STATUS AND DISTRIBUTION OF CARNIVORES IN HUNGARY

Ph.D. thesis

HELTAI MIKLÓS

Gödöllő

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name: Postgraduate Course in Animal Husbandry

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Head of program's endorsement Project leader's endorsement

1. Introduction

1.1. Significance of the topic

Regarding diversity of wildlife is concerned, Hungary is one of Europe's richest areas. Most carnivores species found on the continent occur in this country. There are only a few exceptions, some rare species that have small distribution areas on the continent, such as the brown bear (*Ursus arctos*), the wolverine (*Gulo gulo*), the common genet (*Genetta genetta*), the European mink (*Mustela lutreola*), the American mink (*Mustela vison*) and the marbled polecat (Vormela peregusna). During the second half of the 20th century some indigenous carnivores species that had become extinct in Hungary, such as the wolf (*Canis lupus*), the lynx (*Felis lynx*) and the golden jackal (*Canis aureus*) started to repatriate and reproduce in the country; moreover, invasive, alien species spreading Europe-wide, like the raccoon (*Procyon lotor*) and the raccoon dog (*Nyctereutes procyonides*) have also appeared here.

However, scientific knowledge on these species compared to other animal groups, such as songbirds, small rodents or amphibians is very scarce in Hungary. Also more intensive studies in other countries have been conducted. Very few publications are available about the distribution and population changes of carnivores in the last decades in Hungary.

Lack of information is revealed by Báldi et al. (1995), who developed an evaluation system of Hungarian vertebrate fauna. In their study the information available on a given species and the measures taken to protect it were taken into consideration. The information available on distribution, density changes, and the number of the publications on the given species were also assessed. Scores ranged between 0-45, from "total" knowledge to 1total1 lack of information. Most of the carnivores species, with the exception of the red fox (15 points) scored a minimum of 28 points, while the 38 points recorded for the weasel and the 40 points for the western polecat and the lynx show the need for more data on these carnivores.

Accordingly, several aspects of the situation of carnivores in Hungary remain unclear. In the absence of regular countrywide surveys, the distribution, density changes, and population dynamics of these carnivores are largely unknown.

1.2. Laying the groundwork for the study

At the Department of Wildlife Biology and Management surveys have been conducted based on mail questionnaires as well as with field and laboratory investigations headed by László Szemethy since 1987. Until 1997 only mail questionnaire surveys were used. From 1997 on field studies were initiated first in four and later on in eight study areas to check the questionnaire surveys and to obtain additional data (e.g., on feeding behavior and animal health). I joined the project in 1988 as an M.Sc. student and since 1994 I have been in charge of the nationwide data collection and evaluation. This long-term contribution allowed me to write my PhD dissertation on this topic.

The importance of our work is indicated by the continuously increasing interest in the results of our surveys even backing to earlier years. The reason for this interest is that a heated debate has arisen among the general public, members of the wildlife management, and nature conservation communities on the role of carnivores species. These debates have often been conducted with total disregard of the facts and have highlighted the need of reliable data in everyday decision-making and management processes; moreover, it underlined the importance of and need for further research.

The main issues in these debates can be summarized as follows:

< Some species can adapt very easily to urban environments and they appear or inhabit more and more often in human areas.
< The range and population density of some species (badger, pine marten) are growing; this is partly due to the effective measures taken to protect them, resulting in increased levels of real or supposed damage to protected or managed populations of other species.
< Large carnivores (wolf, golden jackal, lynx) considered extinct have returned to Hungary. The necessity of coexistence with these species comes as a surprise to the human population, and the solution of conflicts arising is not easy.
< New carnivores species (raccoon, raccoon dog), not very familiar even to experts, appear and spread in the country. There is uncertainty about the policy to adopt towards them and how to manage them.

- The effects of immunisation against rabies are also poorly understood. However, some phenomena are considered being the consequences of immunisation (e.g., the fast density increase of red fox and its frequent occurrence in human settlements), so this program is often attacked.
- The population reduction and management of huntable carnivores species are not efficient enough, which may cause human-animal conflicts (increasing densities, damage) even in human settlements.
- The natural disasters in the past few years (floods, inland inundation, harsh winters) significantly reduced the density of small game populations. In these cases effective control of carnivores would have been especially important. However, methods for control are limited. Traditional techniques (fumigation, poisoning, leg-hold traps) are prohibited because of the dangers to other species. At the same time, no effective selective control techniques are available. More over occasional carnivore reductions are conducted without appropriate planning.

The Atlas of European Mammals edited by Mitchell-Jones et al. (1999) also confirms the importance of studying the distribution areas and the need for continuous data collection and processing.

1.3. Purposes

My main purpose was to analyse and evaluate the data on carnivores for the last decade in a unified system including:

- Elaboration of the methodology of a relatively simple, but reliable monitoring system for carnivores, and, by checking the results extensively, ensuring its applicability.
- Establishing a uniform database, which can be linked to the National Game Management Database and the National Biodiversity-Monitoring System.
- Description and evaluation of the status of carnivore species.
- Evaluation of population dynamics of species where this is possible in the period studied.
- Development of proposals to support nature conservation and wildlife management interventions.

2. Material and methods

2.1. Methods of collecting data

2.1.1. Mail questionnaire survey

Data on the distribution and population density of were collected by mail questionnaire surveys sent to each game management unit (hunting area). This method allowed to gain a large amount of data in a relatively simple way; on the other hand, no suitable alternative techniques were available.

An address list was first established based on the registration list of Hungarian Hunters Association, then from 1997 on the list was compiled based on the National Game Management Database. Questionnaires were sent to the presidents, head keepers and masters of the hunting areas. Respondents were given 1-1.5 months to reply. From 1994 a reminder was also sent after the deadline had passed.

I have processed data from nine surveys between 1987-2001. In the first period surveys were conducted under different ongoing research programs, and no uniform questionnaires were used. A unified survey was developed only in 1997. Table 1. shows the species studied and the statistics for the responses in different years.

Two questions were asked about distribution and population density. One of them was about the presence or absence of the species, that is, it was designed to explore whether or not a given species was found in the given area at all, and if this presence was stable (reproducing population) or occasional. This question was always asked - except for the red fox, which was assumed to be present everywhere. In case of small mustelids (weasel, ermine, stone and pine marten, western and steppe polecat) I have not collected more detailed data. From year to year some minor changes were introduced in the questions, but stable or occasional presence or absence of the species was always asked. This present/absent answer can be easily accepted and regarded as reliable from an expert working in everyday in the field. In general it is also easy to check the validity of the response.

In case of species that are relatively well observable or important in nature conservation or wildlife management (red fox, wild cat, badger, otter) I asked for data on estimated population densities. Obviously, these responses to this question are less reliable, because they are based on suppositions, and it is also more difficult to check the data. However, significant changes between one survey and another will suggest actually occurring processes. Therefore, these data are not intended to answer questions like how many red foxes lived in Hungary in 2001, but to provide information on the question whether the population in 2001 had a higher or lower density than in previous years.

3.1.2. Additional data

In Hungarian zoological research the questionnaire survey is not a widely-accepted method; in addition, information collected from hunters and wildlife managers is often doubted. Consequently, I had to check the data collected by independent parallel methods.

For huntable species (red fox, golden jackal, raccoon dog, raccoon, western polecat, stone marten) I have also considered county bag data, based on the records of the National Game Management Database (Csányi, 1999, 2000, 2001, 2002). In addition, in case of several species I had the opportunity to use data from other research programs conducted by the Department of Wildlife Biology and Management. The most important programs were the following:

< Study of the repatriation of the golden jackal and its effects in wildlife management (2001- , supported by the Ministry of Agriculture, Wildlife Management Fund).

< Field study of the spontaneous repatriation of the wolf and the lynx (2001- , supported by EU LIFE Nature and the Ministry of Nature Conservation).

< National monitoring program of carnivores (1997- , supported by the Ministry of Agriculture, Wildlife Management Fund and Central Environmental Fund).

The first two programs started less than one year ago. At present we would like to prove the presence of these species using direct and indirect methods. In the national monitoring program, however, data on the more common carnivores are collected using standardised methods. Under this programme, field studies have been conducted in 17 areas. In each area twice a year - in August-September and January-February for six weeks - 25 large-size and 40 small-size live-traps are set to explore the carnivore fauna of the area. Every March, the burrow density of foxes and badgers along transects in the south-north direction is estimated.

In repatriating (wolf, lynx, golden jackal) or invasive (raccoon dog and raccoon) rare species I checked individual pieces of information occasionally, while in wolf, lynx and otters I compared distribution data with the data from the literate.

Table 1.: Data of the questionnaire surveys and the studied species

Species	1987	1988	1990	1994	1995	1997	1998	2000	2001
Golden jackal						X	X	X	X
Wolf	X		X			X	X	X	X
Red fox		X	X	X	X	X	X	X	X
Raccoon dog						X	X	X	X
Raccoon						X	X	X	X
Stoat						X	X	X	X
Steppe polecat							X	X	X
Weasel						X	X	X	X
Western polecat							X	X	X
Stone marten						X	X	X	X
Pine marten	X		X			X	X	X	X
Badger	X		X	X	X	X	X	X	X
Otter			X	X	X			X	X
Wild cat	X		X	X	X	X	X	X	X
Lynx	X		X			X	X	X	X
Answering rate (%)	41	34	26	42	51	40	47	48	44
Covering rate (%)	80	46	50	36	43	40	47	50	47

2.2. Data processing

The data received were recorded in Paradox and Quattro Pro (Corel Corporation) data base programs, linking the official code of the hunting area to every respondent, which made it possible to geographically localise data later. Every Hungarian hunting area has an individual code, which is necessary for official national registration. Responses that were unidentifiable in this respect were omitted from the data processing. The answer and the area coverage rate were calculated based on identified, coded areas. Statistical analyses were performed by the software SPSS 7.0 (SPSS, Inc.), while map views were generated by ArcInfo 3.0 and ArcView GIS 3.1 (Environmental Systems Research Institute, USA).

Data processing was dependent on the number of surveys of the species, characteristics of the data (presence/absence data or density information) and the occurrence of the carnivore. On the basis of all these information, carnivores were categorised into the following groups:

< Rare, spontaneously repatriating or invasive species: golden jackal, raccoon dog, raccoon, wolf, lynx (rare species). In these species all the information available is reported, even if it was not possible to confirm them by supplementary checks. Such data are descriptive, and in these cases no statistical analyses could be done. Densities were not compared between years because of the high uncertainty of these data.

< Relatively common, hardly-observable small-size mustelids: ermine, western and steppe polecat, weasel, stone and pine marten (small size mustelids). Here I only collected discrete data: absent, occasionally appears, regularly appears, stable presence. I compared the distribution of data among these categories by P^2-test between years. In the map view, however, I only used the two extreme categories - absent and stable presence.

< Carnivore species particularly important for nature conservation due to their endangered status or for wildlife management because of their high population density: red fox, badger, otter and wild cat (particularly important species). Their estimated population density was calculated for to 1000 ha and one-way or two-way ANOVA with Duncan-Range post-hoc tests was used to make comparisons between areas and years. In red fox and badger - the two common species - analyses were carried out using national data. Data from the different parts of the country were also analysed separately. The reason for this procedure was the *per os* immunisation against rabies in red fox, while in badger it was its Eastern expansion. I have investigated the density of burrows in a similar manner. In the case of otter and wild cat I analysed groups of density data separately for areas where these species are considered as stable present, i.e. supposed to reproduce. Furthermore, as in Mustelids, data on presence/absence were analysed by P^2-test.

Map views were prepared using digital maps of Hungarian hunting areas as well as on the Hungarian part of the map by Universal Transverse Mercator (UTM), with grid cells of 10 X 10 km. This latter type of map is common in botany and zoology and is used mainly to show the distributions of presence/absence categories.

UTM-based distribution maps show the maximum distribution area of the studied species in the study period similarly to the European Mammal Mapping, but I applied much more severe criteria. A species was considered as present in a quadrate if I had information on at least 6.25 % of this area. I counted the given marginal value so as to lose the least possible information. Thus, I supposed the worst situation, where a hunting area with an area smaller (2500 ha) than determined by the Game Management Act (3000 ha) is distributed in four equal 625-ha parts in four UTM cells; therefore, we have information on 6.25 % of a cell of 10 000 ha. I prepared this map for every year for each species, and I present a combined map for the entire study period. No maps on red fox were made because of its general occurrence. In rare species all the information suggesting their occurrence was included into the database of the map, but for other carnivores data were used only for those areas where stable presence was reported.

We had opportunity to make more detailed analyses on the digital maps of hunting areas. I show the most interesting changes, negative answers or estimated densities on this map. Since spatial analysis may differ significantly among species, the details of this, diverging somewhat from the traditional structure of a thesis, will be presented in the Results section. However, on these maps I always used data from several years. Negative answers (absence) are always on the top of the map, irrespective of the collection date. This, as distinct from UTM maps, I present thinner distribution areas based upon stricter criteria.

3. Results

According to my results, the status of several carnivore species has changed in the period studied. Golden jackal (*Canis aureus*), wolf *(Canis lupus*) and lynx *(Lynx lynx*), which had been considered extinct, have reestablished their populations in Hungary in the last decade. Golden jackal has been intensively spreading since the middle of the 90s, showing the characteristics of invasive species. Nowadays its range is centralised to South-Hungary, namely in Somogy-, Baranya- and Bács-Kiskun County. Wolf and lynx have shown low-density, but stable populations in the Northern Mountainous Region. Their populations are strongly dependent on the populations in neighbouring countries. At the end of the 80's several wolf appearances were registered in the southern part of Bács-Kiskun County; probably a reproducing pair lived there. No wolf occurrences have been indicated in this area recently.

Two alien species had appeared in Hungary in the last 15 years. After earlier sparse observations, the raccoon dog (*Nyctereutes procyonoides*) is more and more common in the area East of the River Tisza. I have also proved the occurrence of the raccoon (*Procyon lotor*), although the probable source of its presence is individual animals escaping from captivity. In case of both species their further expansion is not welcome and should be prevented.

Our most common carnivore is the red fox *(Vulpes vulpes*). Its density has doubled countrywide. In Transdanubia, where antirabies treatments have already been conducted, its population growth has been continuous and faster than in the untreated eastern parts of the country, where in some years even minor decreases have been registered. The urbanisation of the red fox is also becoming a serious problem.

The density of badger *(Meles meles*) has increased significantly and, although to a smaller extent, the range of the pine marten (*Martes martes*) has also increased. In the case of the badger, I was able to show a population increase, too. Its debiting from protected status was reasonable. For pine-marten, however, information on population densities is not available, therefore its debiting is not advised, even though its area has increased.

As against the above-mentioned carnivores, the status of the wild cat (*Felis silvestris*) is more alarming. This is the only native carnivore species with a decreasing range and with declining population densities. It has disappeared from many sites of its former range, and wild cat populations have probably become separated from each other. For the wild cat, strict protection measures and efficient conservation treatments are urgently needed.

The ranges of otter (*Lutra lutra*), stoat (*Mustela erminea*) and steppe polecat (*Mustela eversmanni*) can be considered stable. Since all of these species occur only in their original habitats and their population densities are stable, the surveys do not suggest increasing populations. It is advisable to leave their protected status unchanged.

Weasel (*Mustela nivalis*), stone marten (*Martes foina*) and western polecat (*Mustela putorius*) are common species in the whole of Hungary. The weasel is no longer a protected species, but its open season has yet to be declared. I advise that this should be done now.

One of **the most important results** of my work is, that data collection, which started in 1987, has become regular, the questionnaires have been made uniform, the data have been recorded in a computer database which has been linked to a GIS. In this way I have set up **a well-working monitoring system**, and this database will create opportunities for future studies. I have proved that the mail questionnaire survey is an efficient method for setting up and maintaining such a system; and the data collected in this way can provide reliable information on the general status of carnivores species. **I have created the distribution maps of 15 carnivores in Hungary** and I have evaluated their actual status. **The data collected were arranged in a uniform database** and linked to the National Game Management Database and through the UTM maps to the National Biodiversity Monitoring System.

3.1. New scientific results

Based on the data collected, which were checked against independent sources in case of most species, the following scientific results have been achieved:

1. I set up the systematic national monitoring program involving most Hungarian carnivores by conducting regular surveys and by linking the to a GIS database. I prepared the distribution maps of these species for Hungary. I demonstrated the Hungarian status of ermine, western and steppe polecat, weasel, stone marten and otter in a uniform system for Hungary.

2. I clearly proved that golden jackal is a stable member of the Hungarian fauna and it has reproducing, increasing and expanding populations in the southern part of the country.

3. The range and/or population density of highly adaptive, generalist carnivores has increased significantly. Thus I could prove that red fox populations were intensively growing during the 90s and their density probably doubled. In Transdanubia, which has already been treated successfully against rabies, the growth rate is higher than anywhere else in the country. In case of mustelids I was able to prove an increase in the range of pine marten and badger.

4. I was able to prove the settling down of two alien carnivores, the raccoon dog and the raccoon, by using mail questionnaire surveys and additional information from hunting bag statistics and proving specimens.

5. In wolf and lynx, the distribution data from questionnaires and field observations are well-fitted. Thus, we know that the wolf occurred and reproduced in two areas, in the southern part of Bács-Kiskun county and in Aggtelek and the Zemplén mountainous areas, between 1987-2001. In the same period the lynx also repatriated in the Börzsöny Mountains, Aggtelek and the Zemplén areas.

4. Conclusions, proposals, and management implicctims

Public and professional opinions on carnivores has always ranged between two distant extremities. In the last third of the 20th century heated debates arose about the status of these species, the need for conservation or wildlife management interventions, huntability or protection. The main cause of these debates was the lack of information on their distribution and population changes. Thus, the debates were meaningless, since it is impossible to determine the real status of a carnivore without knowing where it occurs and how likely it is to appear somewhere. Without appropriate information, the efficiency of interventions and management cannot be assessed realistically, and declaring a species protected or huntable is based on emotional motives. **After the introduction of EU conservation legislation will become much more important to obtain up-to-date information on distribution areas, direction of population changes and possibly the estimated densities.** This is the only way to prepare conservation plans for species listed in the appendices of the FFH directive, management plans for other species. It is these data that make it possible to conduct checks on the implementation process of the directives.

This is the reason why a continuously operating and relatively in expensive **national carnivore monitoring system**, providing reliable data for experts and decision-makers has become **particularly important.**

I. The data for the period 1987-2001 **show trends similar to those in other European countries.** In this period three species included in the Red Data Book (Rakonczay 1989), and believed extinct in Hungary, the **golden jackal, wolf and lynx repatriated in the country**. **The range of the badger increased** significantly, **and so did that of the pine marten**, although to a smaller extent than that of the badger. In spite of many difficulties and disasters, the Hungarian **otter population is stable and large** in a European comparison. **The status of ermine and steppe polecat** seems to be **stable**, while **other small mustelids** - weasel, western polecat and stone marten - are common and **occur everywhere**. **Increasing populations of red fox** and the stone marten appear more and more often in human inhabitations, and occasionally we can even find the western polecat, weasel or badger in the villages or cities. On the other hand, **the status of wild cat has been deteriorating**. Urgent protective interventions are needed. Similarly, urgent actions would be necessary to reduce the densities of invasive species.

II. According to my results, among species believed extinct, it is the **golden jackal**, in which the highest changes are observable. It **repatriated** in Southern-Hungary in the last decade of the 20th century. **The growth and expansion of its populations is very fast**. According to actual tendencies it can become a common species countrywide in the next period. **Nowadays there is no reason to consider it a Red Book species and protect it**; although the hunting ban during its reproducing period (15 June-28 February) seems to be justified. Nevertheless, we should not forget that its fast expansion makes it similar to invasive opportunistic species. Consequently, we should pay increased attention to further changes in its population, and, if necessary, declare it huntable all the year round.

III. The two other Red Book carnivores believed extinct - **the wolf and lynx - also repatriated in Hungary.** Their situation warns us that our knowledge may not only become obsolete in a short time, as in case of the golden jackal, but any knowledge we assume we have may be false in the first place. My data show that the wolf and lynx were already stable members of the Hungarian fauna when the Red Book was published, and they have been present ever since that time. **They have low-density, but probably reproducing populations.** During the study period the wolf was present in the southern (Bács-Kiskun County) and northern (Aggtelek, Zemplén mountainous areas) parts of the country. **The occurrence of large carnivores in Hungary is still variable and low-intensity**. At present there are stable wolf and lynx populations only in the Northern Mountainous Region, but even these are **highly dependent on the populations in the neighbouring countries.** This is supported by the fact that their frequent occurrence is in correlation with the Slovakian and Polish population increases (Hell et al. 1997, Glowaciñski and Profus 1997, Jedrzejewska et al. 1997, Plodzieñ et al. 1996). Continuous field monitoring, stopping their illegal hunting and strict protection measures are advisable.

IV. The **red fox** is the best-known and the most common carnivores species in Hungary. Consequently it is our most important carnivore, both from the wildlife management and the

nature conservation point of view. Since it can spread the rabies, it should be considered in human hygiene. Its frequent occurrence in human settlements shows its high adaptivity. **Red fox population density has doubled nationwide, and there is evidence that in Transdanubia, where rabies has practically been eradicated, the rate of increase is faster.** However, the latest observations suggest that this population growth has reached its maximum and the curve is leveling out. The intensity and direction of population changes is similar to other European countries (Chautan et al. 2000). This increase, however, could not be completely explained as a result of immunisation. Irregular and inefficient population control also contribute to this process (Heltai et al. 2000). **Problems associated with population growth influence several areas.** It may cause difficulties for wildlife management especially in the small game areas, but these problems can probably be solved by planned, systematic and controlled management. However, it can cause higher damage in the **populations of protected species.** National parks are not prepared to control carnivores and competitors of protected species. The handling of the problem of urbanised red fox populations is entirely unsolved. **Human settlements** are often integrated into hunting areas, although they are unsuitable for wildlife management. The methods, place and timing of control are regulated for the red fox, which is a huntable species, by the hunting law. Thus, there is no straight answer to the question as to who is responsible for solving these problems. **Probably a separate organisation should be established for this purpose, and the legal framework for its work should be ensured.**

V. **The raccoon dog appeared as an alien species** among carnivores. The spread of this species in Europe, coming from Interior Asia, is due to humans, although we do not know whether Hungarian specimens derive Eastern-European populations or they are escaped animals from Hungarian fur farms. Our data show that the raccoon dog **occurs more frequently in the eastern part of the country;** some small reproducing populations are probable there. This fact would indicate natural appearance. Its presence in the Hungarian fauna is undesirable. **Hence, in addition to maintaining its unlimited open season, field checks of the observations and bag data, and the location and eradication of reproducing populations are desirable.**

VI. **The raccoon has also appeared in Hungary as a new species.** Proving specimen, pictures of wild animals in the field, and bagged animals provide unambiguous proof of its settling. In contrast to the raccoon dog, **it is more probable that some individuals escaped from captivity or were released pets,** as it was found at least in one case. In the pet shops anybody can buy a raccoon for about 30 000 Ft, which can be well-tamed when young, but getting older it becomes snappy. Judgement and proposals for future treatment are similar to those for the raccoon dog, i.e., **the main goal should be to check information in the field and eliminate reproducing populations.** Since animal trade is probably the main source of its spreading, such trade it should be limited or prohibited according to European recommendations (Orueta and Ramos 2001).

VII. **The populations and distribution area of badger have significantly increased.** It has become a common species countrywide to the end of the 90s. It does significant damage to ground-nesting species, as observed by the experts of nature conservation and wildlife management. Its agricultural damage has also become more frequent. On the basis of these facts the long-awaited decision on abolishing its protected status (decree, 13/2001 (V.9.) Ministry of Environment) and the declaration of its open season (decree, 90/2001 (XI.7.) Ministry of Agriculture) were justified. However, the changes in its legal status and its treatment make it very important to monitor the changes in its populations in the future, and to detect changes that might take place as a consequence of hunting. This is important in spite of the fact that its hunting season (15 July -15 February) does not really help to reduce the damage caused by badger. This has two causes: on the one hand, although the badger does not hibernate, from the beginning of November its activity significantly decreases; on the other hand, if a badger causes damage, it does so in the nesting and rearing period in spring. In order to minimise the damage caused by badger, it is evident that we should control them in this period.

VIII. **The range of pine marten** - similarly to that of badger, but to a much smaller extent - **has increased** during the study period. Presumably its population density has also increased, but we do not have data on this. This lack of data shows the limitations of our method, and underlines the importance of field investigations. Pine marten is more specialisted in its diet

choice and habitat requirements than badger, consequently its appearance in unforested areas is not expected. Moreover, international data on the high fluctuations of its population densities are warrity. **Abolishment of its protection is not recommended, but in areas where it is a threat by its nest-devastation to valuable bird species, population control or translocation of live caught individuals might be acceptable.**

IX. **According to my data, among our carnivores it was only the wildcat whose situation has clearly become worse in the 90s. Its range area and density have decreased,** it has disappeared from many parts of the country, and its remaining populations are probably fragmented. A species protection plan to save the wildcat and stabilise its populations is very urgent. Its protection should also be promoted by legal measures, therefore **I recommend that wildcat should be declared a strictly protected species and that its ideal value should be raised significantly.** This is particularly justified in the light of the fact that the otter, which occurs in its every potential habitat, enjoys the same high rank of protection.

X. Among small mustelids it is the **weasel, western polecat and stone marten that are generally common species.** None of them is under protection, but the weasel is not huntable. Culling of their population had no observable effect. It is true that all of them are well-trappable (Tapper 1992), but trapping is now totally absent from everyday hunting practices (Kőhalmy 1994). **I recommend to keep the existing hunting seasons for stone marten and western polecat, while for the weasel I propose the introduction of a hunting period.** However, as in the case of badger, we should reconsider the hunting seasons of mustelids. Stone marten and western polecat are huntable in autumn and winter, between 1 September and 15 February. All of these species, if they have an appreciable effect on nature conservation or wildlife management, then this effect is significant in spring during the nesting and rearing period. Thus, if the aim of declaring a species huntable is to reduce its damage, then the hunting season should cover this period.

XI. **Ermine** is vulnerable because of its special habitat and dietary requirements; its population changes are highly prey-dependent. (Erlinge 1977, Tapper 1976). It does not occur beyond its common habitats. **There is no reason to abolish its protection: its maintenance is recommended definitely.**

XII. **The situation of steppe polecat is the hardest to evaluate** in the lack of sufficient information. We should conduct field studies in the potential ranges identified on the basis of the questionnaire surveys to collect proving individuals and make detailed studies on them. **Maintenance of the protection of the species is justified primarily because of the lack of data on its status, and field studies should start as soon as possible.**

Summarising my results and findings I can conclude that I have achieved my purposes. I have established an up-to-date database, which allows mapping of population distributions and changes in Hungarian carnivores. However, work cannot stop here. We have to continue to monitor regularly carnivores populations in the future. As in wolf, lynx and golden jackal, we should begin to check questionnaire data in the field and reveal the causes of the changes in other carnivore species, too. Systematic and unified processing and evaluation of data should attract attention to many problems waiting to be solved. The most important ones are:

< The status of carnivore species is changing rapidly. Regular reconsideration and updating of the lists of huntable and protected species is therefore indispensable.

< These fast changes require a regular updated edition of the most popular books, e.g. the Red Data Book.

< Before placing a carnivore species on the list of huntable species, not only the causes but the aims of this decision should be identified. If the purpose is to reduce the damage done by a given species then the hunting season should be adjusted according to that.

- We should be prepared for the problems of alien, invasive species and stop their intensive area expansion and population increase.

- The growing populations of red fox and badger should be treated on a principled basis for nature conservation or game management purposes.

- Appropriate measures and actions are needed to tackle problems of urbanisation of carnivores. Legislation clarifying and regulating their population control is an urgent need.

Hungary is one of the richest areas of Europe as regards wildlife. Carnivore species play a significant role in this natural variability. ***We should show our appreciation of this treasure by treating, protecting or managing their populations on a principled basis, aware of their actual status.***

5. References

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6.4. Publications to popularise

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7. Scientific curriculum vitae

Name: Miklós Heltai
Qualifications: M.Sc. in agriculture and postgraduate diploma in game management University of Agricultural Sciences, Gödöllő
Institute: Department of Wildlife Biology and Game Management, Szent István University
Position: assistant lecturer

Teaching activity:

Graduate training: Field ecology methods in the wildlife biology (practical classes, 1995-1998), Zoological characterisation of wild birds and mammals (1998-), Wildlife biology practical classes I. Estimation of population parameters (1998-), Wildlife biology practical classes II. Maps, trapping, marking, diet analysis (1998-), Management of pastures and habitat developing (2001-)

Postgraduate training (1996-): Characterisation of wild birds and mammals I-II., Wildlife management and protection. (Habitat protection and improving)

Technical leader: distance education division (2002-)

Scientific activities:

< 1991-1994: Nature conserving importance of the introgressive hybridisation of wild and domestic cat (Hungarian Scientific Research Fund);
< 1994-1995: Data collection and evaluation in the huntable predator species more important for wildlife management and for protected ones (Ministry of Agriculture, Wildlife Management Fund);
< 1996-1998: National monitoring of some predator species important for wildlife management (Ministry of Agriculture Wildlife Management Fund);
< 1993-1996: Radiotelemetry study of migration and habitat use of red deer (Ministry of Agriculture Wildlife Management Fund);
< 1997-1999: Causes and wildlife managing consequences of seasonal habitat shift of red deer (Ministry of Agriculture Wildlife Management Fund);
< 1997-2000: Strategies of seasonal home range use in red deer (*Cervus elaphus*) (Ministry of Agriculture Wildlife Management Fund);
< 1997-1999: Effects of antirabies immunisation on red fox populations (Ministry of Agriculture Wildlife Management Fund);
< 1997-1998: Establishment of national monitoring system for study distribution and population changes of huntable and protected carnivores (Ministry of Environment, Central Environment Fund);
< 1999-2004: Long-term national monitoring of carnivore species and birds important for wildlife management and hunting based on a questionnaire survey (Ministry of Agriculture Wildlife Management Fund);
< 1999-2003: Long-term national monitoring of carnivores important for wildlife management and hunting based on field and laboratory studies (Ministry of Agriculture Wildlife Management Fund);
< 1999-2003: Study of large-scale space use and spreading of red deer (Ministry of Agriculture Wildlife Management Fund);
< 2001-2002: Monitoring of distribution and density changes of significantly endangered carnivores (Ministry of Environment, Central Environment Fund);
< 2001-2005: Study of repatriation of golden jackal and its effects in wildlife management (Ministry of Agriculture Wildlife Management Fund);

Altogether there are 24 Hungarian, 6 foreign language publications, 32 conference book materials and 28 publications in other places, in which I am first or a co-author.

Participation in the academic and professional life:

National: member of the Hungarian Ethological Society, member of the Hungarian Wildlife Management Society, wildlife management expert included into the official expert list of Ministry of Agriculture (1997-).

International: member of the Hungarian organiser committee of 2nd International Wildlife Management Congress (1999).

International relationships: TELEVILT Positioning A.B. Lindesberg (Sweden), Universitat für Bodenkultur, Institut für Wildbiologie un Jagdwirtschaft (Austria), Bialowieza National Parc (Poland).