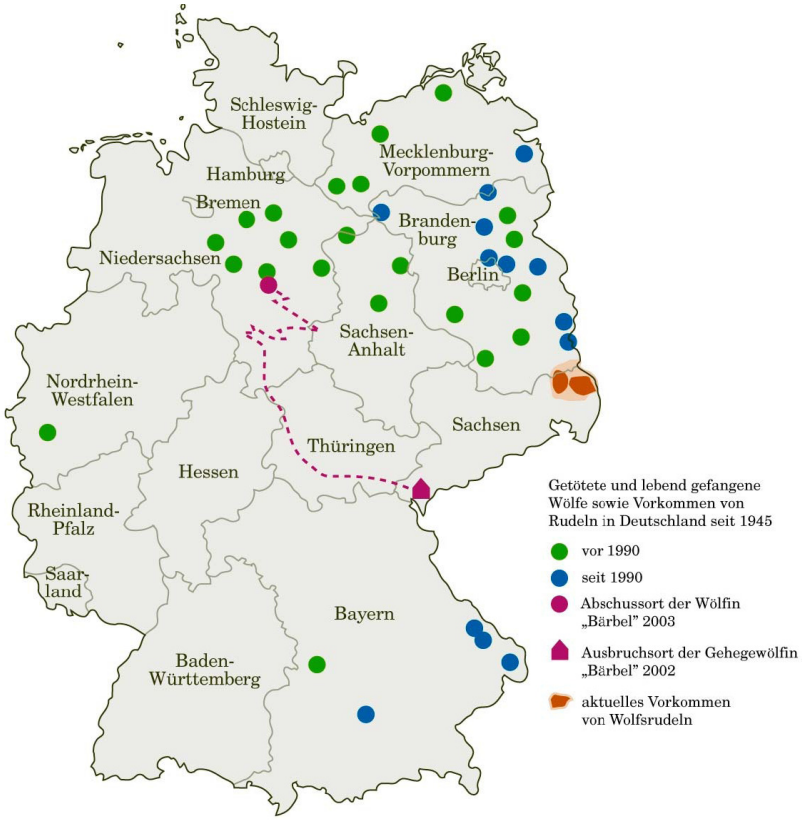

Figure 2. Hunted and captured wolves and the distribution of packs in Germany since 1945. (Source: German Federal Agency for Nature Conservation 2007)
Legend: ● - before 1990; ● - since 1990; ● - escaping, movement and killing of the enclosure-wolf “Bärbel” in 2002-2003; ● - actual distribution of the wolf packs

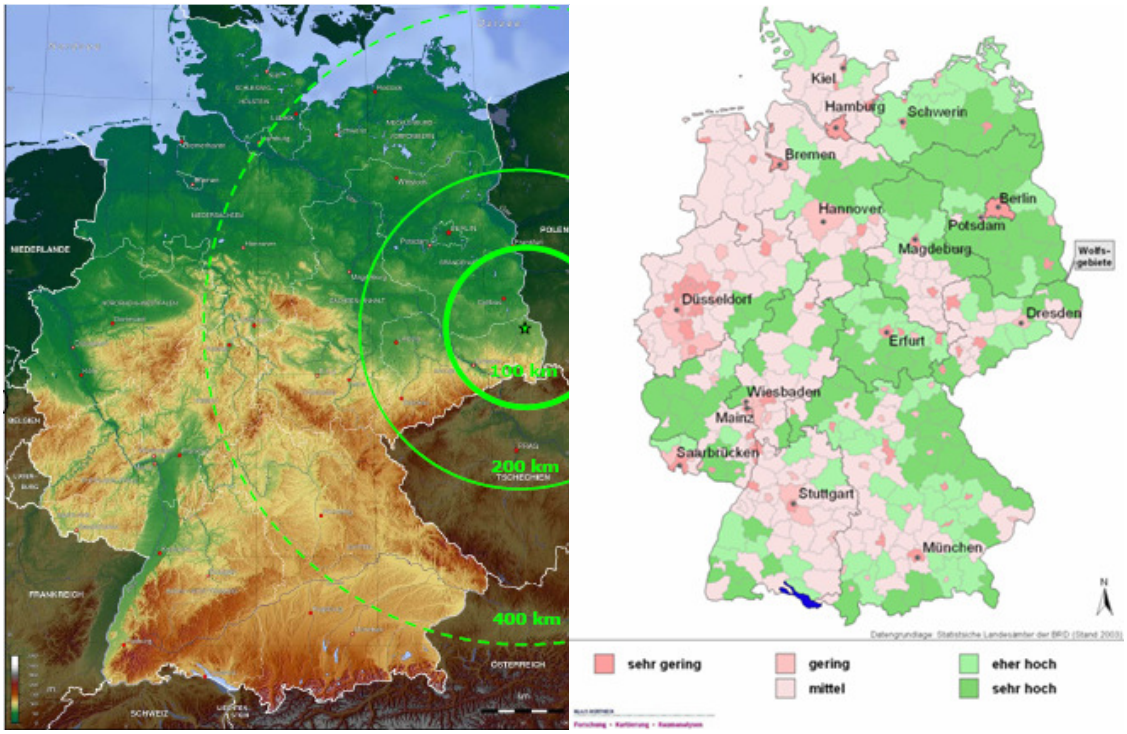

Figure 3-4. Travel range of and possible habitats for wolves (■ to ■ - very good to very bad) (Source: LUPUS Project / German Federal Agency for Nature Conservation 2007)

Wolf in Germany

The wolf was exterminated in 1904. Occasional wolves have been spotted in Saxony over the last two decades, but usually hunters or traffic killed them (**Fig. 2**). Since 2000, two pairs are permanently living in Germany, giving birth in 2001. In 2006, the wolf population in Germany consists of up to 23 wolves in two packs, including two adults, yearlings and whelps. Most of them are living on a military training area in the Lausitz region in Saxony close to the Polish border. The so-called "Pack of the Muskau Heath" consists of a maximum of 12 wolves. The other "Pack of the Neustadt Heath" consists of approximately 11 wolves. Two additional wolves are known in the larger region of Eastern Germany, one in Brandenburg, one in Thüringen. In addition singular wolves have been spotted over the years in Bavaria, mostly of Czech origin and since 2006 of Italian origin. It has to be stated that since 2000, approximately 20 wolves have vanished from the region, likely to be victims of traffic accidents and poaching. Finally the genetic isolation could be a problem in the long run as well as hybridization.

Brown bear in Germany

The brown bear was exterminated in 1835. The last sighting of a bear in today's Germany was recorded in 1838 when hunters shot a bear in Bavaria. The first sight of a bear in Germany in our time was JJ1/"Bruno" in 2006.

"Bruno" had an early preference for livestock and was seen quite often near human settlements. Several attempts to catch Bruno alive failed. Following Austrian standards of risk management of bears, Bruno was classified as being "dangerous" and was shot.

As a consequence of the whole story Bavaria started to develop a management plan to be better prepared to brown bears next time.

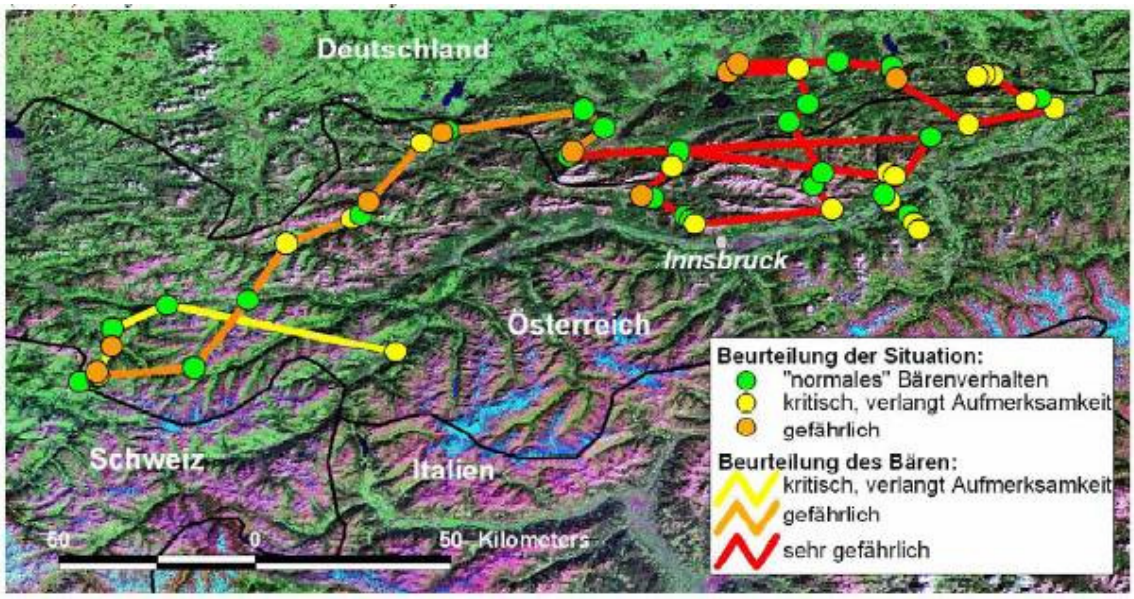

Figure 5. "Bruno's walk", risk assessment of behaviour
(Source: Bear specialist group 2006)
Legend: ● - "normal" bear-behaviour; ● - critical, requesting attention;
● - dangerous; ● - very dangerous

Hunters and large carnivores

Hunters could play a crucial role in conservation of large carnivores. In Germany the majority of hunters recognise their responsibility to be engaged in species conservation. Hunters do have often a unique knowledge of habitats and species. They are committed and continuously present in the countryside. And finally they do have influence in policies and the ability to raise funds. On the other hand some hunters still see themselves in a rivalry with large carnivores on game. This type of hunters must ask themselves if they want to be steward of the ecosystem or just harvesting resources. Against the background of this conflict there is still a strong rivalry of hunter organisations with environmental groups on authority and competence.

Conclusions

1. The presence of the European "Big 3" is likely to become a returning challenge for Germany.

2. Stronger efforts are needed to provide financial and structural network for the return of large carnivores.
3. Hunters may play a vital role in the German process, if their internal obstacles can be overcome.

To overcome these problems is not just crucial with respect to large carnivores but at the same time condition for species conservation worldwide as "How can we fight for tigers in India and lions in Botswana, if we can't deal with large carnivores at home?"

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Management of Large Carnivores in Switzerland

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Abstract. The lynx, wolf and bear were extinct in Switzerland for about 100 years. However, the lynx was reintroduced in the 1970s, wolves are immigrating from Italy and France for more than 10 years and 2005, one bear originating from Trentino (I) visited Switzerland for some weeks. During the last few years, Switzerland has developed management plans for all three large carnivores which come often into conflict with man: lynx – game (and livestock), wolf – livestock and bear – people. The management plans have the same baseline: prevention of damage to livestock, compensation of damages and removal of single individuals of lynx and wolves causing large amounts of damage. Since a national legal frame is lacking, the possibility to intervene on population level of these predators, the conflict with hunters is very difficult to solve; in the case of wolf, management means mainly damage prevention. Conflicts between bears and people can be minimized by keeping bears shy and by educating people how to behave in the bear area.

Key words: Switzerland, Management Plan, Bear, Wolf, Lynx

Introduction

In Switzerland, as in many countries of Central Europe, all large carnivores were driven to extinction by the end of the 19th century. This extermination was caused by human activities such as farming and the resulting conflicts: destruction of habitats by deforestation, over-hunting of natural prey. They became considered as pest species and the authorities paid rewards for their killings. Nevertheless, in Switzerland brown bear (*Ursus arctos*) and lynx (*Lynx lynx*) have been protected since 1962 and wolf (*Canis lupus*) since 1988 by law (BUNDESVERSAMMLUNG 1986).

In 1967, the Swiss government decided to re-introduce lynx and the first releases date back to 1971 (BUNDESAMT FÜR UMWELT 2004a). Today, there are two major lynx populations living within Switzerland: one in the north-western Alps (some 70 adults) and the other one shared with France in the Jura Mountains (some 20–25 adults in Switzerland alone; BREITENMOSER & BREITENMOSER-WÜRSTEN 2004). Releases to found a third population were conducted 2001 to 02 and will be continued from 2007 to 08 by translocations of lynxes from the Alps and the Jura Mountains in the north-eastern part of Switzerland (ROBIN & NIGG 2005, ROBIN & RYSER 2007).

Since 1995, several wolves have migrated from France and Italy into Switzerland. Up to 2005, out of 10 known individuals, only one was a female. In 2006, five more wolves were detected of which two were females (ZIMMERMANN *et al.* 2006, FUMAGALLI 2007). This indicates the forming of small family groups (packs) and reproduction within the next few years.

In the summer of 2005, a bear from the bear project in Trentino (Italy) was living in Switzerland for some weeks (ZIMMERMANN *et al.* 2005) and in 2006, its brother just passed by some hundred meters from the Swiss border on his way from Italy through Austria to Germany (Bavaria).

Conflicts

The presence of large carnivores often causes conflicts with man. Only some years after the first releases of lynx in Switzerland, in some areas hunters stated a decrease of their hunting bag: roe deer. In the meantime, damages on livestock, mainly sheep, increased. In the middle and the end of 1990s, this was especially true in the north-western Alps, where a rather large lynx population was present. In this time, a few were killed officially in consequence of the damage they caused on livestock, six were captured to found the third population in the north-eastern part of Switzerland and many lynx were poached. Because of all these interventions, the population decreased and the damages to livestock almost stopped. But now, it seems the population is growing again (ZIMMERMANN *et al.* 2006). In all these years, hunters were in conflict with lynx due to predation on roe deer (*Capreolus capreolus*) and chamois (*Rupicapra rupicapra*), thus due to prey-concurrence.

Because large carnivores were lacking for one hundred years in the Alps, there was no need to put livestock, especially sheep under surveillance by shepherds during summer time. There are about 250,000 sheep (ewes and lambs) on mountain pastures in the Swiss Alps, often in rather small herds without any guarding (BUNDESAMT FÜR LANDWIRTSCHAFT 2006). During the last years, when a wolf was immigrating from Italy and France into the alpine part of Switzerland, it was almost certain that it would prey on these unprotected herds and cause important damages for the shepherds. Since many of the sheep owners keep sheep as a hobby (only a few make a living from them) there are a lot of emotions involved in the conflict between sheep breeders and wolves.

Bears are smart. They will learn quickly that they can find food without any danger in the proximity of or even within human settlements. Although the bears may not be aggressive towards human in the first intention, there may evolve situations where they attack humans. People do not always know how to behave towards a bear and do not realise that bears are wild animals rather than Teddies.

Management plans

The management plans based on the ordinance of hunting and on the protection of mammals and birds living in the wild says in Article 10, paragraph 6: "The Federal Office (FOEN) shall develop concepts for the species named in paragraph 1 (among them the three large carnivore species). These concepts must contain principles for the protection, culling or capture of the above mentioned species for the prevention and determination of damage as well as compensation measures for the prevention of damage caused by these species." (BUNDESRAT 1988). In the same Article, the share of the costs of damage compensation is defined: 20% must be paid by the Cantons and 80% by the Federation. For the management of all three large carnivore species, Switzerland is divided in eight management units, most of them containing more than one Canton. Therefore, all management decisions are taken together by several cantonal and the federal authorities (BUNDESAMT FÜR UMWELT 2004a, b & 2006).

Management plan for lynx

The first management plan for lynx was elaborated in 1999–2000. It was adapted already two times in 2000 and 2004, respectively (BUNDESAMT FÜR UMWELT 2004a). Based on the experiences in Switzerland, it does not foresee a large-scale damage prevention program for livestock. It was observed that livestock are not regularly attacked by lynxes (ANGST *et al.* 2000). Only the livestock in the areas affected should be protected from lynx. Since lynx most often kill only one or two sheep at one time, it is more economic to compensate for the damage than investing large amounts of money and work in prevention measures. However, after an attack has occurred,

some special measures are taken such as putting blinking lamps on the pasture. Occasionally, a lynx specialises by preying on livestock. Such animals will be culled after they killed more than 15 sheep within one year.

Lynx can have a local and regional impact on populations of their main prey species roe deer and chamois and the hunting bag can be reduced (ROBIN & KÖCHLI 2006). This circumstance leads to conflicts between hunters and lynx. Therefore, the management plan foresees the possibility to reduce the lynx population if it is high within a management unit and the hunting bag is strongly reduced due to the presence of lynx. This reduction of numbers will be done by captures and translocations of lynxes within Switzerland or Europe as it was done in the translocation project mentioned above (ROBIN & NIGG 2005, ROBIN & RYSER 2007). When this is not possible anymore, a quota can be shot. However, the legal base to cull lynxes due to the "damage" they cause to wild ungulates is very weak (wild animals are *res nullius* and therefore nobody suffers a damage according to the federal law on hunting and on the protection of mammals and birds living in the wild; BUNDESVERSAMMLUNG 1986).

Management plan for wolf

The elaboration of the management plan for wolf in Switzerland (BUNDESAMT FÜR UMWELT 2004b) took several years. There were many discussions and even debates in the Swiss Parliament (MAISSEN 2001, UREK-NR 2002). Up to now, there were only single wolves detected in Switzerland and no pack or reproduction was observed (ZIMMERMANN *et al.* 2005, ZIMMERMANN *et al.* 2006). Therefore, the impact of wolves on wild ungulates is still small and there is not yet a conflict with hunters such as occurs with lynx. But the damages on livestock, mainly sheep, can be relatively high for the sheep breeders concerned (BUNDESAMT FÜR UMWELT 2004b, KORA 2007). The main goal of the management plan is the reduction of damages to livestock and Switzerland developed a prevention program to prevent damages to livestock (www.herdenschutzschweiz.ch), which consists of (1) several "competence networks" in the different regions of the country. Most of those networks consist of an agricultural school and some private farmers who breed and educate guarding dogs. The animal breeders and livestock keepers can get information, education, help to apply damage prevention measures and buy guarding dogs within those competence nets. (2) In areas where a wolf is present, the FOEN supports the animal breeders with money, so they can pay the salary for shepherds, maintain guarding dogs and buy additional material such as fences. (3) If in an area a wolf appears, prevention measures are put into action by an emergency team including some shepherds and dogs. (4) Damage on livestock is compensated.

Furthermore, if the damage in a region is too high, the wolf can be shot. A too high damage is defined as 25 sheep killed within one month or 35 within four months. There is no option of any translocations or even releases of wolves in Switzerland.

Management plan for bear

The bear that appeared for some weeks in summer 2005 in Switzerland is only one known presence of these species since 1923 (KORA 1999, ZIMMERMANN *et al.* 2005). Nevertheless, Switzerland elaborated a management plan for bears (BUNDESAMT FÜR UMWELT 2006). It does not expect a high impact on wild ungulates or substantial damage on livestock. If this should be the case, the same measures as in the management plan for wolfs are taken without the option of culling a bear. Bears are clever and opportunistic animals, thus, the main problem will arise when a bear approaches people, because there often food is available (rubbish, domestic animals, honey and other). The management plan distinguishes between

three categories of bears and the corresponding measures: (1) shy or unobtrusive bear: information and damage prevention. (2) Problem or habituated bear: it is not shy and can be observed close the human settlements and causes damage – information, prevention and adverse conditioning. (3) Risky bear: A bear attacked and injured or even killed a human – culling.

Conclusions

Switzerland is confronted with three large carnivore species each needing their own management strategy. However, the strategies have in common that conflicts have to be minimized as far as possible (damage prevention), that damages are compensated and animals causing high damages (lynx, wolf) or risk (bear) will be culled. All three large carnivores are protected by national law (BUNDESVERSAMMLUNG 1986), and bear and wolf are even strictly protected by international law (COUNCIL OF EUROPE 1979). This fact reduces the number of options for a pragmatic management and modifications of the legal bases should be considered accordingly. Furthermore, in the management of large carnivores Switzerland collaborates with the other alpine countries.

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Bear Hunting in Europe: Possibilities and Pitfalls

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Abstract. Hunted brown bear (*Ursus arctos*) populations have been increasing in number and distribution in much of Eastern and Northern Europe, indicating that the hunting regimes were conservative. Due to these increases bears are now more often coming into contact with humans, who often demand increased hunting quotas. Using hunting to stabilise a bear population is more difficult than allowing growth. Also, the public questions hunting and asks how it affects bears.
From modelling, we know that bear populations are vulnerable to overharvest; especially killing of adult and subadult females. Many models assume that all individuals have an equal impact on population growth, but our research shows that this is false. If hunters select individuals with high or low fitness, and this is not included in the models then the output of the models may be very misleading. If fitness traits are heritable, harvesting might even be a selective pressure with long-term and probably irreversible effects. The killing of dominant adult males may have effects not predicted by models if it causes increased juvenile mortality through sexually selected infanticide and evidence for this is presented here. Also, a lack of adult males forces females to mate with young males, which they do not prefer as partners. We have an obligation to understand the subtle consequences of harvesting bears.

Key words: Europe, brown bear, hunting, hunter selection, sustainable use

Introduction

The conservation and management of large carnivores is often difficult and controversial, because they often occur at low densities, conflict with many human interests, and are expensive to study (GITTLEMAN *et al.* 2001). This is also true for brown bears (*Ursus arctos*), and throughout the world, many brown bear populations are declining and becoming fragmented and isolated, due to commercial overexploitation, excessive mortality, habitat degradation and destruction, and natural resource development (SERVHEEN 1990, SERVHEEN *et al.* 1999). Therefore, most management actions regarding brown bears are aimed at saving small and isolated populations (KNIGHT & EBERHARDT 1985, MATTSON & REID 1991, NAVES & PALOMERO 1993, SERVHEEN *et al.* 1999, Zedrosser *et al.* 2001).

In spite of a generally pessimistic picture, brown bears are increasing in numbers and distribution in several areas, particularly in northern and Eastern Europe (SWENSON 2000). This has been reported in several populations in Europe, all of which have been hunted for many decades, including Russia with adjacent Finland and northeastern Norway, in the Carpathian Mountains, the northern parts of the Alps-Dinaric-Pindos mountain complex and in Scandinavia (CHESTIN *et al.* 1992, WIKAN 1996, SERVHEEN *et al.* 1999, ZEDROSSER *et al.* 2001).

The decline and subsequent recovery of brown bears in Scandinavia

Originally, bears were found throughout Scandinavia (COLLETT 1911-12, LÖNNBERG 1929). Based on records of bear bounties by county, we estimated that there were 4,700–4,800 bears in Scandinavia around 1850; about 65% of these were in Norway (SWENSON *et al.* 1995). An enormous number of bears were killed, 2,605 in Sweden and 5,164 in Norway during 1856–93, and the populations declined quickly, about 4.8% annually in Sweden and 3.2% in Norway. The greater decline in Sweden with lower harvest strengthens our conclusion that there were more bears in Norway at that time. Bears survived only in a

few mountainous areas in northern and central Sweden. The low point for the brown bear population was about 1930, when about 130 bears were left in the four sub-populations that survived.

At the end of the 1800s and beginning of the 1900s, many realized that the situation was critical for brown bears in Norway and Sweden and, at that time, both the Swedish Hunters' Association and the Swedish Royal Academy of Sciences called for saving the species. All bounties were eliminated in Sweden in 1893, but this did not happen in Norway before 1973, 80 years later (SWENSON *et al.* 1995). The number of bears in Sweden had increased enough by 1943 that a conservative hunting season was initiated. Since then, the number of bears has increased while being hunted (SWENSON *et al.* 1994). The brown bear was exterminated as a reproducing species in Norway, with the last Norwegian population disappearing in the 1980s (BÆKKEN *et al.* 1994). Immigration from the increasing and expanding Swedish, Russian and Finnish populations has led to a recolonization of Norway, as evidenced by both temporal and spatial patterns of bear occurrence in Norway (SWENSON *et al.* 1995). The latest estimate of bears in Scandinavia was about 2550 (2350–2900), almost all in Sweden, in 2005 (KINDBERG & SWENSON 2006).

The demographic viability of the Scandinavian brown bear population: possibilities for hunting

Knowledge of the viability of a given population is of utmost importance for managers, especially when the species is hunted, and it introduces a quantitative element into risk assessment (BOYCE 1992). However, these predictions are often very uncertain (CAUGHLEY 1994).

We evaluated the demographic viability of the Scandinavian bear population using long-term, individual-based data from our study areas in northern and central Sweden and a diffusion approximation in age-structured populations with demographic and environmental stochasticity (SÆTHER *et al.* 1998). The populations in both study areas showed high population growth rates ($r = 0.13$ or $\lambda = 1.14$ in the north and $r = 0.15$ or $\lambda = 1.16$ in the south) due to a combination of high survival rates and high reproductive rates. The Scandinavian brown bear populations showed the highest population growth rates yet recorded for brown bears (SÆTHER *et al.* 1998), and in the highest reproductive rates yet recorded for brown bears. We estimated that these bears reproduced at about 80% (south) and 70% (north) of a hypothetical maximum rate (SWENSON & SANDEGREN 2000). The variance around r was partitioned into demographic variance, which was relatively large, an estimated $s^2_d = 0.180$ in the north and 0.155 in the south, and environmental variance, which was small, $s^2_e = 0$ in the north and 0.003 in the south. This means that models that assume that all individuals have an equal impact on population growth may give very inappropriate results if hunters select individuals with high or low fitness. If we defined a population as viable when the chance of population survival was greater than 90% over 100 years, a minimum of 8 females ≥ 1 year old must be present in the north, and 6 in the south. However, these estimates are very sensitive to mortality rates, and a small increase in mortality rates will strongly reduce the viability of even relatively large brown bear populations.

The hunting of bears has a long tradition in Scandinavia, and the population in Sweden has been hunted continuously since 1943 (SWENSON *et al.* 1995). According to European Union regulations under the Habitats Directive, bears can only be killed to prevent serious damage to culture and livestock, public health, sanitary and safety reasons and only if this has no negative impact on the preservation of the species (ZEDROSSER *et al.* 2001). It is obvious that the hunting carried out in Sweden has not been detrimental to the preservation of the species, as bear numbers and distribution have increased dramatically since hunting was reinstated (SWENSON *et al.* 1994, 1995, SÆTHER *et al.* 1998, KINDBERG & SWENSON 2006). However, it is both biologically and ethically important to have a good understanding of the effects of hunting on a

bear population. In addition, hunting permits are often issued in Norway to remove bears that have killed sheep (HUSTAD & SWENSON 2001).

The management of bear hunting: pitfalls

We have modeled how a bear population could be harvested to keep it at the lowest possible level, yet still demographically viable. This might be a management strategy in areas where conflicts are high, such as in Norway (TUFTO *et al.* 1999). Using the demographic values reported in SÆTHER *et al.* (1998) and the criterion that the probability of extinction over the next 100 years is less than 10%, we found that all bears could be harvested above a threshold number of 34 female bears ≥ 1 year old (TUFTO *et al.* 1999). However, this number could be lower if a proportion of the bears were harvested above a threshold number (LANDE *et al.* 1995a, b). Then 35% of the bears exceeding a threshold population of 12 female bears ≥ 1 year old could be harvested and a viable population would be maintained. Using this strategy, the population would be expected to stabilize at about 20 female bears. The relatively low estimate for viable, harvested populations is due to the high intrinsic growth rate of the population. However, if this growth rate were reduced by only ca 3%, the threshold must, under some conditions, be doubled. An additional problem is uncertainty associated with population estimation. As this uncertainty increases, the threshold must be raised considerably to assure that extinction is avoided, given the prescribed population survival probability. This is a relevant finding for management, because bears are notoriously difficult to census and monitor (EBERHARDT *et al.* 1986). Other factors that are important to consider when evaluating these results are that the IUCN criteria we used allow a quite high rate of extinction (10% in 100 years), perhaps higher than desired (TUFTO *et al.* 1999).

KATAJISTO (2006) has also modeled the more realistic scenario of the large population of brown bears in Sweden using individual-based models and data from the SBBRP. She concludes that the population is quite robust to changes in harvest policy and could sustain a doubling of the present rate of harvest. However, under some harvest scenarios, especially increasing the harvest of trophy bears (adult males), there would be a time-lag effect that is significantly greater than the short-term effect on population growth. Thus, constant monitoring of the population trend is important.

Beyond the actual killing of individuals and the effect that this has on population change, there are other, more indirect, effects on the population. One effect is the orphaning of cubs when their mother has been killed. Although it is illegal to kill bears in a family group in Sweden, this happens occasionally when the hunter does not see the other bears. In such cases, the cubs have often been captured and taken into captivity. We were the first to document the survival, growth and subsequent reproduction of orphaned brown bear cubs, although it was only 5 cubs from 2 litters. Our results showed that cubs can survive well from about midsummer and for those surviving beyond their yearling year; we did not find that loosing their mother had a negative effect on growth, survival or reproduction. We concluded that it was ethically acceptable to leave orphaned cubs to fend for them after midsummer (SWENSON *et al.* 1998), and this is now done in Sweden.

Our studies have yielded yet another example of an indirect effect of hunting on bear populations, the promotion of sexually selected infanticide (SSI – the killing of dependent offspring by a member of the same species so that the perpetrator can gain mating opportunities with the offspring's mother). The requirements of the SSI hypothesis are: 1. infanticidal males should not kill offspring they have sired, 2. infanticide should shorten the interbirth period of the victimized females, and 3. infanticidal males should mate with the mother of the dead infant and sire her subsequent offspring (SWENSON 2003, SWENSON *et al.* 1997, 2001a, b, BELLEMAIN *et al.* 2006a, b). We concluded that killing an adult male would disrupt the male social organization for 1.5 years, that it decreased the population growth rate (λ) by 3.4%, and that killing an adult male in our southern study area led to a loss of reproductive output that was equivalent to killing 0.5-1 adult females (SWENSON *et al.* 1997). The time lag we recorded does not seem unreasonable for brown

bears if the loss of cubs is primarily caused by infanticide by immigrating males that establish a home range on the study area after the death of a resident adult male. Bears are generally hunted during the fall, when fattening for winter denning is important. The breeding season starts in the spring not long after den emergence and continues to midsummer.

We also looked at the bear-caused deaths of subadult bears (1-4 years old) in relation to the death of adult males (SWENSON *et al.* 2001a). Most yearlings separated from their mothers in May. Other bears killed no subadult females older than yearlings, but males were killed as 1-, 2-, and 3-year-olds. Neither population density nor food abundance influenced rates of intraspecific predation on yearlings, but intraspecific predation on yearling females increased with the number of adult males that had died 2.5 years previously and whether any adult male had died 1.5 years previously. Because we found a similar pattern for intraspecific predation on yearling females as we had found for cubs, we speculated that infanticidal males might also be prone to kill subadult bears (SWENSON *et al.* 2001a). Intraspecific predation on subadults was highest during the breeding season, as it was for cubs and was also reported by MATTSON *et al.* (1992). Combining the results of our studies (SWENSON *et al.* 2001a, b) and calculating population growth using a standard deterministic model (FERSON & AKÇAKAYA 1990), the loss of adult male(s) was associated with a 4.5% reduction in the population growth (SWENSON 2003). However, one could counter that the effects of SSI would be compensated somewhat, because of the shortened litter interval, because females usually breed soon after they loose their young, and therefore give birth the next year (a requirement of SSI). KATAJISTO (2006) did not observe this in an individual-based model, however, probably because the males often fail to kill the entire litter, which would be required to shorten the litter interval. Apparently the females' anti-SSI strategies are relatively successful.

We tested the hypothesis that an increase in harvesting adult male bears would increase cub mortality. After we reported that the southern population showed a 16% annual growth rate in 1985-95 (SÆTHER *et al.* 1998), harvest quotas were increased markedly. We predicted that the increased harvest rate of adult males would increase cub mortality through SSI. In the counties encompassing the southern study area, the annual number of harvested bears increased six-fold after 1995, the annual number of harvested adult ($\geq$ 5 years old) males increased 35-fold, and the total annual mortality of radio marked adult males doubled. As expected, the mortality of cubs accompanying radio marked females also doubled (SWENSON 2003).

Sexually selected infanticide is promoted by the disruption of the male social organization when resident adult males die, thus allowing new males into an area or perhaps allowing other resident males to realign their home ranges. It has a solid and well-documented theoretical basis and should be expected in many species of large carnivores. In species exhibiting SSI, hunting adult males can promote it as the results reported here show.

According to the precautionary principle, wildlife managers should consider SSI when managing the hunting of large carnivores. Because there may be geographical or population differences in the occurrence of SSI, however, much more research is required before we can reliably apply knowledge of SSI to carnivore hunting management. The effects of hunting on the behavior of the hunted animals should receive increased attention from behavioral ecologists and wildlife biologists (SWENSON 2003). Nevertheless, it is important to point out that this is a controversial subject. Several North American bear experts do not accept its occurrence, because it has not been found in brown bear populations in North America (MILLER *et al.* 2003). One potential reason for the apparent difference in occurrence of SSI between the continents is that primiparous females seem to be most susceptible to SSI, with susceptibility increasing with decreasing age of first birth (ZEDROSSER 2006). Scandinavian brown bears give birth earlier than those in North America (ZEDROSSER 2006).

Hunting can also affect the mating system of brown bears. Brown bears have a promiscuous mating system (SCHWARTZ *et al.* 2003). DAHLE & SWENSON (2003) found that both

males and estrous females roamed during the breeding season, supposedly to seek mates. The females had larger home ranges during the breeding season in the north, where there were fewer available males. This is the first time an effect of estrus on home range size has been reported for female carnivores. This roaming implies that the females are selecting mates. We investigated this more closely with our extensive paternity database. We found that females chose the largest, most heterozygous and less inbred males of those around them, but bred with young males if older males were not available. The results also suggest that females might exercise a post-copulatory cryptic choice of the father of her young (BELLEMAIN *et al.* 2006b). We also estimated annual reproductive success in male bears, using the number of genetically determined yearlings born to our marked females as the indicator of reproductive success. Older and larger males had higher annual reproductive success, but size was more important in the north, where there were fewer males per female and therefore less competition among males (ZEDROSSER *et al.* 2007). Also, less inbred males were more successful. Thus, if hunting removes most of the old males, it will force the females to mate with younger males, which they would not have selected had the older males been available.

Is harvesting a selective pressure in bear populations?

An important ethical question is whether harvesting is an unnatural selective pressure on life-history evolution (FESTA-BIANCHET 2003). This has been documented in many harvested fishes (e.g. JENNINGS *et al.* 1999) and a few large mammals with obvious trophy-related attributes that hunters can base selection on (e.g. COLTMAN *et al.* 2003). This could be operating for bears, as 88% of all mortality of bears >1 year old in Scandinavia is due to human causes, almost exclusively hunting, and hunting mortality is different from natural mortality, which is concentrated on very young and very old bears (FESTA-BIANCHET 2003, SAHLÉN *et al.* 2006). The question of the long-term effects of hunting is certainly one that managers will have to face in the near future, as public awareness of this phenomenon grows. Therefore, we recommend that research be conducted on this question.

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Population Status of Large Carnivores in Scandinavia

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Abstract. The number of wolf packs is app. 30 in Finland, 15 in Sweden and 4 in Norway (with estimated 150, 120 and 40 individuals, respectively). The species are in principle protected in all counties, but with a differentiated management system, wolves are controlled especially in the reindeer herding districts. The brown bear populations are some 800–1000, 2,500–3,000 and 50-100 individuals in the same countries. Finland and Sweden have regular quota-based hunting with a yearly bag of less than 100 bears in each country. The wolverine populations are some 120, 420 and 450 animals. Only Norway has a regular hunt and in addition lethal control by taking young pups out of the dens. The lynx populations are censused at some 920–940, 1300–1500 and 400 animals. All three countries have regular quota-based hunting, all with a yearly bag of less than 100 animals.

Key words: Finland, Sweden, Norway, large carnivores, hunting

Introduction

All large carnivores are increasing in number and distribution in the Scandinavian countries. The conflict of interest and challenges for management differs amongst the countries and in different districts within each country.

Wolf (*Canis lupus*)

After having been nearly absent in South Scandinavia for some twenty years, a rather isolated population was established by first two, and then later one additional immigrating wolf coming in from Russia and Finland. Today the wolf population in South Scandinavia consists of some 16–18 breeding pairs, which gives a total of app. 130–160 animals. This is the same number as the Finnish wolf population.

Both populations, and subpopulations, have shown a remarkable high recruitment rate. Due to some illegal hunting the populations have not increased so much the last couple of years. The litter size in South Scandinavia has dropped in the last years, and it is suggested that this might be due to inbreeding.

The wolf is a very controversial animal species. In principal it is totally protected. A few animals are taken by permit to minimize conflicts. In none of the three countries do the management plans aim at having any wolves in the Sámi reindeer herding areas.

The main conflict of interest between hunters and wolf protection is depredation of hunting dogs. This means in many districts the end of traditional hunting methods. In addition comes predation on moose, where a recent study has shown that a pack of wolves can take up to 150–200 moose in one year. A much higher number than reported from North America.

Brown bear (*Ursus arctos*)

As with wolves, Norway and Sweden has a common population, while the population in Finland has connection both towards Russia and North Norway and Sweden. The Swedish bear population of 2,500–3,000 animals is far larger than the management goal set by the Swedish Parliament (1,000 animals). The Norwegian management goal is 15

breeding females each year. So far there are only five breeding females, with lots of young males coming in from Sweden.

Both Sweden and Finland have a regular quota hunting system, but with less than 100 bears taken every year.

In Norway there are some 2.4 million sheep more or less grazing free in the mountains and higher elevated forests in summer and consequently sheep predation by bears is a big conflict. Compensation is paid each year for some 35–40,000 lambs and sheep taken by the large carnivores. In addition there are some 20–40,000 semi domestic reindeer (the number of semi-domestic reindeer in Norway is some 250,000 animals. Out of this, there is paid compensation for some 20–40,000, mainly calves claimed to be taken by large carnivores. Nobody believes that so many are actually killed by big predators, but we have no better figure, and the number 20–40,000 gives an idea of the cost for the society.) The wolverine is responsible for the highest toll, then comes the lynx, and finally the brown bear.

Bear predation on game, and competition with hunters is not a big problem. Even though the Scandinavian bear is not considered to be especially aggressive, there have been a few cases where people, especially hunters, have been attacked and wounded by bears.

Wolverine (*Gulo gulo*)

The wolverine in Scandinavia has long been recognized to be in two separate populations with little genetic exchange. Population size has been calculated on the basis of breeding dens, and in the last years on DNA analyses of faeces. This has also shown that there is genetic exchange toward the population in the mountains in southwest Norway.

Only Norway has a regular hunting quota and hunting season for wolverine. In Finland they have had a management practice, relocating animals that are causing unacceptable damage. While in Sweden they have tried a compensation system where the Sámi people have been paid for the destruction per breeding den within their district, and not compensation for killed reindeer. Certain live-catching box-traps are legal in the hunting season. There is nearly no conflict of interest between hunters and the conservation of wolverines.

Lynx (*Lynx lynx*)

According to the latest data, the populations are calculated to some 920–940 animals in Finland, 1,300–1,500 in Sweden and 400 in Norway. From a conservation point of view, this is a population size that should be viable in all three countries except that in Sweden and Norway, where the lynx is heavily dependant on roe deer as its main prey, the roe deer population is severely declining due to lynx predation, and fox predation on the fawns. Even if the hunters abandoned all roe deer hunting, the carrying capacity for lynx is declining.

The lynx is a very popular hunting species, and this gives some acceptance for the species among hunters.

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Wolves and Politics in Finland
A Balance between Biological Facts and Socio-Economic Viewpoints

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Abstract. To enable a successful management of the wolf population on a national level requires a common agreed and adopted national management plan (MP). This kind of MP has to contain elements as:

- best available scientific data;
- attitude of local people and national policy;
- common goals and achievement of development direction;
- national freedom to achieve the goals on own terms;
- increased status of the species (from "pest" to a valuable nature resource, including hunting aspects);
- When talking about transboundary management, the development has to proceed slowly step-by-step. Usually you can find differences between two countries within the frames of culture, nature, history, population (people/game), game research, damage compensation system, forms of livelihood, politics, NGOs etc.

Key words: Management plan, wolf, development, policy

Introduction

In Finland the wolf (*Canis lupus*) is classified as a game species belonging to the legislation of hunting and game management, which is administrated by the Ministry of Agriculture and Forestry. Against this classification the wolf is totally protected in Finland. The only exception is within the region of the Reindeer Herding Area in Lapland, where Finland has derogation from Annex IV of the EU-Habitats Directive. Within this area wolf is included into Annex V of the Habitats Directive (92/43/EEC). Exceptions from the total protection (outside the Reindeer Husbandry Area) are possible only through article 16 of the Habitats Directive.

According to the Finnish hunting legislation and the Habitats Directive the first challenge is to maintain the wolf population at a favourable conservation status, which means also that we must be able to solve the conflicts relating to wolves. The second challenge is to spread the population over a wider area within the boarders of Finland, which means management measures for natural dispersion into new areas, where the wolf population has possibilities to live in suitable habitats without causing any major conflicts.

In general when questions about wolf and problems caused by wolves are dealt with in public, the immediate reaction is: "*of course we shall have wolves in Finland, but certainly not in our village*". Having this in mind, the equation between the biological facts and needs and on the other hand the socio-economic issues seem to be very far from each other and more or less impossible to solve.

When the results of management are analysed, data from the period of the Finnish EU-membership show clearly that the wolf population has a very strong increasing rate. In 1996, when Finland became a member of the European Union, the size of the Finnish wolf population was about 80-90 animals and 4 breading pairs. Despite an annual cull (hunting licenses issued by the Game Management Districts and killing licenses for preventing damages issued by the Ministry of Agriculture and Forestry) the numbers had increased in 2006 to about 250 animals and 25 breading pairs (**Fig. 1**).

The third challenge appeared through the action brought on 19 September 2005 by the Commission of the European Communities against the Republic of Finland (Case C-342/05)

The Commission claims that the Court should declare that, by regularly permitting the hunting of wolves contrary to the principles for derogations laid down in Article 16(1) of the Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and wild fauna and flora, the Republic of Finland has failed to fulfil its obligations under Article 12(1) and 16(1) of the Directive.

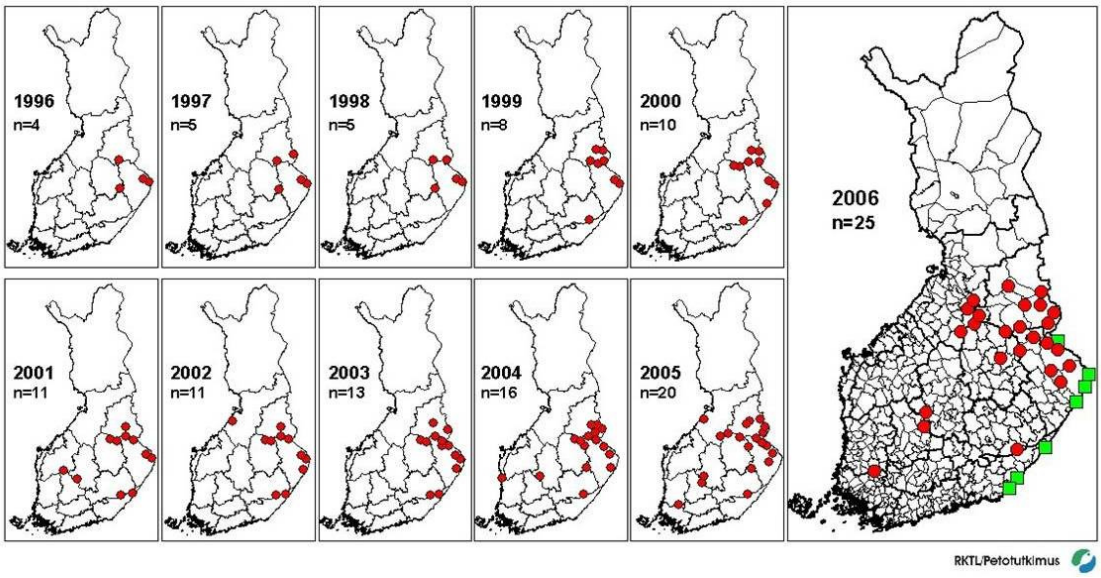

Figure 1. The increase and distribution of wolf packs in Finland in the years 1996-2006. (Kojola *et al.*, 2008)

Pleas in law and main arguments:

- Article 16 of the Directive 92/43 EEC is an exception to the system of the strict protection of species in Article 12, so that must be interpreted strictly. Article 12(1) lays down two preconditions for derogating on the basis of points "a" to "e". First, the derogation must not be detrimental to the maintenance of the populations of the species concerned at a favourable conservation status in their natural range. Second, derogation is possible only where there is no other satisfactory solution;
- since the level of protection of the wolf is not favourable in Finland and other alternative methods are available, and since hunting permits for wolves are regularly issued without there being a properly ascertained connection with individuals causing particularly significant damage, the hunting of wolves is permitted in Finland to an extent which exceeds the conditions laid down in Article 16(1) of Directive 92/42/EEC.

To find a solution to this challenge, (the EU-infringement procedure started already in 1995, one year before the Finland joined the EU), we found out that the only way to present and defend the Finnish situation and decision making was through a neutral management plan based on the best available information and a common agreement between all involved shareholders.

In 2000 we started working with the process for the national management plan of wolves. As a backbone for the working paper we used the main principles and guidelines of the IUCN statement on Conservation By Wise Use, European Council's guidelines for action plans T-

PVS (2000) 23, the Large Carnivore Initiative For Europe (the importance of taking into account the needs and the approval of the local people) and of course the Habitats Directive 92/42/EEC.

T-PVS/INF 28 Large Carnivore Initiative for Europe Core Group position statement on the use of hunting and lethal control, as means of managing large carnivore populations played a major role in the planning:

- Hunting and lethal control are part of a comprehensive conservation management plan for the whole population and its habitat. This plan should be written by the appropriate management agency in appropriate consultation with local human population and acknowledged wildlife interest groups (both governmental and non-governmental);
- the plan should be acceptable to a majority of the affected groups and a majority of the local population. These management plans should be fully compatible with national and international laws and agreements.

Taking into account these conditions, the Ministry of Agriculture and Forestry, as responsible for the management, gave the task to produce a draft for a management plan to the University of Helsinki (socio-economic information) in cooperation with Finnish Game and Fisheries Research Institute (biological information) and University of Oulu (genetic structure). Representatives from Ministry of Environment, Finnish Forest and Park Service and Hunters Central Organisation were invited to form a follow-up group for the project.

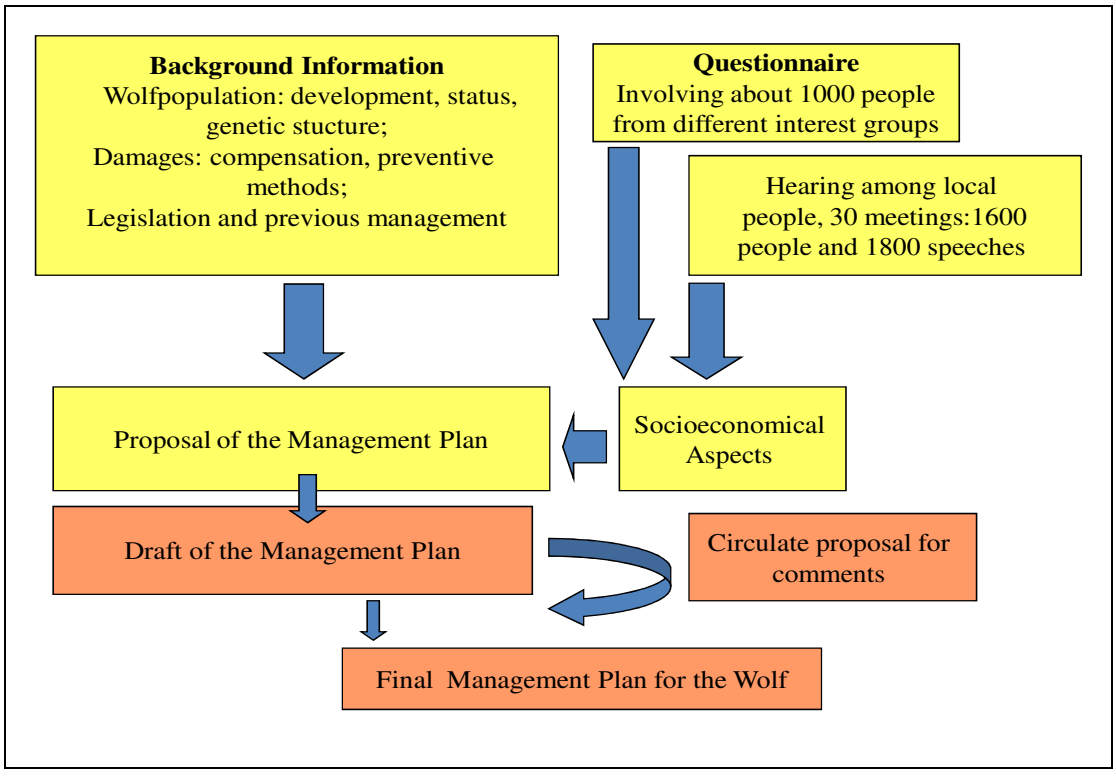

Figure 2. The development process of the management plan (HEIKKINEN 2005)

The method for the preparation was chosen so that the examination started from the grass roots of rural areas where people attitudes and point of views were taken into account up to national level of stakeholders. The very complex and troublesome process is shown in **figure 2**.

The fundamental aim of the management and conservation of the Finnish wolf population is to maintain it at a favourable conservation status. Any measures taken will take account of economic, social and local characteristics.

In Finland at this moment, where we already have a population in the country, we are not in favour of artificial reintroduction into new areas. Our point of view is that the dispersal shall happen within natural terms, because when an animal is moved by man, several problematic questions will arise.

- Nobody can foreshadow how an animal will behave in new surroundings. These especially in situations, when the animal is already a problematic specimen, causing trouble in areas where from it is going to be moved;
- the questions: where to remove it, who really wants to receive it, who really wants to find the problems in his backyard etc. are very essential when taking decisions concerning this kind of strategy;
- an also important question is: whether the new area really fulfils the criteria and fits the new habitant (food, shelter, sympathetic people etc.);
- unsolved problems will occur in situations where the removed animal decides later on to move to a completly new "unplanned" area. Who will be responsible in that case for the negative result, who is obliged to compensate eventually losses etc.?

In the recent decades the goals have been to maintain a very slow increase of the population, this is due to the fact that dealing with this kind of a development rate, people are able to follow and get used to the new situation which occurs in their own local surroundings. From our point of view, this is the only way to achieve the understanding and approval. From a biological point of view we need to maintain a minimum viable population of about 20 breeding pairs if the migration of wolves from populations in Russian Karelia into Finland remains unchanged. If the numbers of migrants falls from the present level the need is about 25 breeding pairs.

Today, however, it seems like this theory is not as valid as before, because the wolf population has increased to such a level that wolfs appear almost everywhere. Another reason is probably the action from the European Commission against the Finnish policy.

In 2006 we had 25 breeding packs. The preliminary estimation of the Finnish research Institute based on monitoring in February 2007 (34 packs and 19 pairs) indicates that we will have over 30 breeding pairs in the season of 2007.

The more critical people are against the wolf, the more efforts are to be put on measures for creating a positive attitude for successful management. Achieving the main aims mentioned before needs a number of measures:

- regional management of the wolf population;
- establish Local Consultative Working Groups on Large Carnivores (LCwgLC);
- damage prevention and costs involved;
- damage compensation system;
- derogations from the conservation of wolves and wolf hunting in the reindeer husbandry area;
- monitoring of and research on the wolf population and their possible development;
- training, advisory services and information provision;
- supervision on hunting and damage prevention methods;
- general information to the public on wolf biology, wolf and man, wolf in ecotourism etc.;
- diseases;
- cooperation between different authorities and organisations.

When the Finnish National Management Plan for Wolf was approved 19 December 2005, it was completely clear, from the very first beginning, that for the implementation of the MP, until it becomes a functioning tool, it must be monitored and updated regularly.

It is also completely clear, that the MP needs a larger general examination, five years from the approval at the latest. The development of the wolf population and its effects will be monitored and the need for setting regional target populations with specific numbers will then be examined.

The Court Decision will be very important for the future development of management as well in Finland as in whole of Europe. When this challenge is solved, we still have a new one: to analyse the wolf situation in a wider biological perspective. What does a very strict policy really mean in practice and what has happened with another successful story?

In historical times the Finnish wild reindeer (*Rangifer tarandus fennicus*) was a very common species that played a major role as game and food supply. Some small fragments of the population were found in the eastern part of Finland in the region of Kuhmo, close to the Russian border. At that time in 1940-50 the idea of management and reintroduction of the valuable species was started. Farming and reintroduction into old areas followed in 1979. Due to the successful work, the size of the population was estimated in 2003 to a total number of 2500 animals. However, the harmony between wolf population and the population of the wild forest reindeer is not in balance anymore. The reindeer population is decreasing with an accelerated speed, relating to an increasing wolf population (WIKMAN 2008).

The question today is what can we do to stop the alarming situation, when the wolf is under strict protection under the Habitats Directive? Which species is more valuable for the biological biodiversity point of view? What is the role of the European Commission?

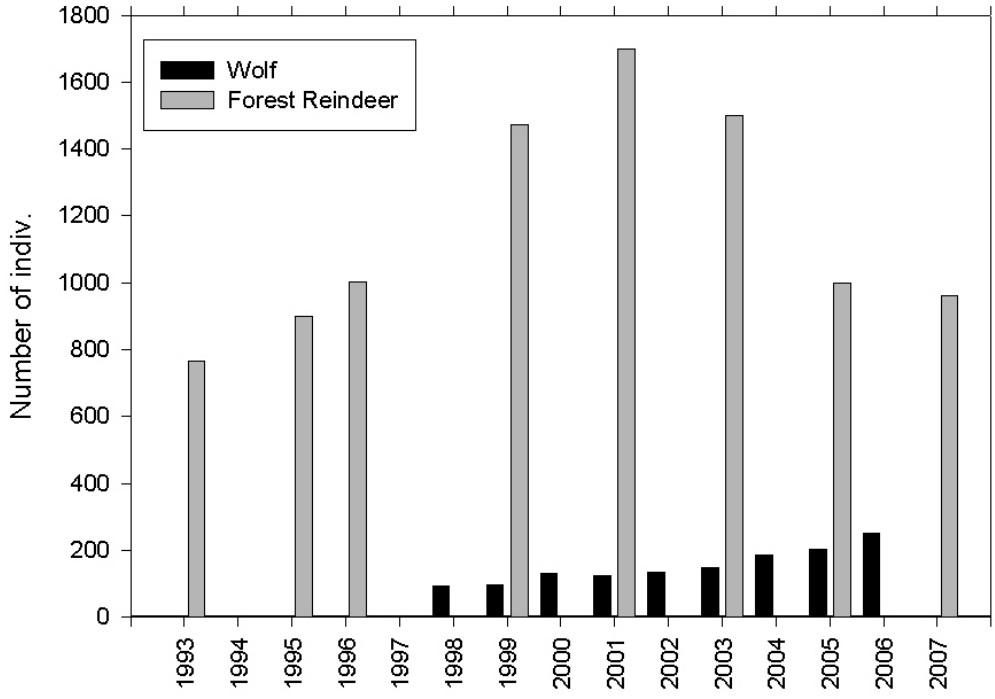

Figure 3. Population size of wolf and forest reindeer in Finland between 1993-2007 (WIKMAN 2008)

The Court of Justice of the European Communities gave its decision on the Finnish wolf case on 14 June 2007 and passed judgment only on one of the three separate charges of the action concerning wolves brought against Finland by the European Commission. According to the decision, hunting has not been detrimental to the favourable conservation status of the wolf. Moreover, Finland was not in breach of the obligation to seek an alternative satisfactory solution. However, according to the Court of Justice, Finland has not shown that by hunting on wolf the very significant damage and loss can be prevented.

The crucial point of the decision is that the current system based on hunting permits granted by the game management districts, is not contrary to the Habitats Directive. The game management districts can continue to grant permits to hunt wolf within the limits laid down by the Ministry of Agriculture and Forestry. An order regulating the hunting of wolves will be issued in the autumn.
The Ministry considers that wolf hunting permits can be granted in the future, too, in order to prevent significant loss or damage. However, a precondition is that the monitoring carried out this year shows that loss and damage can actually be prevented by hunting.

The decision does not concern cases in which the game management districts or the Ministry has granted permits to eliminate, for example, wolves that enter gardens or yards regularly. Neither does it concern so-called population management permits used to achieve the targets of the wolf population management plan.

When planning future wolf policy in Finland, the Ministry will take note of the Court of Justice's desicion on the wolf and the grounds for it. According to the Court of Justice, the wolf's conservation status in Finland in 2002 was not favourable, and the special permit decisions made by the Ministry in the years 2000 and 2001 did not comply with the requirements of the Habitats Directive. However, the decision did take into account the development of the wolf population after 2002 and the wolf population management plan. On this basis the management plan can be considered as a sufficient foundation for meeting the requirements of the Habitats Directive. The management of the wolf population and wolf hunting shall in future be based on the Management Plan of the Wolf Population in Finland approved 2005. The principles of the Management Plan enable more flexibility in the administration of the population and damage control.

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The Deadly Encounters of Dogs and Wolves in Finland
Pet Dogs are at Risk Too

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Abstract. This paper informs you about the pet and hunting dogs that fall for prey of wolves in Finland. This problem does not concern Finland only, but Norway and Sweden, too. During the last ten years we have lost more than 500 dogs in Finland. At the moment there are no good ways to safeguard free running hunting dogs. A prominent solution for the dog might be a protective vest, which can give electric shocks when touched. The increasing number of wolves is seriously affecting the every-day practices of different dog user groups.

Key words: Finland, Norway, Sweden, hunting dog, wolf

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The Finnish Kennel Club has gathered information about dogs wounded and/or killed by wolves. The reason for collecting data was an incident where a wolf took and ate a five months old pet dog in December 2006 from a house yard in broad daylight, even when the owner was nearby (EEROLA 2007a). This clearly shows that the risk of death caused by wolves does concern the pet dogs too, not only the hunting dogs.

To gather information about wounded or killed dogs in Finland has not been easy. There are no official nationwide records about killed dogs. Some private persons or some officials working in the different Game Management Districts have collected data about wounded and/or killed dogs locally. Not every wounded or killed dog is reported for various reasons. The dog may not be insured or the dog may be of mixed breed and therefore of low economical value. The dog may even be of pure breed but of low economical value because it has never merited in a dog show and/or in a field trial.

The Finnish Game and Fisheries Research Institute (FGFRI) has estimated that 55 dogs are killed yearly by wolves (EEROLA 2007b). So we have lost more than 500 dogs during the last ten years. At the same time the number of wolf litters has rapidly increased from 4 to 25 (FGFRI, pers. comm.). The Ministry of Agriculture and Forestry (MAF) has compensated economically the loss of 17 dogs in 2004 and 40 dogs in 2005. There were 58 applications for economical compensation in 2006 (MAF, pers. comm.).

There are plenty of things you have to take into consideration, while living in an area with wolves. Your dog pen must be large and predator-proof, you must be alert about the locations of wolf packs in case you want to exercise your dogs, or when you go out hunting with your dogs, or when you test or compete with your dogs in a field trial.

There are some 20 different field trials for different hunting dog breeds. In these field trials the dogs are running free, in some cases several hundreds of meters or even kilometres apart from the dog owner and the judge of the field trial. In 2006 there were 2,079 field trials with 17,824 dogs starting the test – in several cases the tested dog has been killed by wolves.

There are some conservation organisations and smaller one-task activist groups, whose aim is to increase the number of wolves. It is not surprising that the urban people loudly vote for wolves and at the same time the reality of rural life is often completely ignored.

Some local point of views:

- Why only the dog owners must bare the economic costs of protecting their four-legged friends against the wolves?
- Why only rural people have to solve the problems caused by increased wolf numbers even when they are not the ones who want more wolves in their backyards?

- Why do the different organisations, that would like to increase the number of wolves, accept no liability concerning the economical consequences of their fulfilled demands?

From the viewpoint of the Finnish Kennel Club the solution to safeguard the dogs is not

- to build a two-meter high steel fence around your house;
- to always keep your dogs inside the house except while walking the dogs;
- to cease all forms of exercising and practising with dogs outdoors;
- to stop all field trials;
- to stop the use of hunting dogs while hunting.

There should be a consensus among all stakeholders about how every interest group can go on practicing their free time activities while the number of wolves is increasing.

There are plenty of problems arising from the increasing number of wolves and if these problems are not solved in a proper way, taking into consideration all stakeholders, the result is an increased anti-wolf and anti-nature conservation opinion climate, especially among rural people.

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Human-Wolf Coexistence in the Baltic

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Abstract. Although the number of wolves in Lithuania, Latvia and Estonia, peaked in the mid 1990's the population still consists of almost 1000 individuals. The recent fragmentation of the Baltic wolf population may be a problem due to a "bottleneck" in central Latvia. With EU accession in 2003, Baltic countries had to conform to the requirements of the Habitats Directive, but negotiated successfully not to establish protected territories for wolves but for the regulation of population numbers. Different management frameworks (bags and quotas) are used throughout the Baltic. Wolf damage to livestock is decreasing along a north-south gradient. Estonia and Latvia experience minimal levels of depredation; wolf damage to livestock owners was found to be the main problem for species acceptance in Lithuania, raising problems with its protection. Compensation is not paid in all Baltic States, and there is no state-based and unified damage survey. Some differences between the countries were found in species acceptance, based/depending on (1) anxiety for the safety of family members, (2) rural-urban residence, (3) acceptable distances and proximity to large carnivores, (4) desired or acceptable population size, and (5) potential economic loss. In general however, wolf conservation prospects in the region are good.

Key words: Baltic countries, wolf, human dimensions

Introduction

The wolf (*Canis lupus*) population in the Baltic countries (Estonia, Latvia and Lithuania) is one of the strongest in Europe, and its numbers exceeded in 2005 one thousand individuals (SALVATORI & LINNELL 2005). Until recently, wolves were never protected here – thus, the history of human-wolf coexistence in the Baltic States is based on the long-term hunting experience, treating the species as a pest. Wolves were never extinct in Baltic countries (TIMM *et al.* 1998). In the Soviet era wolves were hunted without quota all year round, even paying bounties for the hunters (BIBIKOV 1985). As an opportunistic carnivore species (JĘDRZEJEWSKA & JĘDRZEJEWSKI 1998), gaining most in the periods of political instability (JĘDRZEJEWSKA *et al.* 1996), after 1990 wolves gave a burst of numbers in all three countries simultaneously; just the different management approach. After joining the European Union, Baltic countries changed the status of wolves, shortening hunting season and introducing quotas.

While the main conflict in the past was wolf damage done to farmers by killing livestock (ANDERSONE *et al.* 2001) and also direct conflicts (LINNELL *et al.* 2002), this is not so now, as damage levels are currently much less than those in southern European countries. Still, the public hostile attitude to the wolf as to a pest animal is very evident.

Wolf numbers and distribution in the Baltic countries

Historically, numbers of wolves in Baltic countries are not known. The pre-20th century population is supposed to have been high, because negative wolf-human contacts were widespread (ANDERSONE *et al.* 2001a, ROOTSI 2001, BALČIAUSKAS 2002, BALČIAUSKAS *et al.* 2002). A similar picture was observed in other European countries (LINNELL *et al*. 2002). But, while in later centuries most of Europe has lost its wolf population, or it was significantly reduced (SALVATORI & LINNELL 2005), the Baltic States were always supporting strong wolf numbers.

After the Second World War, the number of wolves in Lithuania was about 1700 (BLUZMA 2000); with the same situation in Latvia and Estonia. This post war peak was suppressed by intensive hunting, as wolves were doing too much damage to the weak livestock industry.

In the 60s and 70s, wolf numbers became very low, just a few tens per country (BALČIAUSKAS 2002), and the hunted numbers were up to 120% of the official survey; even allowing for errors this was much higher than any population could support (BALLARD *et al.* 1987). Still surprisingly, wolves maintained to exist and increase in numbers in all three Baltic countries. One of the possibilities was immigration to Estonia and Latvia from neighboring areas of Russia (ANDERSONE *et al.* 2001b), and, what became obvious in 2006–2007, to Lithuania – from Byelorussia and Latvia (BALČIAUSKAS unpublished).

All three Baltic countries experienced a rise in wolf numbers in the mid 1990s, soon after regaining the independence. There are several reasons, including the restructuring of the farming system, destroying of previous hunting societies and changes in land-use (BALČIAUSKAS 2002). Latvia and especially Estonia reduced wolf population by hunting, while in Lithuania the causes of population drop were not clear, indeed the hunting bag remained stable over the years.

The wolf distribution in Baltic States was continuous at the beginning of the last decade (TIMM *et al.* 1998, BALČIAUSKAS *et al.* 1999), becoming fragmented in the very last years (SALVATORI & LINNELL 2005). In Lithuania the patches of wolf distribution are not stable. Until 2000 all afforested territories were inhabited (BALČIAUSKAS *et al*. 2002). In 2000–2002, although the wolves did not inhabit stretches near the biggest highways and the patchiness of the wolf distribution increased in 2003–2005 (BALČIAUSKAS 2005, 2006).

We may question the reliability of official game statistics, on which population numbers were based up to 2000, because, possibly, double counting may have been occurred and all three Baltic States had few statistics until recent years. In Estonia, two methods (snow counts using so-called Finnish triangles and mapping of wolf observations throughout the year, thus locating breeding units and pairs) were used, but their results differed up to threefold (MÄNNIL, pers. comm.). In Latvia, simultaneous track counting in the snow all over the country, performed by foresters and hunters, and repeated after three days, was introduced in 2004. The same method is used now in Lithuania with 'minimum population counts' carried out in winter 2006 and 2007. In February 2006, the 'minimum population count' revealed 79 forest units, where wolves were observed (19% of 409 units) forming no less than 20 packs. The migration of wolves to/from Latvia in the north-west, Latvia and Byelorussia in the east and to/from Byelorussia in the south were all detected.

Wolf status in the Baltic countries

The status of wolves in Baltic countries is based on the following issues:

1. current system of protected territories inside each country and law system;
2. Habitats Directive;
3. Natura 2000 species protection system;
4. Convention on the Conservation of European Wildlife and Natural Habitats, (Bern Convention);
5. Hunting limitations.

The Baltic States have well-developed and effective conservation systems. This means, that every country maintains strict nature reserves and other protected territories, where hunting is totally prohibited. These territories are home or refuges for several wolf packs. No special territories were established for the wolf as

a consequence of implementation of the Habitats Directive, but wolves inhabit territories, designated for other species.

In the process of joining the European Union all three Baltic States negotiated exemption for wolf population management and now are enjoying it. The same situation is with the Bern Convention, as in Baltic countries it was ratified with exception to wolf population management.

Thus, in all Baltic countries wolf populations are regulated by hunting, the main instruments being length of the season and quota. In Soviet years and after the independence wolves were hunted without any limits or season restrictions leading to the peak numbers! Before joining the EU however, the hunting legislation was adjusted. The shortest season for wolf hunting is in Estonia (01 December – 28 February), while longest in Latvia (15 July – 31 March). Lithuania adjusted the season length three times. Till the year 2002 it was similar to Latvia (01 July – 01 April), in 2002–2005 shortened by one month (01 August – 01 April), and after 2005 is quite short (01 December – 01 April).

In Latvia and Estonia a quota for the wolf was established in 2003, while in Lithuania – in 2005, due to intensive pressure of NGO's. Bounties are not paid in Latvia although big bounties were paid in the period 1997–1999. In Lithuania, in 2002 there was a local initiative for paying bounties, but this stopped in the same year.

Quotas are currently set in a centralised way, depending on the population size (in Estonia – also taking into account wolf density, demographic structure and damage level). Up to 130–150 permits are issued annually in Latvia, up to 40 in Estonia. In Lithuania the hunting bag was not limited until 2005. For the last two seasons it is established by 20 animals; in both years the quota has been filled before the season was closed.

Lithuania has no national wolf population management plan. An agreement on minimum viable population number is needed as well as a plan for the solution of conflicts caused by wolf depredation on domestic animals. Without these, in the last years there have been serious disagreements between stakeholders and NGO's, and public opinion about the wolf is deteriorating.

Wolf damage

Compared to Central Europe, wolf incurred damage level in Baltic States is not high. In Estonia it is negligible, in Latvia minimal (ANDERSONE *et al.* 2001a); while in Lithuania it is moderate (BALČIAUSKAS *et al.* 2002). There is no unified damage survey in the countries, and no compensations are being paid for livestock losses.

Wolf damage changes over time are available from Lithuania. In 1927–1929, damage consisted from 1500–6000 heads of cattle, 500–2000 dogs and ca. 500 domestic birds (ELISONAS 1929, JACEVIČIUS 1930). In 1956–1959, in Lithuania wolves killed up to 3000 cattle, pigs, dogs, and domestic birds annually (PRŪSAITĖ 1961). According to the data from questionnaire research, in 1995 the loss caused by wolves in Lithuania was approximately 1000 individuals, most often sheep (BLUZMA 1999). In 1999–2001, the preliminary annual loss was no less than 400–1000 individuals, the smaller part of which consisted of sheep, goats and the greater part by cattle (BALČIAUSKAS *et al.* 2002). A case study in northwest Lithuania in 2002 showed that the losses may have been bigger. Later, with the reduction of population numbers and distribution area, the damage level reduced: in 2003–2004 it was considerably lower, and in 2005–2006 – mere tens (up to 100) of domestic animals (BALČIAUSKAS & VOLODKA 2005, BALČIAUSKAS & BALČIAUSKIENĖ 2006).

Amongst more than 400 local administration units in Lithuania there are several where, over the last few years wolves killed more than 20 domestic animals (maximum is 87, mainly sheep). Such areas are located near or among forests and bogs, which make wolf population control difficult or impossible. The spatial distribution of the wolf damage in north-west Lithuania in 2004 and 2005 is corresponds to the damage in south-west Latvia, suggesting that there are wolf packs using areas near the state border, which are free from hunting and with limited human access.

Public acceptance of the species

Studies of the human interactions with the large carnivores were carried out in the Baltic States in 1999-2001 but the results were not comparable (BALČIAUSKAS 2001, BALČIAUSKAS & VOLODKA 2001, BALČIAUSKIENĖ & BALČIAUSKAS 2001, ANDERSONE & OZOLIŅŠ 2004). However generally, a high acceptance of the wolf was found, regardless of quite high damage levels in Lithuania (BALČIAUSKAS 2001, 2002).

More data on species acceptance using unified questionnaires were collected in 2004–2006 in the frame of an international project "Large carnivores in northern landscapes: an interdisciplinary approach to their regional conservation". Only a few of the findings are published, mainly on the in-country basis (BALČIAUSKAS 2005, 2006, BALČIAUSKAS *et al.* 2006a) or as a comparison between two countries (BALČIAUSKAS *et al.* 2005, 2006b).

Differences between the Baltic States in acceptance of the wolf are surprisingly large. More than 80% of Lithuanian respondents would worry about the safety of their families, if they had to be in the forest, where wolves live; in Latvia, this share is more than 70%, but in Estonia – just over 30%. Indeed about 50% of Estonians had no worries about wolves, in comparison to ca. 10% of Lithuanians and Latvians (differences highly significant, $p<0.001$).

Examining these data in relation to distance from the wolves Lithuanian and Estonian respondents were unanimous: 50–65% of them said they may accept wolves more than 10 km away, or not in their district. I understand that elsewhere this is an example of the NIMBY (Not in My Backyard) syndrome. Yet in Latvia about 30% of respondents would accept wolves closer than 1 km from home and 22% at a distance of 1–5 km (these country differences are highly significant, $p<0.001$). Earlier it was demonstrated that those living in cities would accept wolves much closer and that, respondents living in farmsteads and small villages are most sensitive to large carnivores (BALČIAUSKAS *et al.* 2006b).

Lithuanian respondents were exceptional by their negative attitude to wolf numbers in the country – ca. 45% of them would like wolf numbers reduced, ca. 42% kept the same and ca. 13% increased. In Latvia and Estonia, just 16% and 19% of respondents were for number reduction, yet 25% and 27% for the number increase. Again the negative point of view of Lithuanian public significantly differs from that of the two other countries ($p<0.001$). Also it is worth to highlight, the fact that despite the wolf population decrease in Lithuania and very active NGO pressure for full species protection, public acceptance is deteriorating.

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People's Attitude towards Large Carnivores in Russia

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Abstract. The most problematic large carnivore species in Russia is the wolf. The peak in population number was in the beginning of the 90s: approx. 48,000 animals, whereas now it is 43,000, which is too high compared to the low ungulate population density. The best rate between wolf and their prey is: in case of moose – 1:30, of red deer – 1:100, of roe deer – 1:300–400. Now it is 1:12 for all ungulate species. The 13–15,000 annual wolf harvest is very low; it should be about 70% of the wolf population. Otherwise wolves cause huge damage to game and livestock, and are a threat to human health and safety. Brown bears cause less damage in spite of their higher population number: 140,000. The population of this species is stable with a slow increasing trend; the harvest here is also not enough. The number of Asian black bears (currently 4500) is declining, due to habitat loss and poaching and the legal harvest is strictly limited. The population of lynx (approx. 25,000 individuals) is rather stable with an official harvest about 400 annually; though in some regions hunting lynx is forbidden. Leopard, snow leopard, tiger and polar bear are protected. Tigers may cause problems in near future as their number is increasing considerably in spite of habitat loss and declining ungulate populations.

Key words: Russia, carnivores, number, harvesting, relationship

Introduction

Due to the considerable variations of the attitude of game biologists and people in general, it would be reasonable to view the question of attitude from the position of the animal species.

Wolf (*Canis lupus*) may be considered as a major problem. The highest population peak was observed after World War II, with 50,000. However, due to the intense hunting, the wolf population was reduced significantly. By the early 60s, the total number was about 13,000, whereas in the first half of the 70s it was reduced to 7–8,000 specimens. The number of wolves hunted dropped from 45,000 to 5,000. In the 70s, some biologists initiated a wolf protection campaign. Wolves were called "forest doctors"; they were ascribed an excessively significant role in the ecosystem. As a result, in spite of increasing hunting, the number of wolves started to grow more rapidly. Game biologists and hunting organizations were unable to control the growth in number any more. By 1981–1982, the bag had increased to 35,000 specimens, while the hunting level amounted to 15,000 specimens per year. A change then occurred in the minds of game biologists. No more conservation tendencies were observed for wolves; hunting level grew steadily, which resulted in the gradual decrease in numbers – up to 1990 about 22,000 individuals. However after the USSR collapsed, all state premiums for wolf hunting were abolished. The population of wolves immediately responded to the decline of wolf hunting level and started to grow drastically again: It reached up to 48–50,000 heads in 1999. This led to the reduction in the elk population, which is the main prey of wolves. After 1999, wolf hunting leveled out at 13–15,000 heads per year, which, in turn, stabilized the population number at a high level – 43–48 000 animals.

Regarding the distribution wolves it can be observed that there are only few wolves in the tundra and taiga zone. The largest number of wolves can be found in the steppe zone and at the Northern Caucasus foothills and in Khakassia, which are the most suitable habitats for building dens and for breeding. Another area of the increased wolf population is the west part of European Russia – Pskov, Smolensk and Tver regions. It is related to the consequences of World War II: destruction of villages, dramatic reduction of the rural population and formation of suitable wolf dens.

Areas with reduced wolf population can be observed in the regions with more intensive hunting activity and there are few wolves in the Moscow region; wolf packs may appear only at their outskirts. Rather few wolves may be observed in the Tula and Vladimir regions and the Kurgan region in Siberia, where hunting activities are also performed at a high level.

Russians have also treated wolf as vermin as it causes damage to game, livestock, sometimes attacking people, especially children in remote areas catching them on their way to school. To characterize the impact of the high wolf population, for instance, in 1920 in Tar district, Omsk region, wolves killed 35,000 cattle, (15% of the livestock), and in Bashkiria 93,000. In January-March 1923, 10,800 cattle were wiped out by wolves in Khakassia, including 38% of horses, 19% of cows, 43% of small cattle, and only 0.2% of pigs. In the winter of 1924–1925, wolves predated 865,000 cattle in Russia, Ukraine and Uzbekistan. And this is not the end of the list.

It is hard to overestimate the damage to game caused by wolf. For example, in southern Siberia, each wolf is able to eat 6–18 elks per year, 11 elks on average – only in the snowy period. Almost all Russian regions show the same figures. In the Central-Forest reserve, wolves reduce the elk population by 21% per year and wolves make up 80–90% of the total death rate for these wild ungulates. By comparison the legal elk hunting quota is 4%, whereas for wolf it is 20%.

A dynamic balance in the carnivore-prey system is only possible if the wolf-elk ratio is close to 1:30, wolf-red deer 1:100, wolf-roe deer 1:300–400. In the late 1960–70s, 50–74 elks fell on one wolf, whereas this number was 12 in the beginning of the 21st century.

Brown bear (*Ursus arctos*)**.** Unlike wolves, Russians' attitude to bears is rather friendly. Bears are often depicted in heraldry, postage stamps; also foreigners associate Russian men and Russia itself usually with a bear. This friendly attitude to bears is quite understandable: it does not cause as much damage to wild and domestic animals as wolves, despite its number, which is 3 times as much as the wolf population. Bears are omnivorous and in addition, they hibernate and so cannot cause damage to wild animals in winter.

The brown bear population amounts nearly to 140,000 individuals. Some growth may be observed following a slight reduction in the late 1990s. On the whole, the brown bear population may be characterized as rather stable, with slight regional variations. This number is reduced in the south of Siberia and the Far East due to poaching and illegal export of bear derivatives: gall, fat, claws for oriental medical needs. In some regions, the number of bears is increasing, e.g. in Karelia and other areas at the Finnish border. Many cases of bear attacks to people are registered in those areas.

Otherwise bears attack people quite rarely, although a mother-bear may attack you if one happens to be close to her cubs. In years of major vegetable crop failures, the number of attacks may increase dramatically – up to a hundred per year – in Siberia and Far East.

Officially, about 4,000 bears are subject to hunting in Russia nowadays. Hunting quotas are considerably higher (10,200 animals in 2007), though they are usually not achieved due to the difficulties of bear hunting. In the fall, one may hunt in oat fields, within the oat milky ripeness period, when bears usually go out to eat. In summer, one may also hunt near apiaries that are often visited by bears. People tend to forgive all kinds of damages to apiaries. In spring, people hunt in the "full blaze of the sun", where bears go out to get warm after their winter hibernation periods. In Siberia and Far East, people often hunt at the river shores where bears come out for fishing.

A few spots of increased population density may be found in the taiga, especially the southern taiga of the European Russia and the Ural Mountains, Southern Siberian Mountains, the south of the Far East, Sakhalin, Kamchatka and Northern Caucasus.

Asian black bear (*Selenarctos tibetanus*) (also called, White-breasted**,** Tibetan, or Himalayan bear,) inhabits only the southern territories of the Far East. The population is slightly more than 4,000 specimen, but decreasing steadily for several reasons. Firstly, the reduction of the Manchurian natural mature forest area by logging, burning and international trade. Considering the fact that this black bear has a narrow habitat niche, this may be considered as the key factor. This bear is weaker than its competitor – the brown bear – that may displace black bear. This is the reason for the higher brown bear hunting quotas in their cohabitation areas. Another strong competitor is the tiger, which is increasing in numbers rapidly along with the reduction in the number of ungulates, being a food source for both species. Besides, the habitats of the black bear are considerably characterized by poaching activities for derivatives, mostly claws, which are illegally exported to Southeast Asian countries for medical purposes.

The legal harvest of black bears is about 2% of the population recently, while the quota amounted to 4–5%. In 2007, the quota was reduced to 2.5%. We hear more and more opinions about the necessity of the total hunting ban for this species.

The cases of black bear attacks on people and apiaries are rather uncommon and rare.

Polar bear (*Thalassarctos maritimus*). The number of this species in the Russian Arctic zone can be estimated at approximately 10,000 animals. This species is included to the Russian Red Data Book. The maximum concentration of polar bears during the mating season may be observed on Wrangel Island – its "maternity hospital". The number of this species is gradually growing. It is becoming more and more symbiotic with man: polar bears often visit people's settlements, feed on scrap heaps and often attack people. Animals that keep attacking people are subject to culling – pursuant to special permits issued by hunting authorities.

Lynx (*Lynx lynx*). The population of this large cat in Russia is rather stable. In the early 1990s, it was estimated at 30–35,000 individuals. Some depression in the population was observed in the mid 90s, followed by a slow increase in European Russia and later in Asia – a slight surge in late 1990s followed by the reduction in numbers, which is still observed nowadays. Up to now, the lynx population has been estimated at approximately 25,000 specimens.

The distribution of the lynx distribution in Russia is similar to that of brown bear; the southern taiga of European Russia and the Ural Mountains, Northern Caucasus, the southern Siberian Mountains and the Chita region.

Lynx hunting is banned in the south of its area, mostly in sub-taiga forests where there are very low-numbered populations. Official hunting amounts to 400–500 specimens, almost equal to poaching values.

No damage to game or humans has been registered so far. Lynx cause only slight harm to small livestock in Northern Caucasus.

Amur leopard (*Panthera pardus orientalis*) can be found in the deep south of the Far East, mainly in the nature reserves and other protected areas. According to the latest counts, its number can be estimated at 27–32 animals, including only 4 adult females with kittens. There is a violation of the sex ratio, in which males are predominant. The number of the Amur leopard is decreasing. This species is registered in the Russian Red Data Book and a number of regional Red Lists. Poaching is at a low level due to the low total number of the population.

Snow leopard (*Uncia uncia*) can be found in the Southern Siberian highlands. The population is divided into an eastern and a western part. The numbers can be estimated at 150–200 specimens. This species is also included in the Russian Red Data Book. Poaching activities are not common because the species is so rare. A taiga population has been discovered recently in the north-eastern Transbaikalia, in the taiga mountain range, which is not quite typical for snow leopards.

Amur tiger (*Panthera tigris altaica*) (also called Siberian tiger or Manchurian tiger) inhabits only the Khabarovsk and the maritime territories. Its population in Russia was estimated at 140–150 specimens in the 1960s. In spite of large-scale poaching caused by significant demand for tiger derivatives in oriental countries, the tiger population kept growing up to 460–520 animals. From the ecological viewpoint, this large cat species should be very rare in natural conditions; however, it seems to have stepped over its environmental barrier. Moreover, the areas of its original habitats are drastically decreasing (cutting and burnouts of forests), and so the population of wild boar and Manchurian red deer, being the main food source for tigers. Tiger also contributes to the decrease of ungulates in the Far East, above that the number of tiger attacks on cattle and people is increasing drastically. There is some evidence for excluding Amur tiger from the Russian Red Data Book and starting strictly limited hunting.

Wolverine (*Gulo gulo*). About 30–40,000 specimen of wolverine were observed in the whole circumpolar area in the 1970-80s. Almost half of them live in the territory of the Russian Federation. Since that time, the numbers have been decreasing, especially in the Asiatic part of the wolverine area. At present, the wolverine population can be estimated at about 10–12,000 animals. With such a number, wolverine may not cause any considerable damage to wild and domestic reindeer population, which is the main prey for this species. However, taiga and tundra hunters still observe harm caused by wolverine ruining their food reserves and decoys. The human attitude to wolverine in Russia is mostly negative, though there are a number of defenders of this species.

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Status of Large Carnivores and Conflicts in Greece

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Abstract. Four larger carnivore species existed historically in Greece. The largest being the brown bear protected since 1969, when it was restricted in the NW Mountains and received endangered status in the Red Data Book (RDB). The abandonment of highlands during the past 3 decades facilitated bear population recovery, but heavy poaching and habitat insecurity halted this expansion. In the early 90s, the public awareness campaigns and active conservation work of ARCTUROS Environmental NGO, has lead to the adaptation of legislation, full damage compensation and prevention. These conservation activities facilitated rapid bear population expansion, occupying today is largest range during the last century.
Both wolves and golden jackals were considered as 'vermin' until 1990 but since 1991 are excluded from the pest list and have threatened status in the RDB. Jackal population decreased dramatically over the past 3 decades, while the wolf maintained its territory and expanded to the south, although densities decreased in the north. The rate of wolf damages to livestock is high, and most of them are compensated by the state, while prevention measures have been introduced in selected areas.
Lynx seem to have been rare since the 19th century and are protected since the 1940s. There is no really reliable data for this cat's presence during the past 30 years.

Key words: Greece, large carnivores, conservation, conflicts

Introduction

Four larger carnivore species existed historically in Greece: brown bear (*Ursus arctos*), wolf (*Canis lupus*), lynx (*Lynx lynx*) and the medium sized golden jackal (*Canis aureus*).

In Greece all larger carnivore species were preserved within its borders, while the brown bear improved its status and the wolf maintained most of its distribution despite the hard persecution. However, there are no reliable data on lynx occurrence from the past 20–30 years and the golden jackal declined significantly during that period.

The present paper is an overview of the population status of all larger carnivore species, their distribution changes in the near past as well as the current human-carnivore conflict rate.

Materials and Methods

Data were collected from published papers and unpublished reports on recent long-term field projects in Greece.

In the past 17 years of continuous brown bear population monitoring, methods were used such as intensive radio tracking of individual animals, genetic population tracking, remote cameras and counts of family groups (PSAROUDAS 1996, 2003, MERTZANIS *et al.* 2005a, MERTZANIS *et al.* 1996, 2005).

Our information about the status of wolf originates from the final report of the LYCOS Project, which was implemented by ARCTUROS from 1998 to 2001, and was the first systematic countrywide wolf survey (PSAROUDAS 2001). The methods included countrywide personal interviews – questionnaires to local people and authorities –, pack counts and intensive radio tracking studies in two locations in south and northwest Greece (PSAROUDAS 2001, MERTZANIS *et al.* 2005a).

Data on the status of golden jackal were gained from the 3-year (2000–2003) systematic countrywide survey by WWF-Greece (GIANNATOS 2004, GIANNATOS *et al.* 2005), where we used again countrywide questionnaires, jackal groups were counted with the acoustic method and intensive radio tracking was conducted in two locations in southern Greece as well as spotlight counts.

Results and Discussion

Brown bear (*Ursus arctos*)

The brown bear population in Greece comprises of two distinct nuclei located in Pindos-range and the Rhodope mountain complex (MERTZANIS 1994, 1999, MERTZANIS *et al.* 1994).

Historically the distribution of the species covered all continental forested mountainous areas in Greece from Macedonia and Thrace southwards – even Peloponnesus (MERTZANIS 1994).

However, from the late 50s to the late 60s the bears were restricted to the northwestern mountainous areas with few sightings in the western Rhodopi Mountains (ZERVAS 1961, GIANNATOS 1997). This was the reason to include the species in the protected list since 1969, a legal status which is still in force and the brown bear is classified as endangered in the Red Data Book of Greek Fauna (KARANDINOS & PARASCHI 1992).

By the early and mid-70s a large scale abandonment of the highlands took place due to the abandonment of traditional animal husbandry and the immigration of many rural people to the larger cities. As a result the forest coverage in the highlands as well as lowland hills has been significantly increased in Greece (GIANNATOS 1997).

Dense forests, especially in Rhodope and north Pindos, cover today areas of the previous manmade pastures. A large proportion of these areas are either protected (National Parks) or their legal protection is on its way (e.g. Natura 2000 sites). This was the main reason of the initial facilitating of bear population recovery, but this was halted by heavy poaching, because, despite the legal protection of the species, there was no law enforcement (MERTZANIS *et al.* 1996).

By 1992, as information on the brown bear status in Greece was limited, ARCTUROS gave a priority for basic surveys and data collection to get more knowledge on the status of the species, aiming at the designing of the first Action Plan for bears in Greece (MERTZANIS *et al.* 1996). At the same time special activities were initiated to remove dancing bears from the country, at last enforcing the law of 1969 with full protection of the species.

After the establishment of the Action Plan, for the recovery of bear population, ARCTUROS organized and coordinated special pilot activities through a series of projects and actions. These actions were supported by the Greek State, the DG 11 Environment of European Commission, NGOs and local authorities. According to the Brown Bear Action Plan the conservation strategy actions tried to eliminate the major threats for the long-term survival of the species, namely:

a) mortality caused by humans,
b) habitat loss and degradation and
c) the absence of public awareness.

To tackle human caused mortality special activities were planned focusing on the prevention of bear related damages, improving the compensation system and in some cases providing additional remuneration for the damages.

The major sources for human-bear conflicts are the damages to bee-hives, livestock, orchards and crops. The measures to reduce these conflicts were: full compensation of bear damages by the state farmer's compensation organization (ELGA), establishment of electric fences for beehive protection and supporting the use of the Hellenic Livestock Guarding Dog by the shepherds. The two latter

measures were included in the Agri-environmental Measures of the Ministry of Agriculture. The amount of total damage paid by ELGA for bear damages runs between 35–60,000 EUR annually (PSAROUDAS 2002).

One measure to create safe habitat zones for bears was the seasonal blockade of secondary forest roads within primary bear habitats.

Other activities were public awareness actions supported by strong campaigns focusing on special target groups like hunters, students and local people.

The adoption of these pilot actions by the state, private authorities and various stakeholders contributed substantially to the recovery of brown bear population, as indicated by the following:

- The bear population increased throughout continental Greece and re-colonized even marginal habitats in the south where the species was extinct many centuries ago.
- The social tolerance towards bears increased in areas of bear distribution and at the same time human-caused bear mortality decreased drastically – by the late 80s, 11.6–15.5% of the estimated minimum bear population of 120 individuals was killed annually. From 1994–95 this rate dropped to 8.4–10%, while for 1997–99 it was only 3.75–4.6% (MERTZANIS *et al.* 1996, PSAROUSAS 2004). With bears moving down to the lowlands there have been many traffic accidents, and several cases of direct attacks on humans resulting usually in non-fatal injuries, except of a recent well-documented fatal attack on an old woman in an isolated shepherd pen in central Pindos (VOUGIOUKLAKIS 2006).

Today the bear population in Greece is occupying probably the largest range for more than a century like Olympus and Voras Mountains and South Continental Greece. The minimum bear population in Greece is conservatively estimated at 180–200 individuals. High densities documented in hilly human-dominated locations in Central Pindos (Grevena) with 50–60 bears/1000 km² (MERTZANIS *et al.* 2005a), while relatively low densities were recorded in the not inhabited dense forests of Rhodopi Mountains with probably less than 10 bears/1000 km² (PSAROUDAS 2003, MERTZANIS *et al.* 1996). The Pindos distribution nucleus is the southernmost range of the species in Europe, reaching the 38^{o} parallel and the south tip of the large, almost continuous Dinaric-Pindos population that runs across the Western Balkans. Also the Rhodopi bear population is the southern part of the Rila-Pirin-Rhodopi population shared between Bulgaria and Greece.

Wolf (*Canis lupus*)

The wolf in Greece occupies a great variety of habitats, from degraded, hilly areas to densely forested mountains. The greater numbers are found in mountainous and semi-mountainous areas with low human population density (PSAROUDAS 2001). Until the 1930's the species distribution covered all the mainland country including the Peloponnesus. The wolf was considered as vermin up until 1991 and a bounty was paid by the government for each dead wolf until 1981. Many poisoning campaigns against "vermin" (wolf, fox, jackal, stone marten, corvids) were being implemented by the Ministry of Agriculture up to 1981. According to the ministry's statistics, on the average 1000 jackals, 740 wolves and 50–74,000 foxes were killed annually by hunters and organised carnivore-poisoning campaigns (GIANNATOS 2004). The wolf was exterminated firstly from Peloponnesus by the early 1950s and from the prefectures of Attiki, Voiotia and southern Fokida (south mainland Greece) in the 60s. Re-establishment of wolf numbers in south mainland Greece begun in the 80s due to the abandonment of the bounty system and poisoned baits.

The wolf is classified as vulnerable according to the Red Data Book of Greek Fauna (KARANDINOS & PARASCHI 1992). The species is now partially protected since 1991 and can be hunted with official permit only in cases of confirmed damages to livestock; this rarely occurs.

Population numbers seem to be stable in most parts of its range, with a possible increase in its southern distribution. Today, the wolf distribution extends from Thrace in north-eastern Greece, to Voiotia in Southern-Central Greece. Although small gaps between wolf territories exist, there is no evidence of fragmentation between neighbouring wolf areas. The systematic countrywide wolf survey between 1998–2001 estimated approx. 800 individuals or 91 wolf packs, of which 126–172 individuals were found in Central Greece by the LIFE project LYCOS implemented by ARCTUROS. In the intensively studied pilot area of Grevena population density of 10–15 wolves/1000 km^2 was documented (MERTZANIS *et al.* 2005a).

In northern Greece wolf numbers seem to be stable during the last 10–15 years, although in certain regions, such as Epirus and Halkidiki, a decline in numbers has been reported. In areas of the southern range of its distribution, the presence of wolves has changed from periodical to regular during the last 15-20 years. There is no evidence, however, that this positive trend corresponds with an overall increase of wolf densities. Short-term number fluctuations have been reported all over Greece, but these are mostly due to periodic cycles of extermination and decolonisation processes. There has been no evidence of an expansion of range to areas not recently occupied.

Wolves cause considerable damage to livestock in Greece; the country has one of the highest damage rates in Europe. The damages are mostly compensated from ELGA. Confirmed attacks to small livestock (sheep and goats) account for 48% of the total of attacks. The percentage of attacks to cattle and calves is about 47%, while about 5% of the attacks concern mules, horses and donkeys. In addition wolf attacks on dogs are common in certain areas and seem to be the adaptation of specific wolf packs. Surplus killing is common in all wolf-occupied areas, but accounts for only a low percentage of cases. The total amount of compensations for *Canidae* damage to livestock in the municipalities where wolves exist is approx. 603,000 EUR per year (PSAROUDAS 2001). There is a minimum level of damage to livestock, below which no compensation is paid: Four sheep/goats or one calf older than one year. Thus, many small attacks are left uncompensated, which can result over a year in a serious loss of animals and income.

The most common preventive methods are night-time pens, the restriction of young animals from free-grazing, the attendance of shepherds and use of guard-dogs. The latter was the tradition for thousands of years, though nowadays declining, mostly due to changes in grazing methods.

Regarding human-caused mortality, during 1995–1997 only 17 wolves were killed with permission and all in a hunting reserve. This official hunting data cannot contribute to an estimation of the numbers of wolves killed each year.

From the analysis of 415 cases of human-caused wolf fatalities reported by local people (direct evidence) during years 1990–1998, a total of 555 animals were found killed. From these 448 where adult and/or yearlings and 107 were pups (PSAROUDAS 2001). However this is a small fraction of direct human-caused wolf mortality, since the animal is protected and many people are afraid to give data about wolves they have killed. Law enforcement is generally weak. Local forestry services usually accept illegal wolf killing by shepherds or poachers, which is very widespread and common in the whole wolf range, usually due to the high rates of wolf damage. Illegal killing of wolves is considered as a way not only to reduce damage to livestock, but also to reduce

tensions. Moreover, as the existing compensation system does not cover the majority of wolf depredation events and official involvement in damage prevention activities is negligible, they see no other way out than allowing illegal wolf control. Even in the few cases, where legal wolf control takes place, this is not based on biological or other well-defined criteria. Most local inhabitants, including local forestry service personnel, consider the total protection of the wolf controversial and undesirable.

There is no evidence of wolf hybridisation with stray dogs in Greece. DNA analysis performed in 1999 in 33 wolf samples showed that genetic differentiation between Greek wolf and dog populations was significant, which suggest that there is very limited gene flow. Even if hybridisation between wolves and dogs is ongoing, it is very rare in Greece. The presence of stray dogs is a common occurrence in most investigated rural areas (60%), they can be found in or near villages, in garbage dumps, near slaughterhouses and rarely even in the mountains. In areas where both wolves and stray dogs exist, the latter often become the prey of wolves.

The major problem for the wolf's long-term survival in Greece is the low numbers of natural prey (such as deer and wild boar) due to overharvesting and bad ungulate management, which have forced the wolves to turn to livestock, thus exacerbating the conflict with humans.

Golden jackal (*Canis aureus*)

The golden jackal is a medium-sized predator and omnivore, with a range covering the southern parts of the Palearctic, South Asia and north-eastern Africa. The preferred habitat of the jackal in Southeast-Europe is a mosaic of small cultivations and dense scrub as well as lowland wetlands with adequately dense vegetation cover (GIANNATOS 2004, DEMETER & SPASSOV 1993).

The jackal in Greece was considered as 'vermin' up to 1990 and until 1981 a bounty was paid for each animal killed. After 1981 the poisoning campaigns were restricted in smaller areas in order to control fox overpopulation, but also stone martens and sometimes wolves, until they officially stopped in 1993. During the period of 1981–93, jackals were also killed in some areas, although they were not targeted. The jackal was the first to be removed from the vermin list in 1990, followed by the wolf (1991) and the fox (1993). The species in Greece is legally unclassified: it neither appears in the list of game animals that could be hunted nor in the list of protected species.

The jackal is classified as vulnerable according to the Red Data Book of Greek Fauna (KARANDINOS & PARASCHI 1992).

The southern and eastern parts of the Balkan Peninsula seem to hold the largest populations of jackals. Greece, one of the region's strongholds for the species, experienced a large-scale population decline in the last 3 decades (GIANNAATOS & IOANNIDIS 1991, GIANNATOS 2004). According to records of the Greek Ministry of Agriculture (unpublished data), the decline of the jackal population started in the 70s and was even more intense in the early 80s. Already the 1980 harvest was much reduced compared to the years 1974–1979.

The most important causes of the decline have been habitat and land use changes during the past 25–30 years especially in the middle and low altitude areas in Greece. These changes were: the abandonment of the small cultivations in the middle altitude areas, the decline of small-stock raising, the changes in animal husbandry, the intensification of cultivations in the lowlands, the urbanisation in large parts of lowland Greece. These land use changes contributed to population reduction into small clusters, gradually isolated from each other. The population clusters were highly vulnerable to direct human-caused mortality (road kills, shooting), probable

diseases (from stray dogs) and natural disasters (flooding, forest fires etc.) and therefore susceptible to inbreeding and final extinction. Greece is a mountainous country with many mountain barriers mainly in central and western parts, so the small jackal populations are even more vulnerable (GIANNATOS 2004, GIANNATOS 2005).

According to GIANNATOS (2004) important barriers for jackal distribution are:

- Mountains with extensive, high forests or continuous scrub, heavy snowy winters and irregular food supply;
- Large, intensively cultivated areas without cover;
- Intensively used urban areas and
- Established wolf populations.

The jackal population is now confined to a few clusters grouped into 7 sub-areas with criteria such as connectivity and isolation. The largest sub-population exists in the coastal wetland complex of North-eastern Greece. The minimum total jackal population in Greece was estimated in the recent countrywide survey (2000–01) to be about 1000 adult and sub-adult animals in 153–170 family groups (GIANNATOS *et al.* 2005).

The optimum habitat for the jackal in Greece seems to be a mosaic of Mediterranean scrub and small cultivated fields as well as lowland wetlands with sufficient cover. In the alluvial plain of Mornos, nearly 50 animals were recorded in spring in an area of 18 km^2 (~ 2.7 adults and subadults/km^2). Similar densities could be found in the Nestos area, North-eastern Greece with local concentrations of more than 3 animals/km^2. The lowest density of jackals was recorded in poor quality habitat types in Peloponnese: 1 group per 12 km^2, while in most of the surveyed areas 2–3 groups/10–12 km^2 (1–1.5 adults and subadults/km^2) was the average (GIANNATOS 2004, GIANNATOS *et al.* 2005).

Field data indicated that the relationship of the jackal with other dog species was one of competition. Wolves usually dominated the jackals and the jackals dominated the foxes. The range of jackals and wolves in Central and Northern Greece was almost mutually exclusive (GIANNATOS 2004, GIANNATOS *et al.* 2005).

According to local shepherds in the Peloponnese, little damage to small livestock was recorded in some mountainous areas and this was caused basically by roaming jackals. In most of these cases the damages happened when the flocks of sheep or goats graze unattended at night pastures or cases of animals left out of pens at night. In areas with relatively large jackal populations no complaints about livestock damages were recorded. Individual jackals or small jackal groups have been radio-tracked or seen quite frequently very close to sheep pens, around cattle and nearby chicken pens at night, but no complaints for losses from the stock owners were ever recorded. It is considered that the depredation on livestock by jackals is rather local and minimal in Greece (GIANNATOS 2004).

Lynx (*Lynx lynx*)

Lynxes seem to have been rare since the 19th century according to different mammal survey expeditions. There is no really reliable data for lynx presence in Greece during the past 30 years (ADAMAKOPOULOS *et al.* 1991, PSAROUDAS 2002).

The lynx was the first large carnivore protected in Greece as early as 1937. Today, hunting is prohibited by the hunting law. The lynx in Greece is also protected under the Bern and the CITES Conventions.

Although forest coverage is increasing, the prey base remains poor in most areas that could be suitable lynx habitat.

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Transboundary Cooperation in the Southern Balkans in Large Carnivore Conservation Past Experience and New Perspectives

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Abstract. In the Balkans most of the rare wide-ranging mammal species occur in the highlands of the Pindos – Dinaric Alps and Rhodopi Mountains. These ranges are shared by several countries, therefore successful conservation means transboundary cooperation. Since the beginning of its foundation in the early 90s, ARCTUROS – leading Greek NGO working on large carnivores – was interested in transboundary cooperation to preserve biodiversity. Since 1995 ARCTUROS worked with more than 20 conservation NGOs from the Southern Balkans and created the BALKAN NET, a network for large carnivore conservation to complete seven large joint projects and to continue two running projects. These actions empowered local NGOs through capacity building and increased their influence on local governments. This resulted in proper adaptation of wildlife legislation, maintaining the existing transboundary protected areas or creating new ones to include wildlife corridors for endangered and vulnerable species, especially in Greek-Albanian and Greek-Bulgarian relation. Despite all this important effort there is still lack of reliable field data about the real status of populations as well as the actual movements of large carnivores especially along the border areas. This will be our new challenge for the future.

Key words: Balkans, large carnivores, conservation, transboundary

Introduction

The recent rapid political and economic changes in all of the Balkan countries as well as the new joining to the European Union of Bulgaria and Romania are expected to trigger the development and expansion of infrastructure, industry and tourism in the region. This will most probably pose threat to the Southeast-European biodiversity, which remains, in contrast to many Western European habitats affected by agricultural and industrial activities. Especially vulnerable to changes are rare, large and wide-ranging species such as large carnivores – brown bear, grey wolf and Eurasian lynx. Southeast-Europe hosts some of the largest populations of large carnivores (LC) in Europe like the brown bear (*Ursus arctos*), the wolf (*Canis lupus*) and the Eurasian lynx (*Lynx lynx*) (BOITANI 2000, SWENSON *et al.* 1998, KRYŠTUFEK *et al.* 2003). Also the golden jackal (*Canis aureus*) occurs in this area reaching recently South Hungary (DEMETER & SPASSOV 1993, GIANNATOS 2004, GIANNATOS *et al.* 2005 and M. HELTAI pers. comm. 2007). Most of these populations are shared between the countries in the region; therefore successful conservation is possible only through transboundary cooperation. For example, the Dinaric-Pindos brown bear population is the 3rd largest in Europe, and while the northernmost part of the population (in Slovenia and Croatia) has been a target of ecological studies, there have been almost no studies further in the south (except in Greece) (SWENSON *et al.* 1998). The southern range is also a home to the last remains of the indigenous Balkan lynx population, the most endangered European lynx population, where its ecology, population status and distribution are virtually unknown (SWENSON *et al*. 1998). On the other hand

the development of the modern technology creates new opportunities for common transboundary research and expertise exchange.

The Development of the Network

The need for transboundary cooperation was anticipated early and in 1995 an important step was initiated with the creation of the BALKAN NET conservation GOs and NGOs initiative for the protection and management of large carnivores (PSAROUDAS 1996, GODES 1997). Since 1996 ARCTUROS cooperated with more than 20 conservation NGOs from the Southern Balkans to complete seven large joint projects and continue with two running projects and two proposals. These actions empowered local NGOs through capacity building and increased their influence on local governments. This resulted in proper adaptation of wildlife legislation, maintaining the existing protected transboundary areas or creating new ones to include wildlife corridors for endangered and vulnerable species (VRAKA 1997, PSAROUDAS 2002).

The initial project of Balkan Net had a dual purpose: firstly, to continue and widen the activities of an already established network between Greece, Bulgaria and Albania for awareness raising and nature conservation in areas, where brown bear populations live, and secondly to include the Former Yugoslav Republic of Macedonia (FYROM) in its actions; something that had been scheduled in the past, but had not been possible.

The Network concerns organisations dealing directly or indirectly with the natural environment (NGOs, local authorities as well as public services). With the main goal being the conservation of the brown bear and its habitat in the Balkans, the project aimed at:

- Awareness raising on conservation issues both on public and on local authority level;
- Educational activities that involved the adaptation of the "brown bear kit", an educational kit created by ARCTUROS, at the particular needs of each country;
- Exchange of know-how, information and experience between the members of the network, which led to the development of common activities and conservation projects.

Initial members of the BALKAN NET were:

Albania
- Preservation and Protection of Natural Environment in Albania (PPNEA)
- Natyra Nderkufitare (Transboundary Wildlife Association)
- AQUARIUS Albanian Society for the Protection of Birds and Mammals (ASPBM)

Bulgaria
- Wild Flora and Fauna Fund (WFF)
- Youth Environmental Organisation Rhodope (YEO Rhodope)
- Balkani Wildlife Society
- SEMPERVIVA
- Wilderness Fund
- ECO-CLUB 2000

Greece
- ARCTUROS

Serbia-Montenegro
- "MUSTELA" – Wildlife Conservation Society
- ARKA
- Young Researchers of Serbia (YRS)
- Animal World Preservation Society "LYNX"

The Former Yugoslav Republic of Macedonia
- Bird Study and Protection Society of Macedonia (BSPSM)

- National Forum For Animal Protection of Macedonia (NFAPM)
- Journalists' Legal Environmental Center ERINA
- Macedonian Ecological Society (MES)
- Ecologists' Movement of Macedonia (DEM) Movement for the Environment MOLIKA

With the cooperation of twenty environmental NGOs the network implemented the following projects:

1. TEDDY: "Awareness raising in European Bear-Hosting Areas", contract No. 95/S/57-27290/FR. It lasted from 1 January 1996 to 30 September 1997 and the total cost was about 134,500 ECU. Main aim of the project was to create a network for awareness raising and the conservation of wildlife and habitats in countries with bear populations (Greece, Albania, FYROM and Bulgaria). Half of the project budget was covered by the European Commission and the other half by ARCTUROS, with a financial contribution of the Greek Ministry of Environment, Physical Planning and Public Works.

2. BALKAN NET: "Élargissement du réseau 'Balkan net' pour la sensibilisation et la conservation durable des écosystèmes et de la vie sauvage dans certaines régions d'Europe", contract No. 96/443/3060/TS/A3/MM. It lasted from 1 January 1997 to 30 September 1998 and its total budget was 127,118 ECU (EC contribution: 50% = 63,559 ECU). This was the continuation of the previous project and aimed to enlarge the network of Environmental GOs and NGOs that was created by the TEDDY project.

3. BALKAN-NET 2: "Conservation of Large Carnivores in the Balkans" (duration: July 1999 – June 2002, budget: 150,000 CHF – approximately 100,000 EUR.) This project was funded by the Large Carnivore Initiative for Europe (LCIE) with the aim to extend and enlarge the Balkan Environmental NGOs network, plus conservation and awareness raising activities.

4. ECO-NET, DAC/OECD project: "Creation of a network for the legal protection and management of protected areas in the Southern Balkans" (duration: 11 January 2001 – 31 March 2002, budget: 190,462 EUR). The project's aim was to adapt legislation and manage protected areas in cooperating Balkan countries, and it is implemented by partner NGOs from Greece, Albania, the Former Yugoslav Republic of Macedonia, Bulgaria and F.R. Yugoslavia.

5. "Common training course of young people from Greece and Bulgaria for the development of transboundary collaboration in the framework of the 'Youth' Programme". The course took place from 15-24 July 2003 in Frakto Virgin Forest, at the Greek-Bulgarian borders (budget: 14,693 EUR).

6. ECO-INFO: "Cooperation between environmental information centres for improvement of environmental information services and contribution to the sustainable development of mountainous areas" (duration: 01 January 2003 – 31 December 2004, budget: 120,000 EUR), funded by the Hellenic Aid Agency of the Greek Ministry of Foreign Affairs with ARCTUROS as beneficiary.

7. INTERREG III A/CARDS GREECE – FYROM: "Activities for the protection of mountainous ecosystems based on the protection of the Brown Bear" (duration: from September 2005 to April 2007, budget: 200,000 EUR). The project focuses on mountainous areas of Vernon and Varnountas in Florina prefecture, while a special

subtask includes meetings and exchange of expertise between Greece and the Former Yugoslav Republic of Macedonia focusing on the mountainous transboundary areas (Veron-Varnountas-Pelister and Voras-Kaimaktsalan).

New Perspectives

These initiatives have started to fail from the beginning of the 21st century although there are still many activities that have to be undertaken to halt the loss of biodiversity in Southeast-Europe. Despite all previous important efforts there is still lack of sound field data about the real status of populations as well as the actual movements of large carnivores, especially along and across the border areas. Primarily common management strategies for carnivores at population level are strongly needed. A solid knowledge platform is necessary to prepare, adopt and implement those management strategies, while in many Southeast-European countries there is a lack of recent field data on large carnivore species and their habitat. This will be our new challenge for the future.

Following the urgent need to continue future cooperation, a new proposal has been submitted under the SEE-ERA.NET Pilot Joint Call – Network framework of the EU with the title: "Re-creation of the BALKAN NET, a network of conservation bodies in countries sharing continuous large carnivore populations".

The aim of this project proposal will be to revive the BALKAN NET, through an initial number of partners and establish new future cooperation activity plan for the region.

Partners of this proposal are:

ARCTUROS – Greece
Bulgarian Biodiversity Preservation Society, SEMPERVIVA – Bulgaria
Faculty of Forestry, University of Sarajevo – Bosnia and Herzegovina
Faculty of Veterinary Medicine, University of Zagreb – Croatia
Transboundary Wildlife Association – Albania
Wildlife Conservation Society MUSTELA – Serbia

The proposed collaboration will:

- build transboundary partnership on scientific and management level;
- improve capacity building in target countries;
- ensure transfer of present scientific knowledge;
- provide overview of the current large carnivore status in Southeast-Europe;
- establish and improve common research and management methods, keeping in mind an overall objective – to prepare a joint Action Plan for immediate and future common research and management activities for more effective conservation.

The project will be implemented through three phases:

1. An initial work meeting to exchange information, discussion of proper methodologies, better organization and coordination of the project.
2. The main period of rapid countrywide carnivore survey that will be conducted in each partner country depending on the state-of-art and available resources.
3. A final workshop will provide data and ideas for the development of a joint research action plan and preparation of future wider research projects.

Finally it is important to mention that in addition to this common effort of all the partners, several other cooperation and projects are being developed on local bilateral transboundary areas.

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Large Carnivore Management in Croatia

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Abstract. The management plans for brown bears (*Ursus arctos*), grey wolves (*Canis lupus*) and Eurasian lynx (*Lynx lynx*) are expected to bring together different interests such as ecological, aesthetical and economic, as well as care for the safety of people and their properties. Bears are a game species in Croatia, while wolves and lynx are legally protected. The actions following management plans are to ensure the viable sizes of populations but within a social capacity. This means that the densities of large carnivores should be managed to minimize the conflicts with people. In order to achieve this goal, a series of actions and measures related to the human activities in the habitat such as highway construction and forestry, the prevention of damage, the occurrences of problematic individuals and the scientific monitoring of all changes in the population have to be regulated. The implementation of plans is the responsibility of various interest (stakeholder) groups. Croatia expects that, its Brown Bear Management Plan, Wolf Management Plan, and Lynx Management Plan, all officially accepted in 2004, will ensure the long-term existence of optimum large carnivore populations and their habitats, with as few negative effects as possible.

Key words: Croatia, brown bear, wolf, lynx, management

Introduction

Large carnivores are one of the best indicators of well preserved biodiversity but, at the same, time they do pose a big management challenge. There are numerous legal, and, more importantly, practical issues to be met for successful maintenance of large carnivore populations.

Croatia holds all three native large carnivore species: brown bear (*Ursus arctos*), grey wolf (*Canis lupus*) and Eurasian lynx (*Lynx lynx*). Traditional management was organized through hunting for bears (HUBER & FRKOVIĆ 1993), through administrative protection (lynx), or there was no defined management at all (wolf). In 2004 the officially accepted the Brown Bear Management Plan (DEČAK *et al.* 2005), Wolf Management Plan (ŠTRBENAC *et al.* 2005), and Lynx Management Plan (FIRŠT *et al.* 2005) were finalised and all have been implemented since 2005. Legal considerations were set by the international and national community. The signing of international conventions obliges the country to change the national acts accordingly.

This paper is to present a brief overview of management approaches, first of what is common to all three species and then for each species.

International agreements governing the large carnivore conservation issues relevant for Croatia

- *Convention on Biological Diversity*, (NN: International Treaties # 6/96);
- *Convention on the Conservation of European Wildlife and Natural Habitats* (Bern Convention) (NN: International Treaties # 3/5/00);
- *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES) (NN: International Treaties # 12/99);
- *Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora* (Habitats Directive) (92/43/EEC);
- Council Regulation (EC) No 338/97 of 9 December 1996 on the protection of species of wild fauna and flora by regulating trade therein.

The Republic of Croatia is signatory to all relevant international agreements in the field of nature protection, this being yet another way of joining the international community in the global nature conservation efforts. One of the framework agreements is the *Convention on Biological Diversity*, ratified by Croatia in April 1996, (NN: International Treaties #6/96), committing itself to preservation and enhancement of the existing biological diversity and sustainable use of its components.

Croatia ratified the *Convention on the Protection of European Wildlife and Natural Habitats* (Bern Convention) in 2000. This agreement sets all the measures to be taken by European countries to protect wildlife, especially the species listed in its Annexes, including the protection of their habitats. The wolf and brown bear are listed in Annex II, and lynx in Annex III to the Bern Convention, i.e. in the list of strictly protected species whose exploitation, disturbance and habitat endangerment is prohibited. In special cases, the Bern Convention allows for exceptions from this rule when there is no other acceptable solution and providing that the exception would not be fatal for survival of the population in question. Such exceptions are granted only in well justified cases of protecting flora and fauna; preventing serious damage of crops, livestock, forests, fishponds, water and other property; in the interest of public health and safety, aircraft safety and other prevailing public interest, and for the purposes of research and education, repopulation, reintroduction and necessary reproduction. Further, exceptions can be granted only under strict supervision, on a selective basis, and where small numbers are involved. In such cases, the party in question is obliged to submit detailed biannual reports to the Standing Committee of the Bern Convention on the exceptions applied. Since the bear population in Croatia is not endangered and does not require strict protection, the Republic of Croatia has, in accordance with Article 9 of the Convention, made an exception so that bears in Croatia are treated as species listed in Appendix III of the Convention. The Bern Convention adopted the separate Action plans for the conservation of bears, wolves and lynx in Europe, developed by the Large Carnivore Initiative for Europe (LCIE), which has also listed recommendations for the action plan for the conservation of wolves in Croatia.

The Republic of Croatia is a signatory to the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES) (NN: International Treaties #12/99), which obliges the parties to control the international trade in endangered species through a system of issuing import and export permits and certificates. Bear, wolf and lynx are listed in the Annex II of CITES, meaning that they are potentially threatened species, and that the related international trade must be strictly controlled.

The *Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora*, 92/43/EEC, is one of the basic regulations governing nature protection in the EU member states. The European Union members are obliged to integrate the provisions of this Directive into their domestic legislation, and the respective legal harmonisation is expected also from Croatia in the process of EU accession. The wolf and bear are listed under Annex II of the Directive, dealing with plant and animal species of interest for the European Community, the preservation of which requires proclamation of Special Areas of Conservation (SAC) as parts of the Natura 2000 ecological network.

The Council Regulation (EC) No 338/97 of 9 December 1996 on the protection of species of wild fauna and flora by regulating trade therein, regulates the trade in protected animal and plant species within the European Union, and presents the legal basis for the implementation of CITES Convention in the EU territory.

The wolf is listed in Annex A to this Regulation, which includes species that are threatened, extinct or rare, so any form of international trade in such species would endanger their survival.

The European Parliament approved on 24 January 1989 the Resolution (Doc. A2-0377/88, Ser. A) calling upon urgent action of European countries for wolf conservation, adopted the Wolf Conservation Manifest, and appealed to the European Commission to support wolf conservation efforts.

As a signatory to the above mentioned agreements, Croatia is obliged to undertake all appropriate and necessary legal and administrative measures, at local, regional, national and international levels, in order to ensure protection of large carnivores and their natural habitat, and also to provide conditions for maintaining their stable populations which are also a genetic reservoir and potential source for dispersal or reintroduction of the species into other European countries where their populations have disappeared.

Recommendations for the action plans for conservation of large carnivores in Croatia

The Large Carnivore Initiative for Europe was founded in 1995 with the aim of solving the problems of the conservation of large carnivore populations (the brown bear, the wolf, wolverine, the Eurasian lynx and the Iberian lynx) in coexistence with humans. This group prepared action plans for conservation of large carnivores approved by the Council of Europe at the meeting of the Standing Committee of the Bern Convention held in November 2000. In its Recommendation No. 74 (2000) the Council of Europe urges national authorities to incorporate recommendations of the Action Plan for Conservation of large carnivores in Europe into their national plans for the management of this species. There are lists of actions specifically proposed for Croatia for bear, wolf and lynx, respectively (SWENSON *et al.* 2000, BOITANI 2000, BREITENMOSER *et al.* 2000). The management plans described in this paper follow these lists.

Goals in large carnivore management

The overall goal is the maintenance of stable large carnivore populations in Croatia at the level that secures their long term survival and coexistence with man. The other general goals may be defined like:

1. Habitat preservation;
2. Complying with international legislation;
3. Avoidance of risks for humans and their property;
4. Determination and maintenance of desired population sizes;
5. Economic benefit for local residents through tourism and eventually hunting;
6. Raising of public awareness and sharing management decisions with interest groups;
7. Scientific research.

To meet these seven goals the general approach to the preparation of all three management plans was to work with various interest groups, as well as to survey public opinion and to incorporate the results of these surveys. Such an approach took more time, money and effort, but it helped to avoid the danger of rejection of the plans by certain single interest groups. The groups concerned include various governmental bodies like Ministries dealing with nature protection, forestry, hunting, transportation and tourism, representatives of national parks and other protected areas, as well as local governments. Already within the structures there is a variety of, often contradicting approaches. The range of visions among other interest groups like hunters, live-stock keepers and other farmers, environmental NGOs, backpackers, animal welfare groups and others is very wide. A lot of effort is necessary to reach compromise on each

specific issue for each large carnivore species. The work has to be organized through a series of workshops with a professional unbiased approach, including a neutral facilitation.

The issues behind the management goals that are common for all three large carnivore species, as well as some results where appropriate are briefly described here:

1. Habitat preservation
The major recent threats to habitat include:

1.1. Transportation infrastructure

Most of heavily populated and industrialized western countries lost the chance to support there own large carnivore populations due to overdeveloped transportation infrastructure. The major problem it causes is habitat fragmentation, followed by disturbance, pollution, and direct mortality in collisions. The impact of transportation infrastructure may be mitigated by expensive measures that allow the animals to cross the route. In Croatia a total of 9 of green bridges 100-200 m wide have been constructed to allow large carnivores and other animal to cross the new highways in their range. A number of viaducts and several tunnels were also built as requested by Environmental impact studies. Together with other tunnels and viaducts that had to be built due to topography a total of 18.6% of highways length in large carnivore range in Croatia allows animal crossing.

1.2. Forestry and game management

Forests cover 43.5% of the terrestrial part of Croatian territory, and in the large carnivore range it is even over 70%. While this percentage is high the potential long term threats are the network of forestry roads and the selective removal of bear food producing trees. Game management is expected to secure a sufficient prey base for large carnivores, but the acceptance margin is low due to economic demands of hunting businesses. Also poaching is present and some areas it significantly reduces the prey availability.

1.3. Agriculture

The major conflict of large carnivores with humans arises from the livestock husbandry. Wherever possible, the best is to discourage the keeping of domestic ungulates in the large carnivore range. In over two thirds of their range in Croatia this is the case, thus bears and lynx are producing only minor damages. However, in the southern portion (Dalmatia) wolves are causing conflicts with sheep and goat rising. The Plans require damage to livestock to be evaluated to include mitigation measures to minimize damage.

1.4. Sport and tourism

Ecotourism based on the presence of large carnivores is encouraged, but each other tourist activity in that area is to be evaluated for possible impact on the populations. The list includes: skiing slopes and resorts, off road and forest road vehicles, collection of berries and mushrooms, and similar.

2. Complying with international legislation

This was given the highest priority and compliance of all the above listed regulations has been achieved. Where necessary the national legislation (like the Hunting law) has been adapted accordingly.

3. Avoidance of risks for humans and their property

Through various international projects the donation of livestock guard dogs and of electric fences has been applied to minimize conflict. Folders were printed to promote the efficient use of such tools. The risk to humans themselves is to be

minimized through proper warnings and instructions for behavior in large carnivore ranges.

4. Determination and maintenance of desired population sizes

The numbers of large carnivores in their populations are always the hardest to determine. At the same time various groups have deep beliefs about numbers and produce the widest range of numbers leading to conclusions that the same population is at the same time endangered or over-overabundant by others. Modern technology has made possible the use genetic methods to scientifically verify the true situation. It is important include the various groups to participate in the working process in order to ensure that an estimate, once reached, will be accepted by all groups.

Maintenance of the desired population size is another hot issue. First, it is not easy to agree which size is desirable, as well as to find out how close to it we are at the certain point of time. A big level of patience and compromise is essential. Then comes the issue of method of how to keep the population size at desired level. Enhancing population, including adding animals when necessary is one end of the spectrum (possible case for lynx in Croatia), and the lethal removal is on the other end (wolf to mitigate damages, or bear as a trophy game animal).

5. Economic benefit for local residents through tourism and eventually hunting

Hunting bears in Croatian case is in the economical category, and the Plans offer solutions to produce some benefit from large carnivores to local residents through ecotourism in its all aspects: from housing and guiding tourists to selling local products.

6. Raising of public awareness and sharing management decisions with interest groups

The attitude of local residents towards large carnivores has been thoroughly surveyed (MAJIĆ 2003). The process of creation of the Plans is already an example including interest groups in making the management decisions. The plans are also periodically revised and that is also the opportunity to include a broader public. Each year an up-dated Action plan is produced and it includes public opinions.

The Plans have been presented to public through a series of "open house" and through formal presentations, as well as in various printed materials.

7. Scientific research

Most of the Plan actions require solid based data that can be provided only from continuous scientific research. The brown bears in Croatia have been studied since 1981, wolves since 1996 and lynx since 1999. The research includes radio telemetry, morphology, pathology, diet, reproduction, mortality and genetic (CICNJAK *et al.* 1987, FRKOVIĆ *et al.* 1987, 2001, HUBER *et al.* 1998, HUBER & ROTH 1993, 1997, KUSAK & HUBER 1998, KUSAK *et al.* 2005).

Management actions and results for each one of the large carnivore species

Bear management

1. *Monitoring*
   The population is monitored through the recording of each mortality (due to hunting and other reasons) while the living population is also monitored through counts at feeding sites and collection of scat samples for genetic analyses (WAITS *et al*. 2000).

The current population size is between 600 and 1000 bears.

2. *Hunting*
   A national quota of 70 bears for trophy hunting plus up to 30 for other causes of mortality (traffic kills, problem bears removal, illegal killing) has been allocated to hunting units in 2005, 2006 and 2007. The hunting season is 01 October to 15 December and 01 March to 15 May.

3. *Supplemental feeding*
   Bear hunting is allowed only from hides at feeding sites. Feeding is restricted to the hunting season and the amounts and types of food are limited. There are positive and negative sides of this practice, but the obvious positive sides allow the system to be used.

4. *Garbage*
   Prevention of bear access to garbage (at dumps, garbage bins or baskets) as a feeding source has been implemented by the use of electric fences and bear proof containers in order to prevent habituation that leads to problem bears.

5. *Emergency team*
   A bear emergency team has been established and trained to deal with problem bear cases (using rubber bullets, translocations and lethal removal) and to record all bear non-hunting mortality.

6. *International cooperation*
   The plan is designed to consider the fact that Croatia shares its population of brown bears with Slovenia and Bosnia and Herzegovina. Bears from Croatia have been used, together with the ones from Slovenia, for reintroductions to Western Europe (CLARK *et al.* 2002).

Wolf management

1. *Acceptable anthropogenic mortality*
   The wolf management plan allows up to 10% of estimated wolf population loss due to human activities. As the current population estimate in Croatia is 180 to 220 wolves in 2005, 2006 and 2007 each, the total yearly mortality of about 18 wolves was allowed. Each year in September the balance between the number of wolves found dead due to traffic or poaching and the number 18 is allocated to be hunted in specific regions. These numbers were 2, 7 and 7 in the last three years, respectively. The main goals of this action are to help reduce damage but also to increase the public acceptance of wolves in rural areas.

2. *Damage prevention*
   Wolves create the most damage of all three large carnivore species in Croatia. The use of electric fences and proper livestock guard dogs is continually promoted, including numerous donations (49 fences and 109 dogs) based on sophisticated selection criteria.

3. *Public involvement and education*
   Every year 10 to 30 public talks and open house events are organized to inform the public on the wolf issues and to hear the response of general public.

Lynx management

It is estimated that only 40-60 lynx exist in Croatia today. Although the Lynx management plan allows the considering of a small hunting quota, it has never been applied in the last three years. The efforts are focused on research of genetic status and other methods to help the population to grow. A big international project with neighboring Slovenia is underway to achieve this goal.

Conclusions

1. The management plans for brown bears (*Ursus arctos*), grey wolves (*Canis lupus*) and Eurasian lynx (*Lynx lynx*) have to bring together different interests such as ecological, aesthetical and economic, as well as care for the safety of people and their properties.

2. Bears are game species in Croatia, while wolves and lynx are legally protected.

3. The management actions are to ensure the viable sizes of populations but within a social capacity (which is almost always below the ecological capacity).

4. Actions and measures in large carnivore management are related to the human activities in the habitat like highway construction, hunting and forestry, the prevention of damage and the occurrences of problem individuals and the scientific monitoring of changes in the population.

5. The implementation of Plans is the responsibility of various interest groups.

6. The large carnivore management plans undergo occasional revisions, because in large carnivore management there are no final and universal solutions.

7. Croatia expects that, with its Brown Bear Management Plan, Wolf Management Plan, and Lynx Management Plan, all officially accepted in 2004, will ensure the long-term existence of optimum large carnivore populations and their habitats, with as few negative effects as possible.

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- Conservation and management of wolves in Croatia (Life III project)
- Improving coexistence of large carnivores and agriculture in S. Europe – COEX (LIFE project)
- Capacity building to meet the challenges of multi-level democracy: the case of conserving species with transboundary populations. Norwegian Institute for Nature Research (NINA)
- Gaining and maintaining public acceptance of brown bear in Croatia – BBI MATRA project. (ALERTIS)
- Transboundary cooperation in management, conservation and research of the Dinaric lynx population (DinaRis). – INTERREG IIIA
- Conservation of large carnivores in Croatia. EURONATUR
- Ministry of Agriculture, Forestry and Water Management, Ministry of Science, Education and Sports, State Institute of Nature Protection, Croatia Highways.

Figures

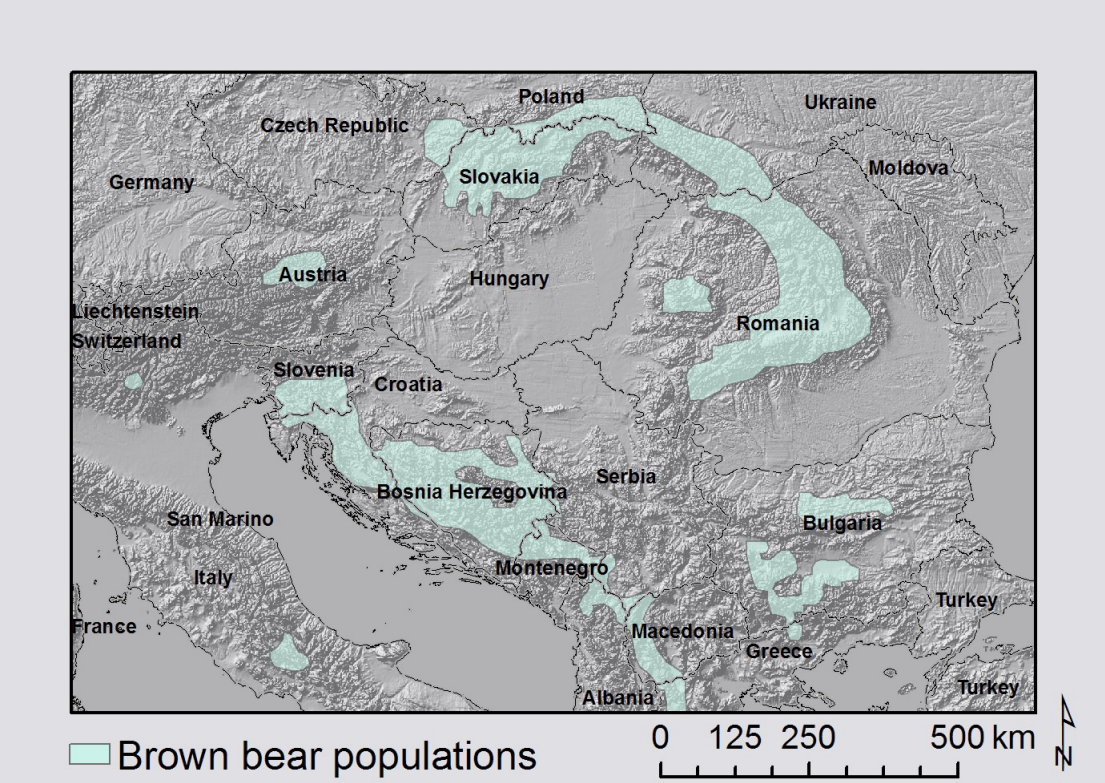

Figure 1. Location of Croatia in south-central Europe and the range of brown bear populations

Figure 2. Brown bear range in Croatia with the zone categories (from DEČAK *et al.* 2005)

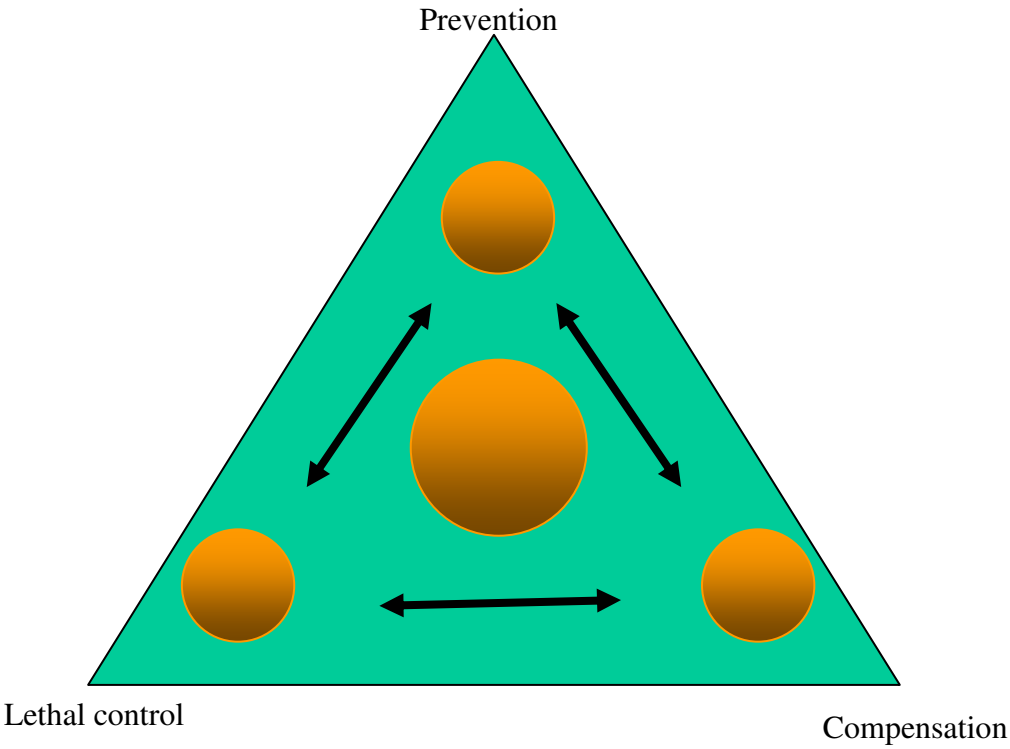

Figure 3. Large carnivore damage management

Figure 4. Bear friendly logo for local products

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Conservation and Management of Brown Bear in Slovenia

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Abstract. Thanks to careful management of all natural resources that was adjusted to be as close to nature as possible, Slovenia is at the present one of the few countries in Europe with a stable brown bear population, with expanding habitat and increasing numbers.
At present management of the brown bear in Slovenia is based on scientifically grounded ecological principles involving mutually complementary legal and administrative measures in the fields of culture, sociology and the economy, all aimed at preserving the bear and its natural habitat. To have a successful management measures must be adapted to the ecological characteristics of the environment and historical socio-economic conditions in Slovenia. The purpose of brown bear management in Slovenia is therefore to determine the goals, as well as implement measures for the protection of this species and its habitat as well as to ensure coexistence of brown bears with humans in the brown bear area.
Scientific objectives for brown bear conservation that are adjusted with to the level of acceptance in the local environment (social capacity) are the key elements for successful modern management of brown bear populations in Slovenia.

Key words: Management, monitoring, coexistence, long-term conservation, conflicts

Introduction

Brown bear protection on Slovenian territory (particularly in the area of Visoki Kras) goes back to the 19th century. The first initiatives for the conservation of brown bears came from the private estates of large landowners mainly for hunting reasons, but nevertheless expressing their strong tendencies toward hunting having sustainability goals. The "Ordinance on the Protection of bears in the Kočevje, Črnomelj, Novo mesto, Logatec and Ljubljana Districts", dating from 1935, effected a ban on shooting and killing, as well as buying and selling of bears, which represented one of the first measures for the protection and preservation of bears in Europe and the first attempt for establishing various bear habitat zones in the territory of Slovenia. Today, the Slovenian brown bear population is one of the most important in Europe.

Bear management in Slovenia

In contrast to the traditional, but now outdated approach, the modern management of free-ranging species, based on ecological principles, cannot be limited only to animal species or just a small proportion of these species in isolation from everything else that enables them to survive in nature. Modern ecosystem management must include all the animal and plant species, which are by their nature linked together in living communities, closely connected and co-dependent on each other and on all the elements of the area they live in, which includes man and his activities. In this integrated approach, all the modern management measures aim to consider the natural laws that determine and govern relations and relationships among individual species in a particular community (JONOZOVIČ 2003).

The management of the brown bear population in Slovenia is not left to the free market and chaos; it is a part of an integrated planning system. As bears are a species of special importance, both in

Slovenia as well as in a wider European and even world sphere, bear management takes into consideration all the factors mentioned and legal and professional documents.

Legislation

The protection of bears on Slovene territory was maintained in all the legislation related to hunting from the end of World War II to the present. Although being a game species until 2004, brown bear has always had the status of a specially protected species.

In **1966**, a Decision defined a special '**bear region**' in Slovenia, encompassing most of the central area of the bear's habitat. This is the core zone where brown bear habitat is preserved.

On these foundations the present legal documents for the conservation of bears in Slovenia are based. In **2001**, the "**Brown bear Management Strategy in Slovenia**" was drawn up and then adopted in 2002 by the Government. This is a management strategy for free-ranging species, based on scientifically founded ecological principles and involves considered and mutually complementary legal and administrative measures in the fields of culture, sociology and economy with the intention of preserving the bear and its natural habitat.

The Strategy is based on two principles:

- brown bear biology;
- the relation between the brown bear and man.

On the basis of these principles, two, equally important goals of the strategy were set:

- the long-term preservation of the brown bear species in Slovenia, including its habitat and
- ensuring the coexistence of man and bear.

On the basis of the Stategy, an **action plan for monitoring the Slovenian brown bear population** was accepted in **2003**.

In **2004** a new act on protected species was adopted, transposing the Habitat Directive. Since then the brown bear is not a protected game species but a protected species.

Management zones

The Slovenian territory populated with brown bear is the northwest edge of the Dinaric-Balkan territory (ADAMIČ 1993), which consists of central and south part of Slovenia, mountain areas of Croatia, Bosnia and Herzegovina, Montenegro, Kosovo and Macedonia. The territory is linked also with the brown bear habitats in Albania and in Greece.

The Brown Bear Management Strategy in Slovenia devides the territory of Slovenia into four basic "bear" areas (JONOZOVIČ 2003):

- a central area (350,000 ha – 17,3% of national territory);
- a marginal area (257,000 ha – 12,7%);
- a transit (corridor) area (312,000 ha – 15,3%);
- an area of exceptional bear presence (1,109,000 ha – 54,7%).

So, almost half (45,3%) of the national territory has some measures regarding brown bear management.

Each area has different measures regarding both strategy goals. These regimes are reflected through both the protection and regulation of the population, as well as measures for adaptation of human behaviour and activities (local population, farming, forestry, tourism, infrastructure, etc.) in order to enhance coexistence with bears.

The brown bear habitat

Habitat conservation

Within the strategy frame some measures are targeted to preserve the habitat of the species. We believe that this is the most essential conservation measure. If you lose proper habitat, all other measures are inefficient. Because in Slovenia we succeeded to manage a proper habitat we have a continuity with the brown bear population until today. Thus the vital areas of the brown bear habitat are included in the Natura 2000 (2,380 km^2 – 12% of the national territory). The second pillar are measures corresponding to the species level (strict protection of the species) and the third pillar are measures to enhance coexistence (conflict and damage prevention measures, intervention group, compensation system etc.). The Strategy is taking into account the provisions of the Bern Convention with its Action plan for the brown bear population in Europe and the Habitats Directive (92/43/EEC).

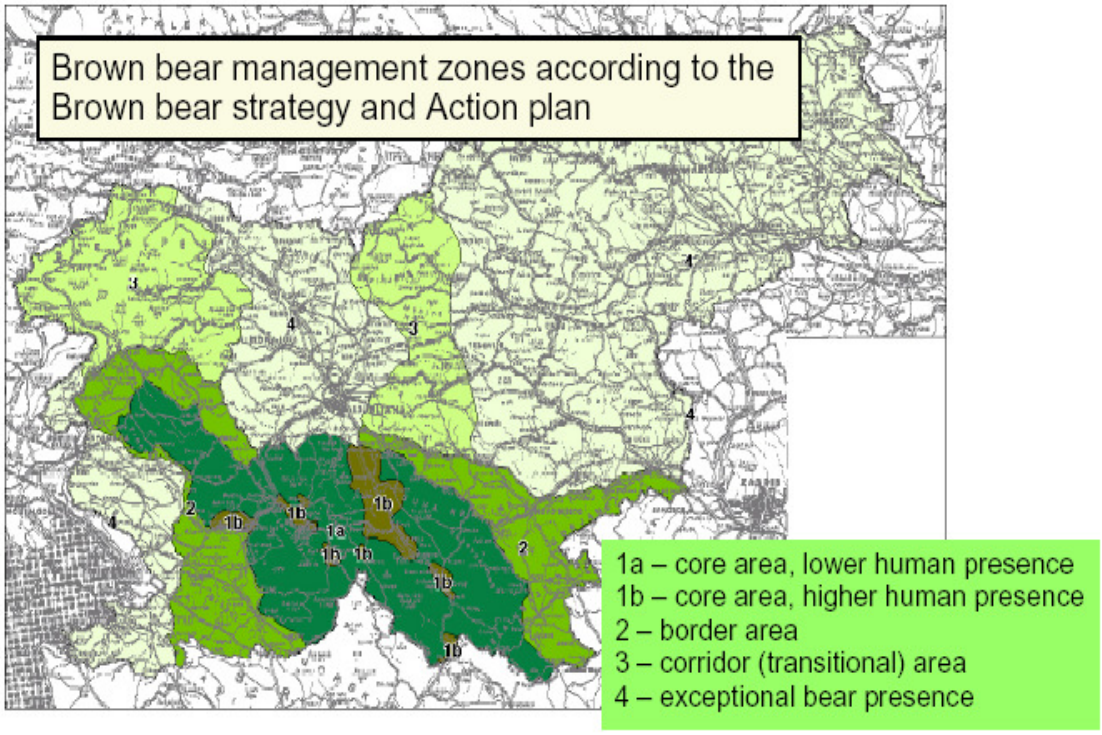

Figure 1. Brown bear management zones. Source: Brown bear Management Strategy in Slovenia

Alpine-Dinaric backbone

Presently, the greatest difficulty for Slovenia is to set up the regimes for bear population management is in the transit area, where we face on the one hand the clearly expressed expectations of the international public, particularly in neighbouring countries, and on the other the increasing number of conflicts between man and bears. The main reason is, that this area is now more populated and the habitat is not so suitable for the brown bear (ADAMIČ & KOBLER 2000). Brown bears are using this corridor rather frequently, but it is not realistic to restore the habitat in this area and establish ecological conditions for a permanent presence of the brown bear in the Dinaric-Alpine corridor (ADAMIČ & KOREN 1998). We encourage in this case the restoration of a functional corridor, bridging this gap with translocations in case other Alpine countries would like to increase the numbers of their brown bear populations.

Organisational structure / Competences

In 2004 the competences regarding Brown bear management in Slovenia were transferred from Ministry of Agriculture, Forestry and Food to the Ministry of the Environment and Spatial Planning, which is now competent for decision-making, policy accepting and international matters.

Other institutions dealing with Brown bear management in Slovenia are:

- a Working Group within the Ministry of Environment and Spatial Planning responsible for brown bear population management;
- Slovenia Forest Service (technical issues: monitornig, integral planning, damage assessing, recapture, intervention group);
- Environmental Agency (permitting, reporting, compensations);
- Institute for Nature Conservation (technical advice).

International cooperation

Slovenia is also paying attention to international and especially transboundary cooperation, as the following activities show:

Bern Convention

- Implementation of the Action plan;
- Osilnica workshop on transboundary brown bear management.

Repopulation projects

- Italy: 1999–2002, 10 bears;
- Austria: 1993, 3 bears;
- France: 1996–97, 3 bears; 2006, 5 bears.

LIFE projects

- Conservation of Large Carnivores in Slovenia – Phase 1: *Ursus arctos*;
- Principles for the potential formation of a bear metapopulation in the Alps (with Italy and Austria).

Transboundary monitoring cooperation with Croatia, Italy and Austria

Encroachments

It is probably hard for other parts of Europe to imagine that with the present number of bears in Slovenia there is simply no other alternative but to carry out regular culls. With this in mind Slovenia, in line with the provision in paragraph 1 of Article 22 and in relation to Article 6 of the Bern Convention, negotiated a reservation to Appendix II for the brown bear (as well as for the wolf).

During the whole previous year, 104 bears were harvested in the core area, 19 in the marginal area, none in the transit (corridor) area and 2 in the region of exceptional presence of bears. A large number of bears were harvested in the northern part of the core area, where also the number of damage cases was highest, as well as in those parts of the core region in which the human population density is the highest (Slovenia Forest Service 2007).

The majority of the harvest/cull (61%) was carried out on the basis of a yearly defined quota under strictly supervised conditions, on a selective basis and to a limited extent, provided by the hunting organizations in accordance with population regulation, followed by 21% of losses (natural deaths, traffic accidents – roads, railways, etc.), 14% of "exceptional cull" (serious threats to humans and their property) and 4% of live capture and relocation (transfer of 5 bears to France) (Slovenia Forest Service 2007).

In 2006, among the 126 bears harvested (**Tab. 1**), relocated or lost, 22 of them were females at reproductive age (of which four females were captured and transferred to France). 63% of the bears harvested or lost were not sexually mature yet (up to three years), less than the previous year (78%). These data show that special attention must be paid to the structure of future encroachments upon the population (Slovenia Forest Service 2007).

Among the bears harvested in 2006 (**Tab. 2**), there is a strong preponderance of those with a body weight of less than 100 kg (64,2% of all known bear deaths), while the bears weighing 101 to 150 kg accounted for 25,4% of bear deaths, and those weighing above 150 kg for 10,4%. These percentages are quite close to the levels defined in the Strategy (Slovenia Forest Service, 2007).

Table 1: Encroachments in 2006 (Source: Slovenia Forest Service 2007)

Area	**Encroachment carried out on the basis of yearly defined quota**	**Exceptional cull**	**Lost**	**Live capture and relocation**	**TOTAL**
Kocevsko-belokranjsko	28	15	12	1	56
Notranjsko	31	3	12	4	50
Primorsko	6	-	1	-	7
Zahodno visokokraško	5	-	2	-	7
Novomeško	5	-	-	-	5
Zasavsko	1	-	-	-	1
TOTAL	**76**	**18**	**27**	**5**	**126**

Table 2: Bears harvested/lost in 2006 according to their weight (Source: Slovenia Forest Service 2007)

Area	**up to 100 kg**	**101-150 kg**	**over 150 kg**	**Male**	**Female**	**Unknown**	**TOTAL**
Kocevsko-belokranjsko	38	13	5	23	32	1	56
Notranjsko	34	11	5	29	20	1	50
Primorsko	4	3	-	4	3	-	7
Zahodno visokokraško	2	3	2	5	2	-	7
Novomeško	3	1	1	3	2	-	5
Zasavsko	-	1	-	-	1	-	1
TOTAL	**81**	**32**	**13**	**64**	**60**	**2**	**126**
Share (%)	**64,2**	**25,4**	**10,4**	**50,7**	**47,6**	**1,6**	**100**

Decision-making process

Harvesting and culling of the brown bear population is carried out on the basis of expert opinion submitted to the Ministry of Environment and Spatial Planning responsible for brown bear management. The proposal is prepared by the Slovenia Forest Service. Their opinion is adjusted by the Working Group established by the Ministry and presented to the general public.

The Working Group consists of independent experts (from the Department of Forestry, the Department of Biology and the Zootechnical Department at the Biotechnical Faculty of the University of Ljubljana, Slovenian Hunting Assosiation and from the Slovenia Forest Service), representatives of various interested parties (hunters, NGOs, livestock breeders and local communities) and state officials (the Ministry of Agriculture, Forestry and Food and the Ministry of Environment, Spatial Planning and Energy).

The adjusted expert opinion is communicated to the Minister who takes into account the suggestions and remarks of the expert Working Group and all stakeholders. The Minister then decides harvesting/culling policies for the bear population (as well as for other large carnivores).

Conflicts

Following the strategic goals there are different measures in each of the brown bear zones, aiming to regulate the population and to minimise the number of conflicts with men. The principles of harvesting/culling rates for the bear population are a part of this management.

The most common conflicts are:

- in agricultural areas
  - taking of sheep and goats
  - damage in beehives
  - orchards etc.
- contacts with people
  - local people (in villages, forest works)
  - tourists (hikers, bikers, mushroom collectors)
- direct attacks (very rare, 1–2 each year)

The share of losses of bears resulting from road accidents is markedly high in recent years – it amounts to more than 20% of the total mortality number. In 2006, there were 20 losses due to traffic; in addition to these, there were 13 traffic accidents involving bears that were not found afterwards. During the last 7 years, 107 bears died in collisions with vehicles: 11 on highways, 49 on local roads, and 47 on railways (Slovenia Forest Service 2007).

Damages and compensation

The data (**Tab. 3**) show that, prior to 2002, the number of damage cases was just over a hundred yearly. The nominal value of compensations kept increasing, slowly at first, whereas in 1998 and 1999 it went up dramatically. But the amount declined after 1999. In 2002, the number of cases shot up. It is highest in the Kočevje and Notranjska areas and in the wider alpine and sub-alpine region. In the former, this is the result of the higher number of bears; whilst in the latter the main cause is the utilisation of the land (free pasture in the mountains), as the number of bears here, compared to the central area, is considerably lower, but nevertheless increasing (JONOZOVIČ 2003).

Table 3: Damage in 2006 (Source: Slovenia Forest Service, 2007)

Year	Number of damage cases	Damages paid out in SIT
1994	7	837,000.00
1995	57	2,826,562.00
1996	45	6,139,890.00
1997	81	9,724,539.00
1998	105	28,913,215.00
1999	138	23,921,963.00
2000	139	12,614,238.00
2001	123	10,601,558.00
2002	503	31,483,145.00
2003	239	15,557,848.00
2004	466	29,746,252.00
2005	814	47,329,139.00
2006***	678	37,851,519.00

*** All the damages in 2006 are not yet estimated and resolved (lawsuits, etc.).
1 EUR= ca. 240 SIT

Conflict management

To minimise the number of conflicts with men there is some kind of management system, such as:

- Population management:
  - monitoring;
  - population control (by space, age, sex, condition) – strictly controlled culling;
  - translocation (from urban areas to core areas);
  - feeding (controversial issue).
- Preventive measures:
  - shift of the agricultural policy (e.g. encouraging cattle breeding instead of sheep);
  - fencing;
  - encouraging shepherd dogs.
- Compensation system:
- Intervention group (established in 2000):
  - using 112 and 113 telephone numbers;
  - 167 interventions in 2006.
- Public awareness:
  - how to live together (acceptance and adoption).

Integral monitoring of brown bear population

Integral monitoring of the brown bear population consists of:

- Regular counting at 176 permanent sites 2-3 times a year at the same moonlit night;
- Other counting sites;
- Observations;
- Registering contacts and intervention calls;
- Captures and losses;
- Telemetry;
- Genetic research.

Beside the counting at the permanent counting sites the counting also takes place at other counting sites (feeding stations, places of regular bear sightings, etc.), which are defined and agreed on by Slovenia Forest Service, Hunters Association of Slovenia and Regional Association of Hunting Grounds an Special Purpose Hunting Grounds Managers. Their number varies and also depends on the effort and interest of hunting grounds managers to gain additional data.

Each proposal regarding the harvesting/culling of the brown bear population takes into consideration all available data, technical methods and is harmonised with the responsible bodies in game breeding areas, which are the wider, ecologically rounded units for game management in Slovenia. It is agreed with those carrying out the harvesting or culling on the basis of the following parameters:

- brown bear losses so far (shot, captured or lost);
- ascertainable damage to crops, livestock, buildings, vehicles and elsewhere;
- conflict situations involving bears as recorded by the brown bear intervention group (167 calls for intervention in 2006, 176 calls for intervention in 2005) (Slovenian Forest Service, 2007);
- data on the counts and the assessment of brown bears that have been carried out since 2000 two or three times each year by the Slovenian Forest Service and the Hunters Association of Slovenia;
- experience (both theoretical and practical) of experts working within the scope of the activities of the Slovenian Forest Service.

The planned encroachment includes not only bears that are to be shot – proven losses in the bear population are also subtracted from the quota, influencing the realisation of the Ministerial decision. This ensures that the population dynamics are controlled, as the planning of hunting alone could lead to an uncontrolled number of accidental losses, which seems to have grown in recent years.

Figure 2. Counting sites (Source: Development of a population management plan)

Monitoring – counting places

The absolute number is not the only important factor, more significant is the population trend that is, as already mentioned, a progressive one. The absolute number is used only when it is necessary to decide in what way and by how much to harvest or cull the population by culling, starting from the assessed number of bears. Whether the number of bears can be simulated with various models or whether it is easier to assess it on the basis of "hard" facts derived from the actual monitoring of the population, is left to individual judgement. The monitoring of the bear population in Slovenia means that the number of bears is ascertained by direct counts in relatively permanent places (bear feeding stations, corn feeding stations for wild boar, and other counting places) and by daily monitoring indices in the Slovenia Forest Service professional game breeding areas in the central bear zone, encompassing an area of over 70,000 ha. All hunting organisations in whose hunting grounds bears are permanently present participate in this, counting bears on the same date (on a moonlit night), 2–3 times a year. After the count, the collected forms are analysed and any sightings judged to be duplicated, are excluded. Adamič (1993) with the Hunters Association of Slovenia, developed a method, with which it is possible to follow the population trends as well as determining the social structure of the population – the proportion of bears sighted involving female bears with cubsper. Under optimal weather conditions it is possible to sight and count at the feeding stations up to 70% of the bear population. After the count, hunting organisations fill another part of the form, where they estimate the number of bears more or less constantly present in their hunting grounds, which were not spotted during the count. And this produces the difference between the numbers recorded (the number of animals actually counted – the assessed number).

Based on the Project Life Natura III and European Commission requirements the net of permanent counting sites (167) was formed. The counting at these sites is

obligatory and the results obtained are processed and kept separately. The counting sites are located two kilometres from the nearest settlement and three kilometres from each other. The net of permanent counting sites was formed for the purpose of long term population trend assessment.

Counting results

Comparing all the counts, the most interesting is the number of cubs per female (**Tab. 4**, **Fig. 3 and 4**) (in their 1st and 2nd year) – which is very stable, most often around 1.8–2 cubs per female, the lowest number – only 1.71 – occurring in April 2000, and the highest – 2.33 – in May 2000. The number of bears counted (since 2000) was highest in the last counts, as was the assessed number of bears, which additionally confirms the thesis about the progressive growth of the population. We estimate, that the annual increment of bears (newly born) in Slovenia is between 100 and 150. It should be mentioned here that we estimate the survival level of cubs to be very high, mainly because the sufficiency of both the natural and offered food (e.g. at feeding stations) (Slovenian Forest Service 2007).

Conclusions: which is the "happy" number?

When setting objectives for a strategy plan the basic question is, what is the proper population size? The scientific aspect of right population size gives attention to the carrying capacity of the area, intraspecific relations within the population, links between meta-populations, genetics, etc. There is also the social aspect, which points out the level of acceptance in the local environment (social capacity).

Table 4: Counting resulsts of the last six years (Source: Slovenia Forest Service 2007)

Year and counting No.	No. of counting spots	Counted in total	Females	Cubs in their 1st and 2nd year	Cubs per female
2000 – 1	206	288	51	87	1.71
2000 – 2	278	326	67	156	2.33
2000 – 3	315	432	84	156	1.86
2001 – 1	293	212	41	76	1.85
2001 – 2	290	285	57	103	1.81
2001 – 3	321	279	53	104	1.96
2002 – 1	349	344	57	105	1.84
2002 – 2	372	468	100	186	1.86
2003 – 1	378	291	52	93	1.79
2003 – 2	366	224	40	68	1.70
2004 – 1	342	271	45	88	1.96
2004 – 2	391	233	42	74	1.76
2004 – 3	394	233	45	85	1.89
2005 – 1	337	407	73	140	1.92
2005 – 2	305	434	89	176	1.98
2005 – 3	351	378	69	139	2.01
2006 – 1	283	329	65	125	1.92
2006 – 2	284	265	46	94	2.04
2006 – 3	292	312	64	120	1.88

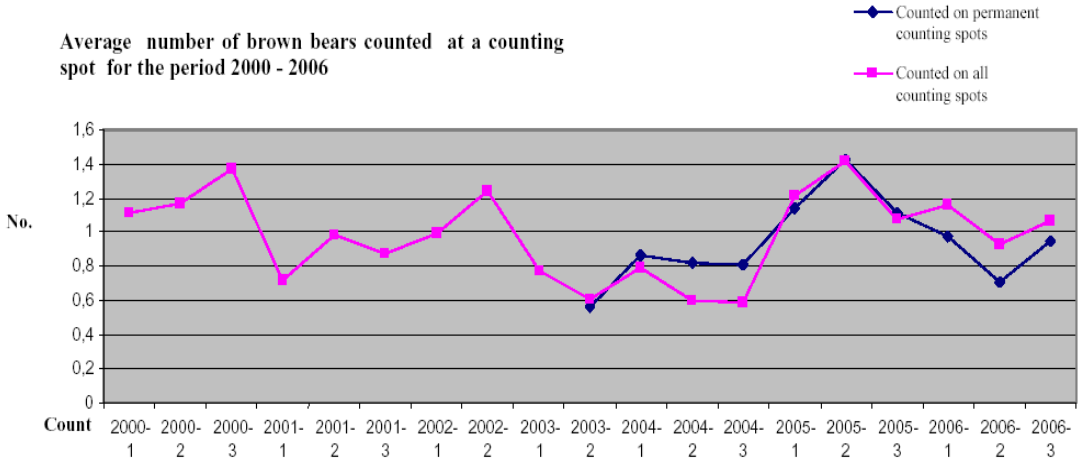

Figure1: Average number of brown bears (Source: Slovenia Forest Service, 2007)

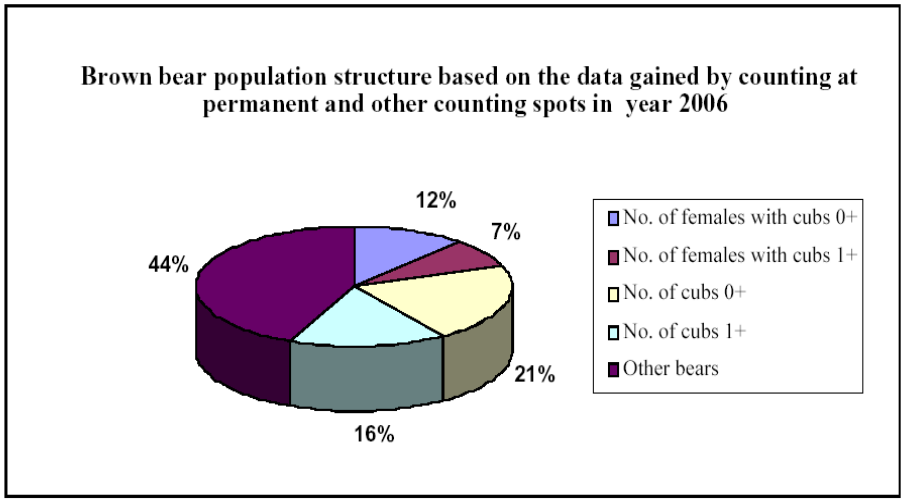

Figure 2: Brown bear population structure (Source: Slovenia Forest Service, 2007)

All those elements need to be considered in a proper brown bear management. It is necessary to find the balance between the brown bear population size and the social acceptability in the local environment. This is the only way that with certainty leads to successful and sustainable management of the brown bear populations in Slovenia.

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Proposal for encroachment upon Brown bear population in Slovenia in 2007 (2007): Slovenia Forest Service, Ljubljana: 5

Status, Management and Conservation of Large Carnivores in Serbia

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Abstract. Brown bear, grey wolf and Eurasian lynx are the three large carnivore species in the mammal fauna of Serbia. Although their presence, abundance and ecological role indicate their great importance in Serbia, until recently few data were available about them.
Each species has a different legal status – the lynx is permanently protected, the wolf unprotected (except in the Northern Province of Vojvodina where it is protected as a natural rarity and under close season throughout the year), and the bear has been protected by close season throughout the year since 2002. Although officially not included with the large carnivores, the golden jackal also plays a significant role in Serbia.
Since 2004, modern methods and techniques have been intensively used to study and determine the historical and present state of populations of all three species. During 2006 and 2007, National Strategic Plans necessary for their conservation in Serbia have been produced.
The fragmented distribution, abundance, population trend, habitat characteristics and threat factors for each species are elaborated and documented.
Due to the connection of habitats and populations in Serbia with those in neighboring countries, there are permanent contacts and reciprocal trans-border cooperation in the field of research, conservation, protection and management.

Key words: Serbia, large carnivores, distribution, status, management,

Introduction

Out of 98 mammal species in Serbia, 19 are carnivores, with the 3 large carnivores – brown bear, grey wolf and Eurasian lynx holding a special position in this group. In addition we should also mention the golden jackal due to the most recent increase of this species in Serbia. All four mentioned species, in spite of being ecologically related, have a different status, so it is necessary to implement completely different approaches and management measurements for their conservation. However, in spite of their important role in fauna and nature of Serbia, it is safe to say that until recently the large carnivores were not a subject of detailed interest or research activities in Serbia. The following data represent the results of the first more substantial steps in that direction.

Material and methods

The material used in this paper includes the data collected by author's own research, the database of Natural History Museum, Belgrade, Serbia, the documentation of the Hunting Association of Serbia (ŠELMIĆ 2001), as well as the government's statistics data. The scanty national and relevant international references were also studied (MIRIĆ 1981, MILENKOVIĆ 1985, MIRIĆ & PAUNOVIĆ 1992, 1994, SAVIĆ *et al*. 1995, PAUNOVIĆ 2000, PAUNOVIĆ 2002, PAUNOVIĆ 2004, PAUNOVIĆ *et al*. 2002, HUBER 1999, BOITANI 2000, BREITENMOSER *et al*. 2000, SWENSON *et al*. 2000, HUBER 2002). In order to present the legal regulative and laws about large carnivores in Serbia, we consulted present official legal documents (OFFICIAL GAZETTE 1993a, 1993b, 2002).

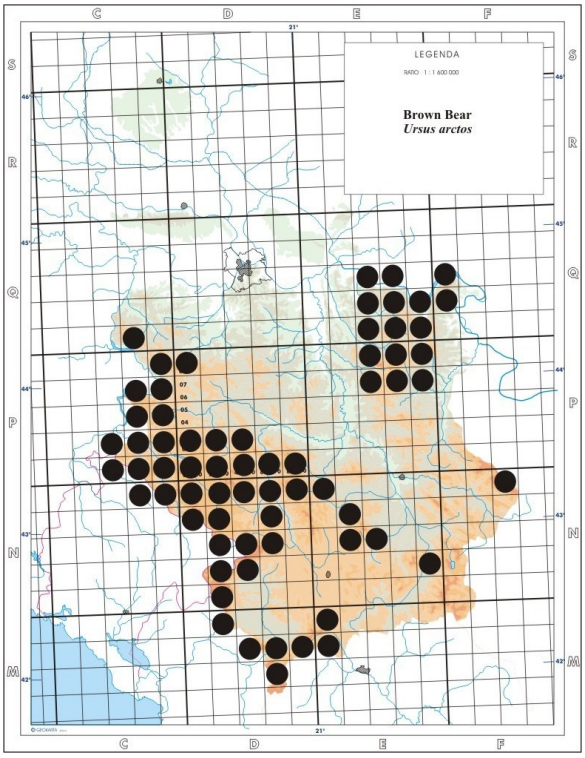

Figure 1. Recent distribution range of brown bear (*Ursus arctos*) in Serbia (UTM – 20x20 km)

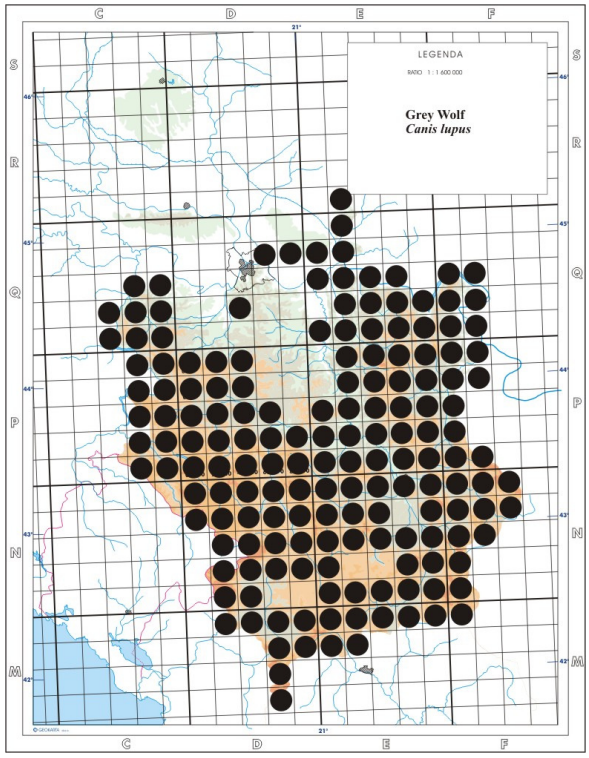

Figure 2. Recent distribution range of grey wolf (*Canis lupus*) in Serbia (UTM – 20x20 km)

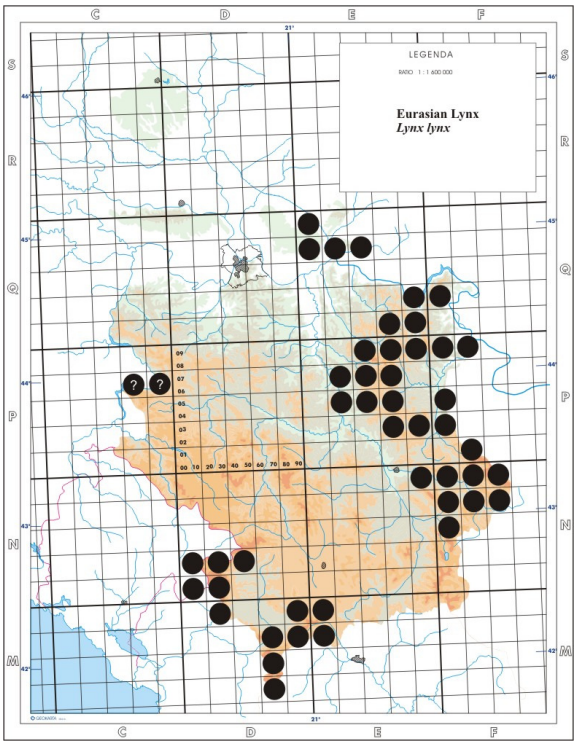

Figure 3. Recent distribution range of Eurasian lynx (*Lynx lynx*) in Serbia (UTM – 20x20 km)

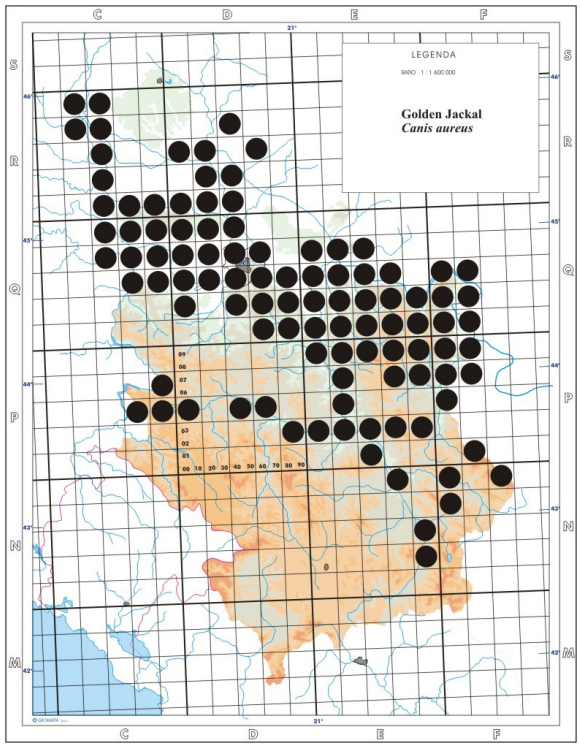

Figure 4. Recent distribution range of golden jackal (*Canis aureus*) in Serbia (UTM – 20x20 km)

Results and discussion

The common feature in the distributions of the brown bear, Eurasian lynx and grey wolf is the large range gap in the lowlands and valleys of Serbia, for example Vojvodina and central parts of the country with valleys of Morava river and its tributaries. The most important causes of this gap are agricultural practices, lack of suitable relief and the high concentration of human population. The range of each species is therefore fragmented, which is best pronounced in brown bear and least pronounced in grey wolf. The maps (**Fig. 1–3**) show that along the borders of Serbia the distribution of all three species is less fragmented, i.e. relatively continuous range is present with the core areas for large carnivores. These areas may be described as less-settled, forested hilly and mountain areas, with extensive livestock farming and a pronounced human depopulation. These areas are also important corridors connecting the ranges of these species with those in the neighboring countries.

Although it is officially not included in the large carnivore species, the golden jackal (*Canis aureus*) is a very numerous and often the only present larger predatory species in the valleys and lowlands, and especially in the anthropogenically altered areas of Serbia. Due to the great expansion of range and population numbers, as well as its important role in nature, the presence of this species must be acknowledged.

The brown bear lives in suitable habitats in hilly-mountainous regions of western, southern and eastern Serbia (**Fig. 1**). Population numbers are estimated to 50-60 individuals, excluding the data for Province of Kosovo-Metohija, lacking since 1998 (PAUNOVIĆ 2002). In the recent times (since 2000) the bionomic and ecological studies of this little-known carnivore were intensified. A special program of relocation of individuals (PAUNOVIĆ & ĆIROVIĆ 2006) as well as a program of radio-telemetric monitoring of marked individuals were started in 2006. The brown bear has been protected by a close season throughout the year since 2002 (OFFICIAL GAZETTE 2002). It is placed in the category of vulnerable species (SAVIĆ *et al*. 1995).

The present distribution of grey wolf in Serbia, which has remained almost stable for a long time (BOJOVIĆ & ČOLIĆ 1974, MILENKOVIĆ 1997), includes hilly-mountainous, mostly forested areas of western, southwestern, southern, southeastern and eastern Serbia, forming a horseshoe shape with a hiatus in the region of Šumadija where wolves are only rarely recorded (**Fig. 2**). In the province of Vojvodina this species is permanently present only in the area of southern Banat. The population numbers are estimated to about 700-800 individuals. According to the statistics of the Hunting Association of Serbia, the annual harvest over the last 20 years was about 200 individuals, indicating a relatively stable population trend. This species is unprotected, except in the northern Serbian Province of Vojvodina where it is protected as a natural rarity with a close season throughout the year (OFFICIAL GAZETTE 1993a, 1993b, 2002).

The Eurasian lynx mostly lives in forested and wooded-rocky hilly-mountainous areas, but it was also recorded in lowland and lower hilly areas. It inhabits the northeastern, eastern western and southwestern parts of Serbia (**Fig. 3**). At least two populations/subspecies are present in Serbia – part of Carpathian population/subspecies in northeastern and eastern Serbia, and part of Balkan population/subspecies in southwestern Serbia, especially in the Province of Kosovo-Metohija. The present range in Serbia is disjointed, and the main barrier for dispersion and movement of individuals is the anthropogenically altered valley of the Velika Morava river, which divides the central part of Serbia into the eastern and the western part. The Balkan population has a decreasing trend, and the total abundance is estimated to be no more than 30 individuals (GRUBAČ 2000, PAUNOVIĆ *et al.* 2001). The

Carpathian population size is estimated to 30 (GRUBAČ 2000) or 40 individuals (PAUNOVIĆ *et al*. 2001), with an increasing trend. There were some indications of 3-6 lynx individuals on Mt Tara in western Serbia (PAUNOVIĆ *et al*. 2001), but they have not been confirmed in recent years. The lynx is protected by two legal documents. The Ordinance on conservation of natural rarities (OFFICIAL GAZETTE 1993a) included it in the list of protected species and the Hunting Law (OFFICIAL GAZETTE 1993b) protects the lynx with a permanent close season throughout the year. It was also included in the category of vulnerable species (SAVIĆ *et al*. 1995).

The golden jackal is present in the lowlands and hilly areas of Vojvodina province, central and eastern Serbia (**Fig. 4**). After the WW II, the organized poisoning of wolves had a devastating effect on golden jackal population numbers in Serbia. With the cessation of intensive poisoning, an increase in population numbers was noted, and closely after that a noticeable dispersion and spontaneous recolonization of primary range. For example, during the last decade, about 500 jackals were shot in vicinity of Negotin in northeastern Serbia. Northeastern Serbia and Lower Srem represent centers of jackal distribution in Serbia where this species has always existed. In northeastern Serbia, populations were especially large in the vicinity of Negotin and Bela Palanka. Spreading from these nuclei took place to the west and northwest, that is, into the valley of Velika Morava river. The population in Lower Srem spread to the east down the banks of Sava river, and to the north toward the western slopes of Fruška Gora mountain. All the other records for the territory of Serbia can be presently considered to be vagrants. Recently the abundance and range are both in huge expansion. The population is estimated to be not less than 2,000 individuals. It is unprotected in the whole territory of Serbia.

Factors of threat to large carnivores

In the primarily natural conditions, the large carnivores are at the top of trophic pyramids and basically do not have any natural enemies that would pose a threat to their survival. The direct and indirect human activities are the only significant threats which in Serbia are:

Poaching [illegal killing] directed primarily at protected species such as Eurasian lynx and brown bear; this may be very important.

The **inadequate management of game species** generally has led to a decrease in the main foods of large carnivores, primarily the wild ungulates. The usual alternative prey is domestic animals; this increases the clash between the large carnivores and the local community, with the final result an increase of poaching intensity, and/or hunting pressure.

Disturbance in habitats due to their exploitation is an everyday phenomenon, especially important during the period of reproduction and often connected with habitat degradation and fragmentation.

Habitat degradation and fragmentation primarily includes felling and overexploiting of forests, but there are also other forms of habitat destruction such as building of infrastructural objects, tourist centers etc. This often leads to the formation of barriers that prevent movement of individuals and gene flow.

Over-hunting is present in certain regions affecting species such as the grey wolf and golden jackal leading to the disappearance of local populations.

Lack of historical and current data is generally the case for all large carnivores of Serbia; a consequence of insufficient knowledge and research.

Absence of a system of damage identification and evidence, as well as a system of compensation (PAUNOVIĆ 2004) leads to a generally bad public attitude toward the large carnivores,

especially amongst the public directly affected. The lack of evidence and mis-identification of the predator often leads to an unjustified bad reputation for certain species. According to our research, numerous incidents of damage on livestock in Serbia were often not performed by wolves but by stray dogs, while damage to crops is mostly made by wild boars and not bears.

Catching, showing and trading live animals have a large negative impact on conservation, including the taking of young of large carnivores to be raised and shown in captivity. The recent studies indicate large-scale presence of this phenomenon on the local level. It has the largest effect on brown bear (so-called "dancing bears") and the grey wolf.

Road-kill cases are not very common, but were recorded for all species.

Poisoning as a non-selective method of extermination that was officially forbidden in 1972, although it is still present today, to a small extent.

Large carnivore conservation and management facts and needs

In recent times the state institutions have become increasingly interested in the problems of the protection and conservation of the large carnivores, so understanding and support from the state is now a recognizable factor. This has led to a significant recent intensification of research and use of modern methods and techniques of data collecting. Although the present legislation is relatively favorable, changes or modifications of current legal status are still necessary for certain species, especially the grey wolf and golden jackal, in order to introduce active management of populations and possible increase of both exploitation level and control (in accordance with ANONYMOUS 2002). On the other hand, weak implementation and enforcement of law is an old problem that obviously has deep and solid roots in Serbia.

In agreement with the relevant international documents (HUBER 1999, BOITANI 2000, BREITENMOSER *et al*. 2000, SWENSON *et al*. 2000, HUBER 2002), activities on national strategic/management/action plans for conservation of each species started in 2006. They should significantly contribute to the development and improvement of conservation and purposeful management, as well the development of a damage evidence and compensation system. For the future, permanent research and monitoring in Serbia, and reciprocal trans-border cooperation in the field of research, conservation, protection and management are all of crucial importance.

Acknowledgements

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Future of Large Carnivores in Europe – The Role of People and Hunters

Conclusions of the pre-congress symposium of the 54th CIC General Assembly 1 May 2007, Belgrade, Serbia

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Introduction

The International Council for Game and Wildlife Conservation (CIC) on its 54th General Assembly in Belgrade articulated the need for more fundamental, rational processing of the problems with large carnivores. Wise interaction with large carnivores is based upon research, education, monitoring, loss prevention and fair compensation.

Europe is home to five large carnivore species: brown bear (*Ursus arctos*), Eurasian lynx (*Lynx lynx*), Iberian lynx (*Lynx pardinus*), wolf (*Canis lupus*), wolverine (*Gulo gulo*). These top predators all require large areas of continuous habitat, and so most of the populations occur outside protected areas.

Very little wilderness remained in Europe. Large carnivores have adapted to European semi-natural and multi-use landscapes – consequently more encounters with humans occur. Most populations (88%) are trans-boundary. Population sizes range from less than 20 to many thousand individuals and conservation status varies depending on the region.

Regarding their status in the IUCN Red List, brown bear, wolf and Eurasian lynx are identified as stable and of least concern, wolverine is identified as vulnerable and declining, Iberian lynx is critically endangered. Large carnivores are flagship species for conservation, because they need large areas, and also are 'media friendly' to urban populations. However, large carnivores compete with land owners/farmers for livestock and with hunters for larger game. They cause threat to those rural communities, which are not used to large carnivores, and have the cultural image of dangerous animals. On the other hand, large carnivores are target of recreational or management hunting.

Conflicts

People in historical times had deep-rooted and rational fear of large carnivores. Nowadays, people remain fearful but also positive towards large carnivores; these species are perceived in contradictory ways by the urban European civilisation. The wolf for example remains iconic in embodying fears. As questionnaires confirm, a great majority of people welcomes the return of large carnivores and requests their protection. Most people want viable populations in their country, **BUT NOT IN THEIR BACKYARD.**

Concerns remain among farmers and rural population. In fact, large carnivores are most popular for those that do not have to deal with them (e.g. urban populations). A good recent example – "Bruno", the first bear roaming in Germany after extinction back in 1835. Experts initially recommended capture and aversion treatment, however, experience with this individual showed this to be ineffective. The media opinion against shooting the bear caused authorities to hire Finnish trackers to find him – without success. Unexpected changes in the bear's behaviour caused authorities to issue a hunting licence.

The main conflicts between large carnivores and humans appear because of livestock depredation and competition with hunters for larger game. Most problems occur in areas with communities no longer used to dealing with carnivores. Traditional animal husbandry methods such as

shepherding, shepherd dogs, night time pens proved to be the best measures to minimise damages and minimise the impacts of depredation. Contrarily, the initiatives of the anti-hunting organisations inspired by the urban population have motivated illegal control by rural population with a highly negative impact on species conservation.

Therefore, for decisions in the management of large carnivore populations the attitude of local people, who actually live amongst these 'frightening' animals is important and has to be taken into account.

The authority representatives and scientists have considered the cooperation of hunters in wildlife research and monitoring essential, because they are more often present in the hunting grounds than anybody else and use the same areas as carnivores. In this way hunters can be vital in supporting the conservation and management of large carnivore populations. Hunters also form a valuable link to the local society.

The role of the hunters

Hunting is the traditional and most widespread method for controlling carnivore numbers. In many but not all cases hunting is absolutely compatible with species conservation, provided that it is part of a wildlife management plan and that all stakeholders understand the correlation between population dynamics and the social structure of each species. The management plan has to state the goals for removing individuals and ensure that the removal is sustainable. Regarding sustainable removal, all human induced mortality has to be taken into account.

Solution of the conflicts

In view of the conflicts with humans, the management of large carnivores needs in general a three-legged-approach. The management plans need to be based on scientifically sound ***monitoring and research***. The coexistence with humans in rural areas demand ***prevention measures*** both for livestock and human safety. And above these the damages caused by large carnivores despite all precautions necessitate ***compensation*** in a fair and regulated way. Thus even if problems occur, management involving the hunters can ensure that the public acceptance of large carnivores remains positive. And above all, large carnivore management policies have to be organised with a regional, transboundary approach with international cooperation.