SEMINAR
ON THE MANAGEMENT OF SMALL POPULATIONS OF THREATENED MAMMALS

Sofia, Bulgaria, 25-28 October 1993

SÉMINAIRE
SUR LA GESTION DES PETITES POPULATIONS DE MAMMIFÈRES MENACÉS

Sofia, Bulgarie, 25-28 octobre 1993

Convention on the Conservation
of European Wildlife and Natural Habitats

Convention relative à la conservation de la vie sauvage
et du milieu naturel de l'Europe

Environmental encounters, No. 17
Rencontres environnement, n° 17

Council of Europe Publishing

Council of Europe Publishing
F-67076 Strasbourg Cedex

ISBN 92-871-2470-1

Reprinted March 1999
Printed at the Council of Europe

In the last 10 years the Council of Europe held, in the framework of the Bern Convention, a series of seminars, workshops and working groups on conservation of threatened European mammals. Several reports on threatened species were also prepared. The main species discussed are given in the list below. The reader will be able to find some monographies on these species in the *Nature and Environment* series and, where colloquies were held, in the Environmental Encounter series. The Standing Committee to the Bern Convention decided to hold in 1993 in Sofia a seminar to evaluate how mammal conservation was progressing in Europe and how the Convention could adapt its strategy to the new threats on mammals. This work gathers the conclusions of that seminar and its proposals for mammal conservation in our continent.

Durant les dix dernières années, le Conseil de l'Europe a tenu, dans le cadre de la Convention de Berne, une série de séminaires, ateliers et réunions de groupes de travail sur la conservation des mammifères menacés de l'Europe. Divers rapports sur les espèces menacées ont également été effectués. Les principales espèces dont il a été question sont ci-mentionnées. Le lecteur pourra trouver quelques monographies concernant ces espèces dans la collection *Sauvegarde de la nature* et lorsque des Colloques sont organisés, dans la collection *Rencontres environnement*. Le Comité permanent de la Convention de Berne a décidé d'organiser en 1993 à Sofia, un séminaire afin d'évaluer comment la conservation des mammifères est assurée en Europe et comment la Convention pourrait adapter sa stratégie en vue de remercier aux nouvelles menaces pesant sur ces espèces. Ce document rassemble les conclusions du séminaire ainsi que des propositions en vue de garantir la conservation des mammifères sur notre continent.

Brown bear	*(Ursus arctos)*	Ours brun
European lynx	*(Lynx lynx)*	Lynx d'Europe
Iberian lynx	*(Lynx pardina)*	Lynx pardelle
Wild cat	*(Felis silvestis)*	Chat sauvage
European otter	*(Lutra lutra)*	Loutre d'Europe
Monk seal	*(Monachus monachus)*	Phoque moine
Grey wolf	*(Canis lupus)*	Loup
European mink	*(Mustela lutreola)*	Vison d'Europe

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I MEETING REPORT

1. Introduction

The Seminar on the management of small populations of threatened mammals was held in Sofia from 25 to 28 October 1993. A list of participants is given at the end of this report.

The participants felt that Appendix II of the Bern Convention needed to be revised to include new species, most from Central and Eastern Europe. A list of these species is found in the Appendices to this report.

Many ideas were expressed (see item 2), which were crystallised in some guidelines for the conservation of mammals (see Appendices).

N.B. Although the meeting was devoted to all mammals, there was not enough discussion on bats and cetaceans to admit that the conclusions and proposals below have been designed to cover those groups (although some may indeed also appropriately apply to their conservation).

2. Summary of main topics raised

There has not been any extinction of mammals in Europe in the last two centuries (with a few exceptions of species with a very marginal European distribution). Yet populations of many species of mammals have disappeared from great areas of Europe or have been reduced to small areas or very fragmented surviving populations.

Protected areas are useful tools for the conservation of threatened mammal populations. However, protected areas are often not extensive enough or are not well connected to abe able to sustain viable populations of some mammal species (particularly big carnivores). Thus some protected areas need to be extended and conservation of wild life has to be taken into account outside protected areas. This implies that an important part of the conservation and management of mammals needs to be done in agricultural land, forests and range-lands which support human activities and rural populations.

Unlike most bird, reptile or invertebrate species, some threatened vertebrates may create, even in low densities, important conflicts with farmers, foresters or fishermen for the direct damage they can cause to crops, livestock, hunting animals or fisheries. This happens even if direct damage is irrelevant in total economic terms, as it may be concentrated on certain areas or flocks. Appropriate compensation schemes for that damage have to be contemplated, including adequate insurance systems supported both by the farming, hunting or fishing communities affected and by conservation agencies. More research needs to be done on the efficiency of present compensation systems.

To minimise those conflicts, selective removal of particularly damaging animals may be good conservation policy but general licences to shoot animals at any time should be avoided. No species of a threatened mammal should receive a "pest" status. Use of poisons is to be completely excluded and use of carnivores snares and traps strictly controlled.

Compensation for damage policies have to be linked with preventive measures to avoid damage. This can take the form of, for instance, protecting bee-hives from bear attacks or changing flock movements, guarding them at night and protecting them with dogs to avoid attacks by big predators. As much of the damage is done by feral cats and dogs, it is

of importance to control those animals strictly, specially where their attacks could be attributed to wild mammals.

Other conservation measures for mammals limit some economic activities or prevent or modify development projects. These may also be a source of conflict with different administrations or some social groups. There the importance of adequate information and increasing awareness in the value of mammal conservation is of paramount importance.

Research and monitoring of mammals should be given great attention by conservation agencies, so as to be able to detect in sufficient time which populations have not (or risk not to have) a satisfactory conservation level.

The international dimension of management of wild mammals has often been neglected. Yet population sizes of some species particularly those with vast individual home ranges - are often too small within a single state to assure the satisfactory level of genetic variety required to assure long term survival. Many important populations appear in mountain regions which are shared by different states. This implies that minimum viable populations can only be assured for the whole of the transboundary distribution of the species, so that states need to collaborate to harmonise their conservation policies regarding those species. This is true for species like the wolf, European lynx, pardel lynx, bear, wolverine, wildcat (in parts of Central Europe), and, to a lesser extent, it also concerns species of big herbivores (deer, ibex, chamois, etc.). Important European regions where this harmonisation can be useful are Fennoscandia, the Balkan and Iberian Peninsulas, the Alps, the Carpathians, the Pyrenees and the vast plains in Central and Eastern Europe, from Poland and the Baltic states to Belarus, Russia and Ukraine.

The Bern Convention provides a very appropriate legal and operative instrument ready to be used to start such harmonisation processes.

II PROPOSALS FOR INCLUSION IN APPENDIX II OF THE BERN CONVENTION

INSECTIVORA
Desmana moschata

RODENTIA
Apodemus microps
Microtus cabrerae
Mesocricetus newtoni
Myonimus roachi bulgaricus

CARNIVORA
Vormela peregusna peregusna (now in Appendix III)
Mustela eversmanni
Cuon alpinus
Lynx caracal

ARTIODACTYLA
Gazella subgutturosa
Gazella dorcas
Bison bonasus

CETACEA
Monodon monoceros

III GUIDELINES FOR THE CONSERVATION OF EUROPEAN MAMMALS

The participants at the seminar propose that Parties to the Bern Convention:

1. Give special conservation attention to all small populations of mammal species which are endangered or vulnerable at the European or regional (Carpathian, Balkan, Alpine, etc) level.

2. Carry out extensive programmes of monitoring of threatened mammal populations to know the trends in their numbers and the causes affecting them.

3. Consider (or, if appropriate, reinforce) recovery plans for the list of populations or species listed in Appendix A to this proposal.

4. Evaluate whether the species or populations listed in Appendix B to this proposal require recovery plans. Monitor populations of those species and of any other species the conservation status of which may not be satisfactory, so that decline of populations may be known before they become very threatened.

DESIGN AND IMPLEMENTATION OF CONSERVATION AND RECOVERY PLANS

5. If appropriate and relevant, design conservation and recovery plans for the whole regional population involved, and in coordination with neighbouring states having a part of the population concerned. Pay special attention to coordination in the main European mountain ranges (Pyrenees, Alps, Balkans, Carpathians, etc), especially for conservation of big carnivores (bear, wolf, lynx), trying to coordinate national strategies for those species. Use, if appropriate, the framework of the Bern Convention to enhance such cooperation.

6. Set clear and measurable goals for the conservation or recovery plans; provide adequate long-term administrative, legal and financial means for their implementation; reevaluate the plans as they are being implemented with the knowledge obtained in their development; base conservation plans on sound studies on the biology of the population concerned.

7. Involve, in the design and implementation of recovery plans, other administrative departments; local authorities, people responsible for economic activities which may be affected by the plan and other social groups (hunters, game managers, anglers, visitors, foresters, livestock raisers, voluntary conservation groups, etc) with an interest in the species or population to be preserved.

8. Evaluate whether the species concerned requires particular habitat conservation measures and whether existing protected areas are able to sustain viable populations of the species. If required take measures to give protection status to the core areas of the population, enlarge protected areas or improve their habitat quality; consider taking similar measures to neighbouring areas which may be naturally colonised by the species; establish policies to protect the species outside protected areas proper.

9. Avoid, as far as possible, conflicts with traditional or occasional users of the area where the concerned population lives, by paying compensation for the damage caused by the species, by preventing that damage (protecting flocks, controlling feral dogs and cats, etc), by not restricting unnecessarily economic or leisure activities and by promoting economic activities compatible with the conservation of the species; carry out adequate information campaigns on the conservation interest of the species and the need to preserve it.

APPENDIX A: Taxa needing recovery plans

[] Not in the appendices of the Convention {} in Appendix III of the Convention

MAMMALS

INSECTIVORA
- Talpidae
  - *[Desmana moschata]*

MICROCHIROPTERA
- ?

RODENTIA
- Gliridae
  - *[Myonimus roachi bulgaricus* (BG,TK)]
- Cricetidae
  - *[Mesocriecetus newtoni]*

CARNIVORA
- Canidae
  - *Canis lupus* (South E,N,S,Alps)
  - [*Cuon alpinus*]
- Ursidae
  - *Ursus arctos* (A,F,GR,I,E,)
- Mustelidae
  - *Mustela lutreola* (F,E,ROM,EST)
  - *Lutra lutra* (LUX,B,D,NL,GR -Corfu-, CH,S)
  - *Gulo gulo* (SF,N,S)
  - *{Vormela peregusna peregusna}*
- Felidae
  - *Lynx pardina*
  - *{Lynx lynx* (South Balkans)}
  - *[Lynx caracal]*
  - *Panthera pardus*
- Phocidae
  - *Monachus monachus*

ARTIODACTYLA
- Bovidae
  - *Capra pyrenaica pyrenaica*
  - *{Ovis ammon anatolica}*
  - *[Bison bonasus]*

CETACEA
- Delphinidae
  - *Tursiops truncatus (tursio)(GB)*
- Phocaenidae
  - *Phocaena phocaena* (Black Sea)

APPENDIX B : Taxa to be evaluated as candidates for recovery plans

[] Not in the appendices of the Convention {} in Appendix III of the Convention

MAMMALS

INSECTIVORA
- Talpidae
  - *Galemys pyrenaicus*

MICROCHIROPTERA
- ?

RODENTIA
- Pteromidae
  - *Pteromys volans* (EST, LAT)
- Sciuridae
  - *Sciurus anomalus* (GR)
- Cricetidae
  - *Cricetus cricetus* (B,BG,F,NL)
  - [*Cricetulus migratorius* (BG)]
- Microtidae
  - [*Microtus cabrerae*]
  - [*Apodemus microps* (BG)]
- Zapodidae
  - *Sicista subtilis* (A,BG,H)

CARNIVORA
- Canidae
  - *Canis lupus* (D,I,P)
  - [*Canis aureus* (GR)]
  - *Alopex lagopus* (N,S,SF)
- Ursidae
  - *Ursus arctos (Czech,N,PL,S)*
- Mustelidae
  - *[Mustela eversmanni]*
  - *Lutra lutra* (F,I,DK,N,A)
  - *Gulo gulo* (SF,N,S)
- Felidae
  - *Felis silvestris* (B,F-Corse-,D,GR-Pel.& Cret.-,I-Sard.Sic-,LUX,PL,CH,GB)
  - {*Lynx lynx* (A,D,F,I,CH}
- Odobenidae
  - *Odobenus rosmarus*

ARTIODACTYLA
- Cervidae
  - [*Gazella dorcas*]
  - [*Gazella subgutturosa*]
- Bovidae
  - [*Rupicapra rupicapra balcanica*]

CETACEA
- Delphinidae
  - *Delphinus delphis*
  - *Tursiops truncatus*

I RAPPORT DE LA REUNION

1. Introduction

Le Séminaire sur la gestion des petites populations de mammifères menacés s'est tenu à Sofia, du 25 au 28 octobre 1993. La liste des participants figure à la fin du présent rapport.

Les participants ont estimé qu'il convient de réviser l'Annexe II de la Convention de Berne pour y ajouter certaines espèces, principalement d'Europe centrale et orientale. La liste des ces espèces figure à l'annexe du présent rapport.

De nombreuses idées ont été présentées (voir thème 2). Elles ont été traduites en une série de directives pour la conservation des mammifères (voir annexes).

N.B. La réunion était consacrée aux mammifères, mais les débats n'ont pas assez porté sur les chauves-souris et les cétacés pour que les conclusions et les propositions ci-dessous visent ces groupes (même si certaines peuvent à juste titre s'appliquer à leur conservation).

2. Résumé des principaux points abordés

L'Europe n'a pas déploré l'extinction de mammifères au cours des deux derniers siècles (hormis quelques exceptions concernant des espèces dont la distribution en Europe est très marginale). Par contre, des populations de nombreuses espèces de mammifères ont été éliminées de vastes étendues du continent, ou ont été confinées à de petites régions ou réduites à des populations fragmentées.

Les zones protégées sont de précieux instruments dans la conservation de populations de mammifères menacés. Malheureusement, leur taille est souvent insuffisante, ou elles ne sont pas assez raccordées à d'autres pour supporter des populations viables de certaines espèces de mammifères (et de grands carnivores en particulier). Il faut donc envisager l'extension de certaines zones protégées, et la conservation de la vie sauvage à l'extérieur de ces zones. Dès lors, une part importante du travail de conservation et de gestion des mammifères doit se faire dans des terres agricoles, des forêts, et des étendues occupées par les activités humaines et les populations rurales.

Contrairement à de nombreuses espèces d'oiseaux, de reptiles ou d'invertébrés, certains vertébrés menacés provoquent des conflits avec les agriculteurs, les sylviculteurs et les pisciculteurs par des ravages dans les cultures, le bétail, les animaux de chasse et les pisciculture. Ces conflits surgissent même quand l'impact économique des dommages directs est négligeable dans l'ensemble, car ils se limitent généralement à quelques zones ou troupeaux. Il convient donc de prévoir des programmes adaptés de dédommagement, assortis de plans d'assurance adaptés, financés tant par les collectivités d'agriculteurs, de chasseurs ou de pisciculteurs concernées que par les organismes de conservation. L'efficacité des programmes actuels de dédommagement mérite des recherches complémentaires.

Afin de limiter les conflits, il arrive que l'élimination d'animaux particulièrement ravageurs soit une bonne politique de sauvegarde, mais il convient d'éviter les permis d'abattre des animaux à tout moment. Le statut de "nuisance" ne doit être donné à aucune espèce de mammifère menacé. L'usage de poisons est à bannir totalement, et l'utilisation d'appâts à carnivores et de pièges doit faire l'objet d'un contrôle strict.

Les politiques de dédommagement pour les dégâts doivent s'accompagner de mesures préventives contre ces ravages: protection des ruches contre les ours, modification des

mouvements de troupeaux, garde des troupeaux pendant la nuit et protection de ceux-ci par des chiens contre les grands prédateurs. Comme les chiens et chats errants sont responsables d'une part importante des ravages, il doivent faire l'objet d'un contrôle draconien, surtout quand leurs dégâts pourraient être attribués à des mammifères sauvages.

D'autres mesures de sauvegarde des mammifères consistent à limiter certaines activités économiques ou à modifier des projets de développement. Elles peuvent générer des conflits avec divers secteurs de la société ou administrations. Une bonne information et une sensibilisation à l'importance de la sauvegarde des mammifères sont alors indispensables.

Les organismes de conservation devraient accorder une grande importance à la recherche et à la surveillance des mammifères, afin de repérer à temps les populations qui risquent (ou non) de faire l'objet d'une protection insuffisante.

La dimension internationale de la gestion des mammifères sauvages est souvent négligée. Pourtant, la taille des populations de certaines espèces au sein d'un même pays (et en particulier celles dont l'aire de distribution est très étendue) est souvent trop réduite pour offrir un niveau de diversité génétique suffisant pour garantir la survie à long terme. Bon nombre de populations importantes vivent dans des régions montagneuses partagées par plusieurs Etats. Dès lors, le seuil de population viable peut uniquement être atteint sur l'ensemble de la distribution transfrontalière de l'espèce, c-à-d avec la collaboration des Etats et l'harmonisation de leurs politiques de sauvegarde de ces espèces. Ces considérations concernent le loup, le lynx d'Europe, le lynx pardel, l'ours, le glouton, le chat sauvage (dans certaines régions d'Europe centrale) et, dans une moindre mesure, quelques espèces de grands herbivores (cerf, bouquetin, chamois, etc.). Les grandes régions où une telle harmonisation serait appréciable sont la Finlande-Scandinavie, les péninsules Ibérique et des Balkans, les Alpes, les Carpates, les Pyrénées et les vastes plaines d'Europe centrale et orientale, qui s'étendent de la Pologne et des Etats Baltes au Bélarus, à la Russie et à l'Ukraine.

La Convention de Berne fournit un instrument juridique et opérationnel particulièrement adapté, prêt à être utilisé dans une telle harmonisation.

II PROPOSITIONS POUR INCLUSION A L'ANNEXE II DE LA CONVENTION DE BERNE

INSECTIVORA
Desmana moschata

RODENTIA
Pteromys volans
Apodemus microps
Microtus cabrerae
Mesocricetus newtoni
Myonimus roachi bulgaricus

CARNIVORA
Vormela peregusna peregusna (now in Appendix III)
Mustela eversmanni
Cuon alpinus
Lynx caracal

ARTIODACTYLA
Gazella subgutturosa
Gazella dorcas
Bison bonasus

CETACEA
Monodon monoceros

LIGNES DIRECTRICES POUR LA CONSERVATION DES MAMMIFERES D'EUROPE

Les participants du séminaire proposent que les parties de la Convention de Berne:

1. accordent une attention particulière à la conservation des petites populations de mammifères menacés ou vulnérables à l'échelle européenne ou régionale (Carpates, Balkans, Alpes, etc.);

2. déterminent, par de vastes programmes de surveillance des populations de mammifères menacés, le nombre d'individus et les problèmes qui les affectent;

3. envisagent (et, le cas échéant, renforcent) des plans de rétablissement pour les populations et espèces de la liste de l'annexe A de la présente proposition;

4. examinent si les populations et espèces de l'annexe B de la présente proposition exigent un plan de rétablissement; surveillent les populations de ces espèces et de toutes celles dont le statut de conservation n'est pas satisfaisant, afin que leur déclin soit connu avant d'être trop grave;

CONCEPTION ET MISE EN OEUVRE DES PLANS DE CONSERVATION ET DE RETABLISSEMENT

5. conçoivent, s'ils sont nécessaires et pertinents, des plans de conservation et de rétablissement pour l'ensemble de chaque population touchée, et en collaboration avec les Etats voisins possédant une partie de telles populations; accordent une attention particulière à la coordination dans les principaux massifs montagneux d'Europe (Pyrénées, Alpes, Balkans, Carpates, etc.), principalement pour la sauvegarde de grands carnivores (ours, loup, lynx), tout en s'efforçant de coordonner les programmes nationaux visant ces espèces; utiliser, si nécessaire, le cadre de la Convention de Berne pour améliorer une telle coopération;

6. fixent des objectifs clairs et mesurables aux plans de conservation et de rétablissement; prévoient, pour le long terme, les moyens administratifs, juridiques et financiers adaptés à leur mise en oeuvre; réévaluent les plans en cours de mise en oeuvre à la lumière de leur déroulement; fondent des plans de sauvegarde sur des études rigoureuses de la biologie de la population visée;

7. fassent participer à la conception et à l'application de ces plans de rétablissement d'autres administrations, les collectivités locales, les responsables de secteurs économiques qui pourraient être affectés par les plans, et d'autres communautés (chasseurs, garde-chasses, pêcheurs, visiteurs, sylviculteurs, éleveurs de bétail, associations bénévoles de sauvegarde de la nature, etc.) concernées par l'espèce ou la population à protéger;

8. étudient si des mesures particulières de conservation de l'habitat sont nécessaires pour l'espèce envisagée, et si les zones protégées existantes permettent d'assurer la subsistance de populations viables de l'espèce; prennent, le cas échéant, des mesures pour protéger le noyau d'une telle population, étendre les zones protégées ou augmenter la qualité des habitats; envisagent des mesures similaires pour les zones voisines susceptibles d'être colonisées par l'espèce; définissent des politiques susceptibles de protéger l'espèce à l'extérieur des zones protégées proprement dites;

9. évitent, dans la mesure du possible, les conflits avec les utilisateurs habituels ou occasionnels des zones où vivent les populations concernées, en versant des dédommagements pour les ravages provoqués par l'espèce, en évitant de tels ravages (protection des troupeaux, contrôle des chiens et chats sauvages, etc.), en n'y limitant pas à l'excès les activités économiques ou de loisirs, et en encourageant les activités économiques compatibles avec la conservation de l'espèce; mènent des campagnes d'information sur l'intérêt de la conservation de l'espèce et sur l'importance de la sauvegarder.

ANNEXE A: Taxon nécessitant des plans de rétablissement

[] Pas aux annexes de la Convention {} à l'Annexe III de la Convention

MAMMIFERES

INSECTIVORA
- Talpidae
  - *[Desmana moschata]*

MICROCHIROPTERA
- ?

RODENTIA
- Gliridae
  - *[Myonimus roachi bulgaricus* (BG,TK)]
- Cricetidae
  - [*Mesocriecetus newtoni*]

CARNIVORA
- Canidae
  - *Canis lupus* (South E,N,S,Alps)
  - [*Cuon alpinus*]
- Ursidae
  - *Ursus arctos* (A,F,GR,I,E,)
- Mustelidae
  - *Mustela lutreola* (F,E,ROM,EST)
  - *Lutra lutra* (LUX,B,D,NL,GR -Corfu-, CH,S)
  - *Gulo gulo* (SF,N,S)
  - *{Vormela peregusna peregusna}*
- Felidae
  - *Lynx pardina*
  - *{Lynx lynx* (South Balkans)}
  - *[Lynx caracal]*
  - *Panthera pardus*
- Phocidae
  - *Monachus monachus*

ARTIODACTYLA
- Bovidae
  - *Capra pyrenaica pyrenaica*
  - *{Ovis ammon anatolica}*
  - *[Bison bonasus]*

CETACEA
- Delphinidae
  - *Tursiops truncatus (tursio)(GB)*
- Phocaenidae
  - *Phocaena phocaena* (Black Sea)

ANNEXE B : Taxons à être examinés pour un plan de rétablissement eventuel

[] Pas aux annexes de la Convention {} à l'Annexe III de la Convention

MAMMIFERES

INSECTIVORA
- Talpidae
  - *Galemys pyrenaicus*

MICROCHIROPTERA
- ?

RODENTIA
- Pteromidae
  - *Pteromys volans* (EST, LAT)
- Sciuridae
  - *Sciurus anomalus* (GR)
- Cricetidae
  - *Cricetus cricetus* (B,BG,F,NL)
  - [*Cricetulus migratorius* (BG)]
- Microtidae
  - [*Microtus cabrerae*]
  - [*Apodemus microps* (BG)]
- Zapodidae
  - *Sicista subtilis* (A,BG,H)

CARNIVORA
- Canidae
  - *Canis lupus* (D,I,P)
  - [*Canis aureus* (GR)]
  - *Alopex lagopus* (N,S,SF)
- Ursidae
  - *Ursus arctos (Czech,N,PL,S)*
- Mustelidae
  - *[Mustela eversmanni]*
  - *Lutra lutra* (F,I,DK,N,A)
  - *Gulo gulo* (SF,N,S)
- Felidae
  - *Felis silvestris* (B,F-Corse-,D,GR-Pel.& Cret.-,I-Sard.Sic-,LUX,PL,CH,GB)
  - {*Lynx lynx* (A,D,F,I,CH}
- Odobenidae
  - *Odobenus rosmarus*

ARTIODACTYLA
- Cervidae
  - [*Gazella dorcas*]
  - [*Gazella subgutturosa*]
- Bovidae
  - [*Rupicapra rupicapra balcanica*]

CETACEA
- Delphinidae
  - *Delphinus delphis*
  - *Tursiops truncatus*

LA SITUATION DES MAMMIFERES MENACES EN EUROPE. PREVISIONS POUR LES 20 ANS A VENIR.

Par François de Beaufort.

Résumé

Les premières réflexions et travaux sur les mammifères menacés à l'échelle de l'Europe sont à imputer au Conseil de l'Europe: la publication en est faite en 1969 avec dix-sept espèces ou groupes cités. A sa large échelle géographique et depuis une époque récente, l'Europe n'a pas vraiment connu d'extinction de mammifère mais 5,5% des espèces d'Europe sont plus généralement menacées à l'échelle du monde: Les livres rouges nationaux tendent à établir des taux de 25 à 75 % d'espèces menacées selon ces pays: Tous ces chiffres annoncés ne peuvent toutefois être pris à l'état brut car leur examen critique révèle de grandes hétérogénéités dans les critères utilisés et les informations sur lesquelles ils reposent: Une bonne évaluation est censée reposer sur la connaissance de la répartition; des populations; et de leurs évolutions passées et actuelles:

Sur les 245 espèces de mammifères d'Europe, un peu plus de la moitié peuvent être considérées comme rares ou localisées, menacées, vulnérables, ou en nette régression; 5% sont des espèces introduites qui posent un problème particulier.

Le statut annoncé de certaines espèces doit être révisé soit du fait d'appréciations antérieures non fondées ou d'artefacts, soit du fait de l'acquisition de nouvelles connaissances, soit plus naturellement de celui de l'évolution de leur situation numérique ou spatiale. Les questions de taxonomie, définitions et critères étant supposées élucidées et harmonisées, l'échelle géographique considérée doit être affichée clairement.

Les pressions sur les habitats et leurs composantes se traduisent en premier lieu par des régressions, simplifications et pertes de qualité au niveau local: c'est une étape nouvelle dans les prévisions et pour les plans à venir, et qui prolongera le succès des plans prioritaires internationaux et nationaux qui ont assuré la survie "génétique" d'échantillons des espèces les plus, menacées et la sauvegarde des espaces les plus remarquables.

Les prévisions quant à l'avenir des espèces de mammifères reposent sur leur évolution passée, les tendances actuelles, leurs potentialités biogéographiques et leur capacité d'expansion, leur dynamisme populationniste, les ressources dont elles pourront disposer, les risques naturels, épidémiologiques et technologiques auxquelles elles seront exposées, les pressions directes auxquelles elles seront soumises selon leur "encombrement", la concurrence à laquelle elles pourront leur être appliquées. Après la réussite des approches conservationistes - aucune espèce ne disparaîtra à l'échelle de l'Europe - des stratégies intégrant les différentes échelles géographiques et la notion de qualité vont être développées et seront confrontées plus directement encore à la démographie et aux habitudes de vie des populations humaines.

STATUT ET PROBLEMES DE CONSERVATION DU DESMAN DES PYRENEES

(*Galemys pyrenaicus* Geoffroy, 1811)

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Résumé:

Malgré les lacunes et les incertitudes sur certains sujets de l'histoire naturelle du desman des Pyrénées *Galemys pyrenaicus*, une mise au point sur l'état des connaissances de cette espèce est exposée.

Questions concernant la régression de son aire de distribution, ces réquisits écologiques et les paramètres populationnels sont aussi discutés.

***Galemys pyrenaicus* est un petit insectivore aquatique véritablement menacé. La révision du statut de cette espèce, la définition des priorités de l'étude et de la gestion de l'habitat, et les propositions pour la coopération internationale en ce qui concerne sa conservation sont nos tâches pour l'avenir.**

Une mise au point sur l'état des connaissances de l'histoire naturelle du desman des Pyrénées, la base biologique pour une soutenable stratégie de conservation, frappe sur un ensemble de lacunes et d'incertitudes. Difficultés liées à l'espèce et aux milieux qu'il peuple compliquent les recherches. Il a une aire de répartition restreinte, il est très fragile en élevage et extrêmement discrète dans la nature. D'autres espèces plus grandes, plus belles ou qui traditionnellement sont objet de chasse, ont centralisé l'intérêt des naturalistes. Pendant un siècle et demi les études scientifiques ont resté très fragmentaires.

Dans ce cadre, mammalogistes et techniciens liées à la gestion des cours d'eaux et des espaces naturels se sont réuni à Lisbonne (Meeting on the Pyrenean Desman, September 1992).

Cette communication est le résultat des conclusions de la réunion d'experts et aussi de ma propre expérience et réflexion sur les travaux déjà publiés sur le desman. J'espère qu'elle puisse contribuer pour vous intéresser au petit groupe des desmaninae, qui a chez *Galemys pyrenaicus* et *Desmana moschata*, les seules 2 représentants.

Aire de distribution: y a-t-il une régression ?

L'aire de distribution actuelle du *Galemys pyrenaicus* inclue certaines zones du nord et du centre de la Péninsule ibérique et la région des Pyrénées.

Sur les registres paléontologiques, ce groupe d'insectivores aquatiques était plus répandu au Miocéne (PUISSÉGUR, 1935). Au Pleistocène Ancien, une espèce déjà très semblable à l'actuelle (*Galemys kormosi*) peuplait les cours d'eaux de l'Europe dans un territoire qu'aujourd'hui s'étend de la Hongrie aux îles Britanniques (RUMKE, 1985; HARRISON et al, 1988). Ces auteurs discutent la contraction de l'aire de répartition du *Galemys* au Pleistocène. A leur avis, cette régression peut être expliquée par un phénomène de compétition avec les musaraiognes aquatiques du genre *Neomys*, qui ont apparu sur les

registres paléontologiques au Pleistocène Moyen. Aujourd'hui c'est seulement au Pyrénées qu'on peut rencontre le desman et *Neomys fodiens* dans les mêmes systèmes riverains. *Neomys anomalus*, une espèce moins confiné aux habitats aquatiques, une distribution qui inclue celle du *Galemys*, étant sympatrique à la Péninsule Ibérique.

B RICHARD responsable par un travail détaillé sur l'aire de répartition du desman en **France** (1976 et SFEPM, 1984), a aussi publié une carte de distribution de l'espèce, référenciant pour l'Espagne des bourses d'extinction régionale (RICHARD, 1986). L'introduction accidentelle du vison (*Mustela vison*), potentiel prédateur du *Galemys*, et une capture très élevée d'exemplaires pour les musées sont, a son avis, les causes de cette régression (PODUSCHKA & RICHARD, 1986).

Due à l'absence de données précis sur la distribution de cette espèce dans la Péninsule Ibérique, la situation antérieure n'est pas connue. Certaines informations données par les populations locales et la révision de la bibliographie peuvent contribuer pour référencer l'occurrence du desman dans le passé. Aujourd'hui au Portugal, il est difficile de confirmer l'occurrence de l'espèce au Bassin hydrographique du Mondego où, dans les années 70 a été capturé (ENGELS, 1972). A la même époque, cette espèce était connue aux limites de la "Serra da Malcata", dans les affluents du bassin du Douro (versant nord) et dans les affluents du Tejo (versant sud-ouest).

Malgré son caractère parcellaire et les différents méthodologies employées, les études se sont développés seulement dans les dernières années.

Les enquêtes aux populations locales, particulièrement aux chasseurs et aux pécheurs sportives, personnes qui passent beaucoup de temps dans les rivières, donnent un cadre de références qui doit être confirmer par un travail sur le terrain.

Au **Portugal**, les informations positives vs. nombre d'enquêtes au nord-est du pays indiquent une répartition plus régulière et une abondance relative plus élevée dans les régions de Bragança et de Vila Real (QUEIROZ, 1989). Dans cette zone, le Parc Naturel de "Montesinho" (région nord-est) a déjà été objet d'une prospection de terrain (RAMALHINHO & TAVARES, 1989). On a pu confirmer l'occurrence de l'espèce en (cours d'eaux où elle a été capturée ou signalée par des vestiges indirects (excréments).

Au Parc National de "Peneda-Gerês" (nord-ouest du Portugal), où un travail de prospection détaillé a été mis en oeuvre, le desman semble être présent dans tous les cours d'eaux permanents, dès les petits ruisseaux torrentiels jusqu'aux rivières qui traversent les vallées glaciaires. Il est aussi présent dans les ruisseaux de la plus haute partie du complexe "Peneda-Gerês" (+ 1000 mètres d'altitude). Dans ce type d'habitat, l'eau es relativement peu rapide et le substratum du lit est constitué par sable et petit cailloux (QUEIROZ, 1991).

En **Espagne**, les résultats d'un questionnaire indiquent la présence du desman à la Corniche Cantabrique, en Galicia et dans la partie nord-est du Bassin du Douro. Il est aussi présent sur le Bassin de l'Ebro (les Pyrénées espagnoles inclues), la partie sud-est du Douro et la partie nord-est du Tejo, malgré les données beaucoup plus faibles dans ces zones (NORES et al., 1993a). La confirmation de ces résultats par récolte d'excréments dans les rivières a été possible seulement dans " régions (Asturias, la Rioja et Navarra), malgré les 25 qui ont été prospectées.

CASTIEN & GOSALBEZ (1992; 1993) présentent une carte de distribution de l'espèce au Pyrénées Occidentales (Pays Basque) sur une maille UTM de 10 x 10 Km. HERNANDEZ (1988) a étudié la distribution du desman à l'échelle d'un cours d'eau (rivière de "Torio" - bassin du "Douro", Leon) : 9 observations pour un parcours de 60 Km de longueur (de la

naissance à 1450 mètres d'altitude jusqu'à la confluence avec la rivière de "Bernesga" à 850 mètres) ont permis la confirmation de sa présence.

Il faut aussi se questionner sur les caractéristiques limitatives de sa distribution. Les investigateurs pensent que des facteurs comme l'altitude et la précipitation peuvent contribuer pour expliquer les limites de la distribution. RICHARD (1976) écrit même que "si on regard l'ensemble des régions habitées par le desman des Pyrénées, on voit que l'aire de répartition de l'espèce coïncide avec l'extension des zones de plus fortes précipitations et, dans une mesure moins exacte, avec celle des forêts de feuillus". NORES et al (1993a) ajoute comme hypothèse la limite liée à la répartition annuelle des précipitations : deux périodes de maximum de pluviométrie, l'une en automne et au début de l'hiver, et l'autre en mai. Cette dernière étant particulièrement prononcée aux bassins recevant l'eau de la fonte des neiges.

Il est difficile d'avoir une position sur l'extension d'une régression de l'aire de distribution. Pour une conclusion fondamentale il fallait avoir plus de données de terrain et surtout une étroite collaboration entre tous les biologistes qui étudient le *Galemys*.

Habitat : quels sont ses réquisits écologiques ?

TRUTAT (1891) et PUISSÉGUR (1935), les premiers investigateurs qui ont étudié le desman des Pyrénées, décrivent déjà l'habitat caractéristique de cette espèce : les ruisseaux de montagne, les cours d'eaux courante, froide et oxygénée, pleines de larves et adultes d'insectes aquatiques. C'est aussi la partie occupé par la truite (*Salmo trutta*) et le cincle plongeur (*Cinclus cinclus*).

L'habitat potentiel du *Galemys* voit son contour élargie au même temps qu'on confirme la présence de l'espèce dans nouveaux endroits où manquait de l'information.

COMBES & SALVAIRE (1964) ont capturé un exemplaire du desman dans la grotte de l'Aude (France). L'occupation des portions souterraines des cours d'eaux est aussi décrites par BERTRAND (1993a).

Cet auteur a constaté l'occurrence de l'espèce dans les lacs d'altitude en haute vallée d'Ossau (Hautes-Pyrénées). Cette donnée contredit l'idée très fortement établie dans la bibliographie sur l'habitat du desman où les caractéristiques torrentiels du milieu sont celles qui mieux le décrivent. De l'autre coté, une fois que les lacs sont profondément gelés pendant près de six mois par an, il serait particulièrement intéressant de connaître la biologie et l'écologie de ces animaux (BERTRAND, op.cit.).

Les segments hautes-moyennes de certaines rivières, tandis qu'ils sont plus affectés par les modifications antropocentriques, semblent avoir des conditions pour héberger le desman. Au Portugal, des observations et captures sporadiques nous donnent quelques fois ce type d'informations.

Les études se limitent à décrire les habitats et laissent sans réponse la question **pourquoi** il y habite ou **pourquoi** il est absent. Quelles sont les caractéristiques d'habitat qui assure la présence du desman ?

La qualité des eaux, un des paramètres importants pour la diagnose du milieu aquatique, paraît troubler moins directement notre insectivore que l'on pensait avant. BERTRAND (1993a) réfère la présence du desman dans un affluent de la rive droite du Salat, dans la ville de Saint-Girons (Pyrénées françaises), où ce cours d'eau ressemble plus à un égout qu'à une rivière. Moi-même, j'ai connaissance qu'au rivière du Gerês (région nord-

ouest), dans le village de Caldas do Gerês, cette espèce est fréquemment observée. En été, la pression touristique et le réduit débit dans cet endroit contribuent pour le définir comme un cours d'eau moyennement eutrophisé. Immédiatement en aval de la station de traitement d'eaux résiduelles du Gerês, un collègue qui étude la faune ichtyologique a capturé 2 exemplaires de *Galemys* avec son appareille de pêche électrique (F GONCALVES, com. pess.)

Maintenir la fourrure imperméable et thermiquement isolant sont des réquisits indispensables pour un petit mammifère aquatique. RICHARD (1973) pense que la matière organique en solution dans l'eau peut influencer la bonne condition du pelage, dissolvant la couverture sébacée, qui le lubrifie et l'imperméabilise.

Les eaux peu polluées sont riches en nourriture et on trouve de nombreux membres de presque tous les groupes d'invertébrés. La diversité est maintenue pour un remplacement de ces habitants typiques pour espèces généralistes et ubiquistes qui appartient surtout aux milieux pollués ou modifiés (ZWICK, 1992). Pour un desman, si d'autres problèmes écologiques et physiologiques ne se posent pas, cette disponibilité peut être une bonne raison de (sur)vivre.

Mais les plus récents études sur le régime alimentaire du desman (SANTAMARINA & GUITIAN, 1988; SANTAMARINA, 1993; BERTRAND & CLERGUE, 1992; BERTRAND, 1993b) indiquent que cette espèce est clairement un mangeur de Trichoptères, tandis que tous les autres groupes d'invertébrés benthiques sont également consommés dans une proportion plus faible. Cette spécialisation trophique extrême nous amène à la question des réquisits écologiques et, entre autres, à la sélection des cours d'eaux et des segments occupés en fonction de sa disponibilité "qualitative" en proies.

Une fois que les Trichoptères sont l'un des groupes d'invertébrés aquatiques les plus exigeants en matière de qualité de l'eau et d'adaptation au milieu torrentiel, une liaison entre l'espèce et l'habitat propre et montagnard reste non touché. Mais on ne sait pas si cette espèce peut devenir plus opportuniste quand un changement des conditions écologiques s'impose à son milieu aquatique originel. Les auteurs qui ont étudié son comportement alimentaire en captivité remarquent son caractère généraliste. Mangeant différents types de nourritures le desman peut s'adapter à un régime monotone parfois constitué par "proies morts" tels que des souris, des larves terrestres d'insectes ou des morceaux de foie de boeuf (NIETHAMER, 1970; RICHARD, 1986; QUEIROZ & ALMADA, 1993).

Les prédateurs du desman des Pyrénées, passés en revue par NORES et al (1993c) incluent espèces tant différents comme *Ardea cinerea, Nycticorax nycticorax, Ciconia ciconia, Esox lucius, Strix aluco, Tyto alba et Buteo buteo* pour lesquelles il est une proie occasionnelle.

La loutre, *Lutra lutra*, est pour excellence le prédateur naturel du *Galemys*, étant référencé pour le nord-est de l'Espagne une taxe de 25 truites pour 1 desman dans les excréments analysés.

L'activité prédatrice du vison, *Mustela vison*, sur le desman n'a pas été encore confirmé.

Les aménagements hydro-électriques et tous les changements physiques et morphologiques du lit et des berges semblent avoir des conséquences sur l'habitat du desman. Comme on a constaté, beaucoup de petite centrales sont projetées pour les ruisseux et les rivières habités par le desman des Pyrénées (QUEIROZ, et al, 1993).

La submersion des berges primitives et la destruction des nids et des endroits de repos sont conséquences de l'élévation artificiel du niveau des eaux; Il est bien probable que

la nouvelle ligne des eaux n'a pas des conditions pour remplacer le besoin de refuge de cette espèce qui utilise les racines des arbres ripicoles et les espaces entre les blocs de pierre.

La formation de lacs cause aussi la diminution de la vélocité et de la profondeur des eaux. Ces modifications affectent la composition du substratum, augmentent l'accumulation des sédiments fins et diminuent la concentration d'oxygène au fond. La réduction de l'abondance et de la diversité de la macrofaune d'invertébrés benthiques est une des plus graves conséquences.

La profondeur et le substratum fin peuvent aussi affecter la capacité du desman de s'alimenter: l'animal doit nager des plus grandes distances et dépenser plus de temps pour arriver au fond avec les griffes des pattes postérieures attachés à la gravière et aux blocs de pierre, comme on a déjà décrit (QUEIROZ & ALMADA, 1991).

A l'aval de la zone de rétention ou dérivation des eaux, un débit minimum convenable doit être assuré. La définition du "débit écologique", laquelle permet au cours d'eau de remplir son rôle de milieu varié, a en Portugal, en Espagne et en France un différent encadrement législatif.

Mais la conservation des populations existants avant l'aménagement doit avoir en considération le maintien des fluctuations du débit et des hautes eaux périodiques. Un pourcentage du débit annuel moyen ou du débit mensuel moyen du mois plus sec de l'année peut ne pas assuré la diversité et l'abondance de la faune aquatique.

Populations : sont-elles naturellement rares ?

Les études de l'espèce dans le milieu naturel on fourni, jusqu'à présent, très peu de données sur les paramètres populationnels. Un grand nombre de points restent encore pour éclaircir.

On ne sait presque rien sur l'âge potentiel et la durée de vie réelle estimé par RICHARD (1976b) par l'usure des dents. Il propose la classification des animaux en classes, la dernière incluant les plus âgés, avec au moins trois ans. Les problèmes pour déterminer la longévité du desman aux Pyrénées se heurte avec la méconnaissance de l'âge exact de certains animaux, qui aurait pu servir de mesure absolue. REY-FRAILLE et al. (1993) ont étudié le même sujet avec une population ibérique utilisant les lignes d'incrément du ciment dans une section histologique du canin gauche inférieur. Les lignes d'incrément se forment en hiver et au printemps et la première ligne noir apparaît à la fin du premier an de vie. Lorsqu'on utilisait une différente méthodologie, les résultats obtenus ont été presque les mêmes.

Les études histologiques de PEYRE (1961; 1968) nous donnent les plus valables informations sur la reproduction du *Galemys* à la région pyrénéenne. Il distingue 2 catégories de femelles adultes, les gestantes et les postpartum, et une catégorie de jeunes et d'immatures. La phase de pleine activité génitale du mâle dure de novembre à la fin juin et la moyenne mensuelle du nombre de femelles en gestation est plus haut en février, mars et mai. Elles est plus haut en février, mars et mai. Elles peuvent avoir une phase oestrale avec accouplement au cours de la lactation et un maximum de 3 portées par an. Le nombre d'embryons trouvés dans l'utérus va de un à cinq, mais quatre est le plus courant. La gestation dure environ 30 jours.

Le pourcentage de kystes ovariens est très élevé chez les femelles multipares (26 sur 36 soit environ 72%). L'évolution extrême des formations kystiques aboutit à la stérilisation complète de l'ovaire. Etant donné l'origine particulière de ces kystes, on peut dire que

l'intersexualité ovarienne chez le *Galemys* constitue un facteur limitant de la capacité de reproduction de cette espèce (PEYRE, op. cit.).

Notre connaissance sur l'occupation de l'espace au milieu naturel est aussi très restreinte. RICHARD & VIALLARD (1969) supposent que 2 animaux de sexe opposé vivent au voisinage l'un de l'autre dans un domaine déterminé. Données plus récentes dans la même population (STONE, 1987a) montrent que des individus suivis par radio-télémétrie en mai et juin forment couples mâle-femelle et défendent leur territoire contre les voisins conspécifiques par vigilance et marques odorants. Les couples voisins occupent des territoires contigus avec presque la même longueur. Comme le territoire du mâle est un peu plus grand que celui de la femelle, une certaine juxtaposition est possible. Cette zone de juxtaposition est beaucoup plus patrouillé ce qui semble avoir une rôle de défense. Les jeunes et les adultes solitaires habitent le domaine des couples. STONE (1987b) montre aussi que le mâles et la femelle du même couple habitent différents nids, de l'un et de l'autre côté de la rivière.

Si on constate que cette utilisation du milieu basé dans un comportement d'évitement réciproque peut-être généralisé pour d'autres populations, on établirait comme naturelle pour le *Galemys* une faible densité même en bonnes conditions écologiques. Cette forme de rareté est bien connu pour les espèces exigeantes, du point de vue écologiques (besoin de ressources alimentaires abondantes) et éthologique (territorialité, relations sociales complexes).

Petits groupes populationels sont laissés isolés par la construction de barrières, tels que celles des aménagements hydro-électriques, ou par la dégradation de certains segments des cours d'eaux. ils deviennent plus sensibles aux modifications de l'environnement en conséquence de l'appauvrissement de sa variabilité génétique, de l'augmentation de la taxe de l'"inbreeding" et du stress dûs à l'incapacité des jeunes de se disperser. Difficultés spécifiques de se déplacer dans le milieu terrestre empêche les échanges entre individus de différents sub-populations et la recolonisation des zones isolés où l'espèce peut devenir régionalement extincte (QUEIROZ et al., 1993).

***Galemys pyrenaicus* : un taxon menacé**

Les modifications anthropogéniques des cours d'eaux sont les responsables pour la régression de l'espèce dans tout l'aire de distribution.

La pollution des eaux, les altérations du lit et des berges, et la fragmentation du continu de la rivière sont évoquées comme les principales menaces au habitat du desman des Pyrénées.

Les effluents urbains, industriels et mineurs déchargés dans les rivières sans traitement ont transformé dans tout l'Europe la composition et la richesse de la faune riveraine. Nous connaissons ses effets sur l'ichtyofaune, qui est heureusement bien mieux étudié.

L'exploitation de matériel graveleux, les aménagements hydrauliques avec régularisation du lit et des berges, l'abat de la végétation riveraine sont, entre autres, des plus graves éléments d'artificialisation des ruisseaux naturels.

Les petites centrales hydro-électriques, aujourd'hui défendue contre les grands aménagements, ont aussi un impact négatif sur la qualité de l'habitat du desman. Les endroits où les eaux sont plus rapides (ainsi plus propres, plus oxygenées et plus riches en invertébrés aquatiques) sont les mieux adaptés pour une exploitation au fil d'eau. Une coïncidence entre l'aire de répartition du *Galemys* au Portugal, l'habitat préférentiel de l'espèce et les sites authorisés pour construire des petits centrales hydro-électriques,

préoccupe les investigateur (QUEIROZ et al., op. cit.). La fragmentation du continue de la rivière signifie l'isolement de sub-populations amoindris, aussitôt soumis à variations numériques très marqués, a grave danger d'extinction.

a) Révision du statut

Le desman des Pyrénées a été classifié comme vulnérable au Livre Rouge de I.U.C.N. (1990), au Livre Rouge des espèces menacées en France et au Livre Rouges des Vertébrés du Portugal (1990). Le Livre Rouge des Vertébrés d'Espagne (1991à considère cette espèce comme **rare.** *Galemys pyrenaicus* est aussi inclue dans la Liste des Mammifères Menacés d'Europe (Conseil de l'Europe, (1981) et dans l'annexe II de la Convention de Berne (**strictement protégé**). A la Directive des Habitats (Communauté Européenne), *Galemys pyrenaicus* est considéré une espèce **menacée** (annexe 2) et à **habitat menacé** (annexe 4).

Si on essaye d'appliquer les nouveaux critérium de l'I.U.C.N. (Union Mondiale pour la Nature) pour la classification des espèces (MACE et al., 1992) notre méconnaissance sur certains paramètres populationnels, d'habitat et de l'aire de répartition devient de plus en plus évident. Les nouvelles catégories de menace se sont définie sur une base quantitative (au contraire des antérieures qui sont essentiellement qualitatives). Pour le desman des Pyrénées, nos incertitudes nous empêchent de les remplir sans doutes. L'application des critérium sur l'estimation de l'état des populations (**très fragmenté et dans un déclin continue** observé, inféré ou projeté) ou sur l'extension géographique (**dans un déclin continu** observé, inféré ou projeté) peut nous conduire à l'inclusion de l'espèce à la catégorie de **menacé** (EN - endangered, dans la version originale), si aucune sub-population ne surpasse pas les 1000 individus.

b) Définition des priorités d'étude

Même si on constate les nombreuses lacunes de connaissance, il est possible d'identifier quelles seront à court terme les questions prioritaires que la conservation que cette espèce nous imposera.

En matière de répartition géographique, il faut faire une carte de distribution unique, actualisée et basée dans la même méthodologie, étudiant aussi les facteurs qui limitent la distribution et l'abondance de l'espèce.

En ce qui concerne l'habitat du desman, il faut faire un inventaire complet des endroits fréquentés suivant les désignations établies par une liste internationale (par exemple, CORINE biotopes, manual, 1991). Il faut aussi coordonner les efforts pour qu'on puisse établir une fiche descriptive patronnées, remplie régulièrement pour achever la qualité de l'habitat de l'espèce.

L'évaluation systématique de l'importance relative des facteurs qui posent les populations en risque d'extinction, nommée "analyse de la viabilité populationnel" (PVA, population viability analysis, à la version originale de GUILPIN & SOULE, 1986), exige qu'on connaisse les principales caractéristiques des populations en étude (nombre d'individus, sex-ratio et classes d'âge; taxe de reproduction et de survivance) et tous les réquisits spécifiques qui permet (ou pas) au *Galemys* de résister aux variations naturelles de l'environnement et aux impacts humains.

Qu'est-ce que pour le desman des Pyrénées un minimum viable de population (MVP, "minimal viable population", en version originale) ? Quel sera le nombre d'individus suffisant pour avoir une population avec une probabilité élevé de survivance et aussi de retenir une

grande proportion de la capacité génétique de s'adapter et d'évoluer avec les modifications de l'environnement ? Nos connaissances ne nous permettent pas de donner une réponse.

Si un jour les populations à l'état sauvage tomberaient à des niveaux critiques, programmes de réhabilitation, réintroduction et d'élevage en captivité doit perfectionner notre processus de capture et de manipulation des animaux. Il faut éviter les études qui emporteraient risques graves pour cette espèce.

Avant d'avoir tous les paramètres biologiques pour une analyse de viabilité populationnel, on doit laisser notre expérience nous conduire avec des données basiques disponibles et prévenir, plus que récupéré et amélioré, les dommages sur le milieu naturel.

c) Gestion de l'habitat

D'une façon générale, on peut dire que la gestion écologique intégrée des rivières est le mesure le plus important et préventif de la dégradation de l'habitat du desman. En faveur de cette pratique, ce que signifie réintégrer les activités humaines dans les équilibres naturels, BOON (1992) a considéré 6 classes d'arguments:

1 raison éthique (devoir vis à vis des générations futures);
2 maintien d'une ressource existante et d'un cadre de vie;
3 intérêt pratique (qualité de l'eau, zone d'épandage des crues, contrôle de l'érosion, maintien d'un stock d'espèces valorisables, etc);
4 valeur économique (tourisme, pêche, activités sportive);
5 valeur esthétique, paysagère patrimoniale, espace récréatif;
6 éducation et recherche scientifique;

La délimitation de zones strictement protégées dans lesquelles les modifications anthropocentriques des milieux naturels seront nuls ou négligeables (écosystèmes originels, dans le sens de WASSON, 1992) doit assurer la manutention de "sanctuaires" pour l'espèce, où le desman peut être préservé dans une situation privilégié. Ces endroits peuvent héberger les réserves génétiques que permettrons réhabiliter autres populations en danger d'extinction, servir de patron pour l'évolution de l'espèce et l'étude de sa biologie.

L'amélioration des habitats dégradés doit suivre les régles que les conduisaient à un état plus proche de la situation naturel. Le traitement des eaux, la récupération des berges, l'établissement d'un flux "écologique", sont les mesures plus considérées. Dans le cas du desman, l'étude des barrières (ou l'adaptation de celle utilisés par les poissons) serait une des bases pour l'élimination de l'effet d'isolement causés par les aménagement hydro-électriques.

d) Coopération international

La sub-famille DESMANINAE comprend 2 espèces reliques, *Galemys pyrenaicus* et *Desmana moschata*, avec des aires de distribution résiduelles. Les habitats aquatiques qu'elles peuplent sont des milieux fragiles et menacés, ce que constitue la principale cause de régression pour ces espèces.

Portugal, Espagne et France, qui auberge le desman des Pyrénées dans ses territoires, la Russie, l'Ukraine, le Belarus et le Kasakistan, qui auberge le desman de Russie, ont la responsabilité de garantir que ce patrimoine mondial peut se conserver pour les générations futures. Mais dans le domaine de l'investigation et de la gestion des milieux naturels, le support international peut être de grand importance. La grave situation économique et l'intérêt diminué que les autorités gouvernementaux démontrent pour ces espèces, relégue pour un arrière plan la recherche scientifique et les options intégrés pour les rivières.

Réunis à Lisbonne **Meeting on the Pyrenean desman**, September 1992), biologistes, gestionnaires des zones protégées, et membres d'organisations non-gouvernementales pour l'environnement, ont décidé d'échanger informations sur l'état des connaissances, facteurs de menace et méthodologies de travail sur l'habitat et la biologie du *Galemys*. Les investigateurs de la Russie, invités pour la réunion mais malheureusement absents, ont présenté deux communications en vidéo et un poster. Un plan de coopération scientifique que j'ai accordée avec Dr Gennady Khakhin pour la Conservation des Desmaninae, et qui intègre nos 2 institutions (Instituto da Conservação da Natureza du Portugal et l'Institute de la Conservation de la Nature et des Réserves de la Russie) n'a pas eu encore des conditions matériels pour se développer.

Mais on sait que la formation d'un groupe international pour la Conservation des DESMANINAE, capable de coordonner la recherche et d'intégrer les données, d'élaborer une stratégie de conservation conjointe et sensibiliser les authorités, les populations locales et le public en général pour la préservation des insectivores aquatiques, est notre tâche pour l'avenir.

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RUSSIAN DESMAN PROTECTION STRATEGY

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The Russian Desman, inhabitant of Eastern Europe, is included into the Red Books of Russia, the Ukraine, Belarus and Kazakhstan by the International Union of Nature Protection.

In the past it was a product of fur trade in Russia.

In 1892, there was an attempt to limit the desman hunting but it yielded no positive results. Since 1920, the hunting of this animal has been forbidden everywhere. Since 1929, works have begun to settle the desman both inside and outside its natural habitat. All in all, about 10 000 animals were settled. Nevertheless, these activities didn't affect the increase of the animals number because of the absence of protection, biotechnical and other activities, though as the result of these works, new areas of desman habitat appeared, for example, in Western Siberia.

In the forties, the license hunting of desman was permitted which lasted until 1956 but in spite of the limited hunting, the number of the animal continued to decrease, and in 1957 the desman hunting was forbidden.

At present the desman is preserved in the basin of the Volga - 23 000 species; the Don, 10 000 - 12 000; the Dniepre, 2 000 - 3 000; the Ural, 2 000; the Uy and the Tobol, 2 000 - 2 500 species.

For the last 25 years, the desman number has decreased almost twice, and makes up about 40 000 species. It is anthropogenic factors that lie in the basis of this decrease. These factors can be subdivided into 2 groups.

The first group is desman habitat destruction due to:

- the creation of the water reservoir cascade along the Volga that resulted in sharp decrease of desman number in Tatarstan, in Samara, in Uljanovsk, in Nizhniy Novgorod, Kostroma districts and also construction of the Volgogradskaya hydro-power station that led to desman number decrease in the Volga-Akhtuba flow-lands:
- drainage of flow-lands in several areas resulted in total disappearance of desman. In Vladimir district due to this activity, 30% of all small rivers formerly inhabited by the species disappeared.
- considerable pollution of rivers and other reservoirs with sewage waters that also led to desman disappearance in several regions of the country.

Factors of the second group leading to direct extermination of desman holes and animals themselves are the following:

- fishing with nets;
- ploughing of flow-lands, wood and bush cuttings, cattle pasture;
- trapping of muskrat with traps, having mesh less 45mm;
- mass tourism, followed by trampling and pollution of the coasts of water reservoirs.

Many years experience of simple desman hunting prohibition didn't justify itself as the animal has been protected minimally. At present, there are 5 reservations and 80 reserves that the desman inhabits and where it is protected, but even there, there are many problems of its preservation. The majority of reserves where the desman is one of the protected animals are complex by their status, and it means that there is no special attention to the desman preservation.

At present, the number of specialists studying this animal is very scarce. Nevertheless, the modern level of our knowledge about this animal allows us to carry out activities necessary to restore its number.

The tasks have, as their aim, scientifically-based general strategy of the species restoration (see the scheme).

At the first stage, it is necessary to conduct activities in the following two directions: finding out and preservation of big natural areas of the desman habitat and working out the techniques of breeding the species under artificial conditions.

Inventory making of lands and making up their cadastre should precede finding out and organisation of the animal big habitat protection areas. The methods and lands evaluation.

After inventory making of the lands, there appears an opportunity to select from the highly valued lands' areas with a comparatively high desman density. These large areas will constitute those natural "genetic banks", the protection of which should be paid a special attention to. The broodfemales of these reservations can be used for creation of new populations.

At present the organisation of new protected desman reservations is impeded.

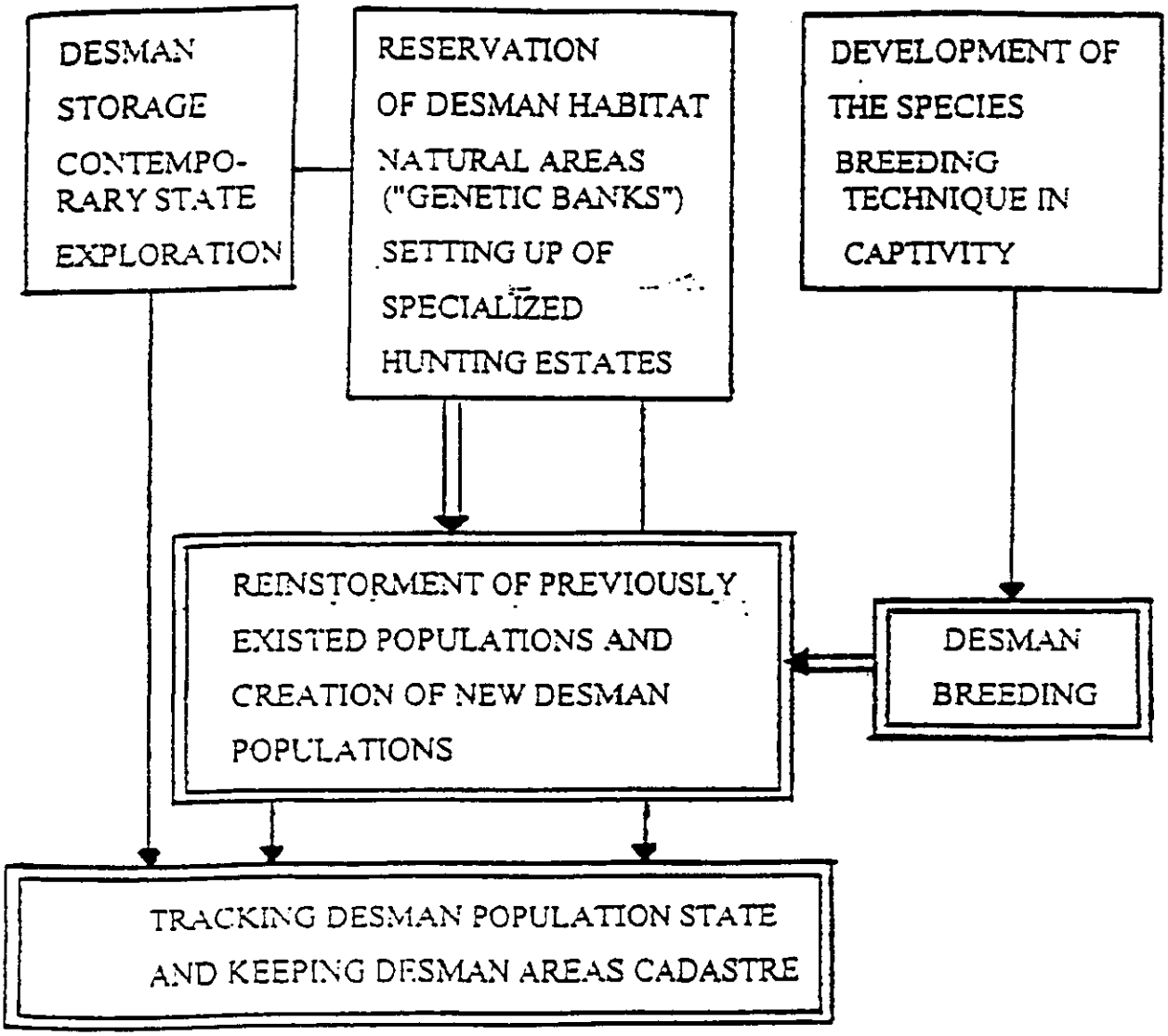
The way out of the current situation can be implementation of a new form of desman protection and that is setting up hunting sports estates which specialise in desman protection. Such farms have already been set up and gained a good reputation.

Multiplication of desman in captivity has not been obtained yet, but diversified schemes of the desman breeding and feeding regime (up to 5 years) have been worked out.

The main aim of the experiments carried out in the country is getting litters of the animals born in captivity. Further on, it is intended to find out a number of the necessary conditions for successful breeding of this species. These activities are being carried out on the basis of Khoper State Reservation.

The problem of desman preservation is the problem of preservation and recultivation of deteriorated flow-land biotopes; and conservation of these sites depends on many organisations which are exploiting flow-lands.

Due to poor implementation of the federal laws at places, there is urgent need to carry out an inventory of desman habitats and reserves to promote developing concrete measures on desman preservation.



The Scheme of activities on desman storage reinstorment

EXPLAINING THE STATUS, CONSERVATION NEEDS AND MANAGEMENT REQUIREMENTS OF THE SPECIES *Panthera pardus tulliana* AND *Lynx caracal* IN TURKEY

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1. *Panthera pardus tulliana* Valenciennes, 1856

1.1. Historical evolution

Lions and wild oxen once roamed the Anatolian plains. The wild ox (*Bos primigenius bojanus*) became extinct about the first century B.C. It is clear from Hittite and Assyrian statues and reliefs that it had been present in large numbers. Ancient Hittite relics from 3 000 to 1 000 B.C. found in central Anatolia clearly show too that, at one time, the roar of the lion could be heard in Asia Minor. Today, the only lions one may see are carved in stone.

Although it is believed the lion became extinct here by the 13th century, there have been reports of sightings in southern Anatolia and in the Euphrates valley in the 1800s.

Max Kasparek, when writing about the historical occurrence of the lion (*Panthera leo*) in Turkey, in "Zoology in the Middle East", Heidelberg, says the country "always seems to have been on the edge of the distribution range of the lion".

That the lion was present in Turkey is well-known from archaeological sources dating as far back as the Hittite period. But in "Die Säugetiere (Mammalia) der Türkei" (Mammals of Turkey), Munich 1975, the author H. Kumerlöve wrote that he could find only one record of the lion's presence in Turkey since the classical Greco-Roman period.

In 1880, Charles Danford, co-author with E.R. Alson, of "On the Mammals of Asia Minor", wrote that he was given information that around 1870, a lion was hunted after it had killed many horses near Birecik on the Euphrates.

In this context, it is worth noting that there were still lions in Southern Anatolia in the mid-19th century.

Charles Fellows, a traveller who visited Asia Minor twice, once in 1838 and again in 1840, was a collector of archaeological inscriptions and ancient coins, but he was also interested in plants and animals.

On his second visit to Turkey he went to the classical site of Sidymae, close to the Mediterranean, south of Fethiye. There he obtained information from the local population which proves the presence of lions at that time. I reproduce here the original description by Fellows:

"The present state of this district is extremely wild; only three or four huts are amidst these ruins on the mountain, and their occupants always have their guns slung over their shoulders, even within the limits of their own cultivated fields.

"On inquiry as to why this custom prevailed, we were told the country was full of wild animals and of the fiercest kind. I was extremely cautious and particular with my inquiries as to their nature, and have no doubt the truth of the account which I heard from many people of the surrounding district, and each unknown to the other. In this village alone, four or five lions, called "aslan" by the Turks, and other animals called "kaplan" (leopard), are killed every year. The man who first told me had himself taken the skins to the Aga, to present to different Pashas, and these presentations had been rewarded by sums of 100 to 200 piastres, which he had himself received. The lions, he said, are timid unless surprised or attacked, and I could not hear that they did much injury to the flocks."

At another point, Fellows directly links his observations with the sculptures on classical buildings from the Greek period.

"The bull contending with lions is the most common subject of the bas-reliefs. The lion is seen everywhere throughout the valley of Xanthus; every bas-relief, tomb, seat or coin shows the figure or limbs of this animal. Lions still live in its (Turkey's) mountains.

"It can thus be taken as certain that a small population of lions was able to survive in southern Turkey, at least until the middle of the last century," Fellows wrote.

Kasparek adds more evidence that lions did exist here. Evliya Çelebi, he writes, saw a stuffed lion at Şebinkarahisar in the northwest Erzincan. The animal was said to have lived in the vicinity of the town for seven years and to have preyed on sheep, goats and cattle. It was hunted and brought to the governor who had the skin stuffed and fixed above the gates of the town. Çelebi described the lion as "a tremendous and gigantic animal" but he exaggerated its size considerably.

Another animal extinct in Asia Minor is the tiger (*Panthera tigris*). Although a tiger was shot in southeastern Turkey in 1970, it is more appropriate to list the tiger as extinct in this country rather than scarce, because this is the only tiger reported to have been seen in the last 50 years. The tiger, a male, was hunted in Uludere, Hakkari. Wounded during the hunt, the animal escaped into the forest, but his body which had been preserved, was found three days later after birds of prey had been seen circling. The skin measured 122 centimetres.

From time to time, stories are told by local hunters in the Siirt and Hakkari provinces that tigers are still hunted in the area. According to these tales, between one and eight tigers are shot each year; their skins are said to be sold to Iraq. But these reports are not supported by any evidence.

Over the last 50 years, the increase in Turkey's population from 10 to 55 million, the modernisation of agriculture, the industrialisation and the expanded transport systems have all taken their toll of the game population. Some species have diminished in number, others are becoming scarce.

Leopards, lynxes and hyenas still exist but not in huntable numbers. The Anatolian leopard (*Panthera pardus tulliana*), which lives in the mountains of western, southern and southeastern Turkey is very rarely seen, but is believed not to be extinct.

In the reports of the annual General Assembly of the Conseil International de la Chasse, which met in Warsaw, Poland, in June 1973, the Anatolian leopard was listed as one of the threatened big game species of Europe and Asia. No indication was given as to the possible size of the population.

1.2. Description and identification

Valenciennes described for the first time a species of *Panthera pardus*, which hunted in the vicinity of Izmir in 1856, as *P. p. tulliana*. The body (with head), tail length and height measurements of the Anatolian leopard, were respectively 125 to 130 cm, 80 to 85 cm and 60 to 70 cm. The head was large and round, the jaw bone protruded forward, and the neck short. The main colour of the skin was a pale red but the dorsal side was darker. The front sides of the neck and the chest, and the inside of the legs were yellow. But the spots were smaller and thicker.

This animal is strong, agile, dashing and deceitful. It can not run fast and it preys by night. It can easily climb up a tree and jump down on the prey. When it attacks the herds of pigs, deer and roe deer, it tears most animals. It mates in January and February, and three months later gives birth to two to three cubs. It usually lives 16 to 22 years.

1.3. Habitat

It lives in very steep and rocky places, forests, clumps of trees or large forested areas and sometimes steppes. It sometimes comes close to villages. In the past, the Anatolian leopard was common in passes and sheer mountain drops, hilly areas and sites covered with trees, shrubs or maquis components. It also lives in large and deep valleys. It ranges at about 3 500 metres above sea-level.

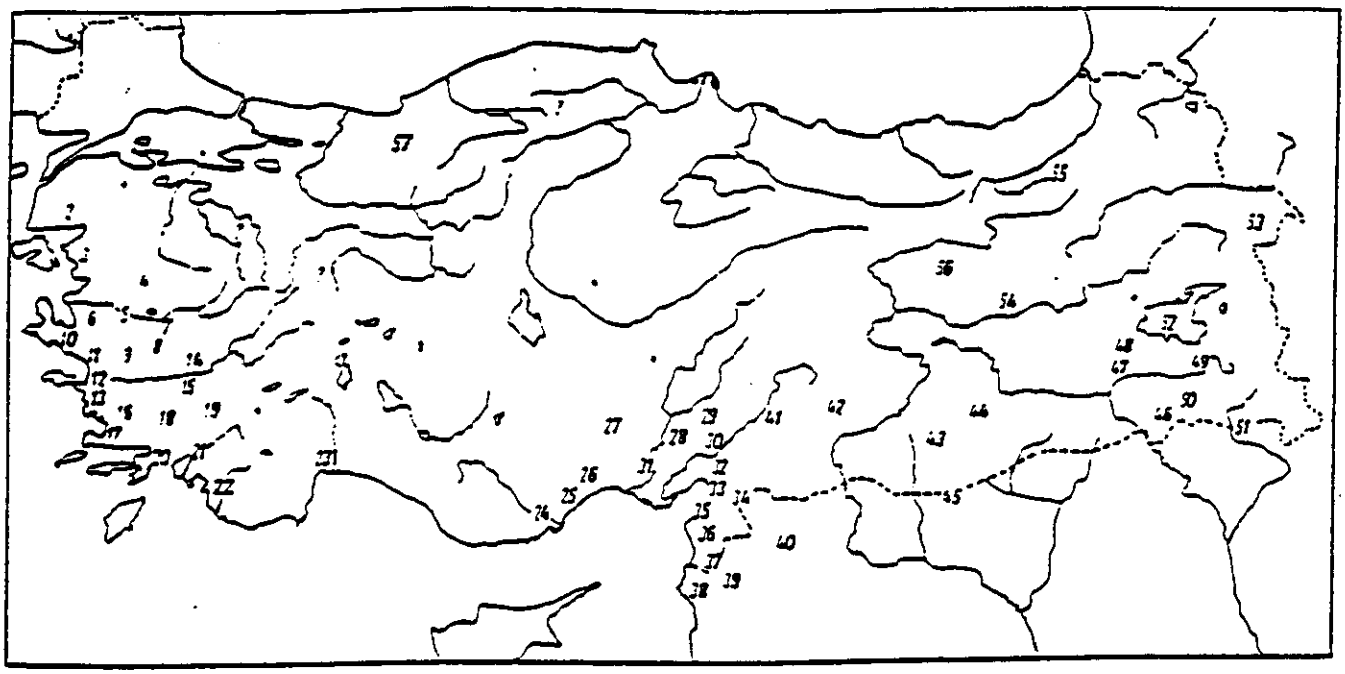
1.4. Distribution sites in Anatolia

According to the ancient drawings excavated in Çatalhöyük, the leopard had been present in Anatolia since 6 000 B.C. (Malaert 1971). There were leopard skins among the thousands of animal samples that were added up in Tanscaucasia and taken to Paris by E. Chantre, an archaeologist, in 1881 (Kumerlöve 1980).

In the excavations of Altvınova, Korucutepe and Norşuntepe in central Anatolia, leopard bones were also found together with others (Boessneck and Driesch 1975). According to the same discovery, the Anatolian lion became extinct about 1870 and the Anatolian leopard was becoming scarce.

The sites where the Anatolian leopard was seen were:

Bolu-Abant, Artvin-Hopa, Erzurum-İspir, Kars, Ağri, Erzincan-Kamah and Kiğı, Bitlis-Sarp mountain, Urfa, Malatya-Besni, Hakkari-Çatak and Çıtak mountain. Izmir-Salihli-Manisa, Seferhisar, Kuşadası-Sirince village, Görüme mountain, Ödemiş-Tire, Aydın, Söke, Denizli-Çivril-Acıpayam, Milas, Muğla-Bodrum, Antalya (Alanya, Akseki, Kaş, Kızılağaç and Gazipaşa). The sites in Anatolia where *Panthera pardus tulliana* had been shown are given in Figure 1.



Alep/Aleppo (Syrien)	40	Iskenderun	35
Alexandrette = Iskenderun	35	Ispir	55
Amanus-Gebirge (Teilbezeichnungen u.a. Gâvur Dağlari, Nur Dağlari) cf. Dörtyol (33), Hassa (34), Belen (36)		Izmir (Smyrna)	6
Andirin	29	Kadirli	30
Antalya	23	Kaplan Dağı (Biber Dağı)	27
Ararat-Massiv (Büyük Ağri Dağı)	53	Karacali Dağı	44
Ayaş	25	Karacasu	18
		Kaz Dağı—Kocakatran Dağlari	2
Balya	1	Köyceğiz	21
Belen (Amanus)	36	Kozan	28
Besni	42	Kuşadasi	12
Beşparmak Dağlari	14	Latakia/Lattaquie (Syrien)	38
Beyrüşebap (Beytişebap)	50	Manisa (Sipil Dağı)	5
Bingöl	54	Maraş	41
Bitlis	48	Marmaris	20
Bodrum	16	Milas (Beşparmak Dağlari)	14
Buldan (— Karacasu)	19	Muğla	15
Çal (syr./türk. Grenzraum)	51	Ödemiş	8
Çatak	49	Osmaniye	32
Cudi Dağlari	46	Salihli	7
Çukurova (Ebene von Adana)	31	Seferihisar	10
Diniker Dağlari (Kozan)	28	Siirt	47
Dörtyol	33	Silifke	24
Efes (Ephesos)	11	Şitak cf. Çatak	
Erdemli	26	Slenfé (Syrien)	39
Erzin (— Osmaniye)	32	Söke (Sokya)	13
Erzincan — Elazig	56	Soma	4
Fethiye	22	Tavas (— Karacasu)	17
Geyikli Dağlari	3	Tektek Dağlari (Uria)	43
Gökdere (— Bingöl)	54	Teil Halaf (syr.-türk. Grenzzone)	45
Hassa	34	Tire	9
		Van Gölü	52
		Yayladağı (Keldağ etc.)	37

Figure 1. The sites where *Panthera pardus tulliana* was observed in Anatolia (Kumerlöve 1971)

1.5. Hunting sites

Hasan Mantoluoğlu, a hunter, killed about 50 leopards between 1930 and 1950 in the vicinity of Izmir and sold their skins.

According to Kumerlöve (1978), a total of 15 to 23 leopards existed in Anatolia: 5 to 7 in the vicinity of Izmir, 2 to 4 on the inner side of western Anatolia, 3 to 5 in the Taurus Mountains and 5 to 7 in eastern Anatolia.

One female in Bolu-Abant in February 1967, another one in Eskişehir-Çatacık in 1972, one male in Kars-Karakale on 12 May 1970, one female in Ağrı in March 1972 and one in Beypazarı-Sağözü on 18 January 1974, were hunted. A female and its cub were hunted in the latter place the same year. The weight of the individual that was killed in the forest, in the north western part of Bolu, was 176.8 kg.

The male hunted in Kars-Karakale Village on 12 March 1970 measured 125 cm and the female hunted in the Ağrı Mountain in April 1972 was 130 cm in length (Baytop 1973).

Around 1975, a leopard was shot in the mountain between Erzurum and Yusufeli-Kılıçkaya.

During the Roman period, leopards had been ordered as a purchase from Asia Minor and used to torture people.

On 18 July 1966, the decision was made by the Central Hunting Commission that leopard hunting was to be prohibited in Turkey.

Sites where it still exists in Anatolia: the National Park of Kuşadası-Dilek Peninsula (10.700 ha).

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SIGN SURVEYS AS AN IMPORTANT TOOL IN CARNIVORE CONSERVATION RESEARCH AND MANAGEMENT PROGRAMMES

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INTRODUCTION

Biological information regarding a species population status and ecological requirements is critical for its survival. Throughout the world many carnivore species are quickly becoming threatened or endangered and virtually nothing is known of their ecological requirements (Quigley and Hornocker 1992). Because most carnivores are wide-ranging, secretive, and found in relatively low densities, they are difficult to study compared to other mammals. Research also is expensive and money for long-term studies difficult to obtain. As a result, there is an urgent need to improve study methods and be as effective as possible in designing carnivore field studies, especially those involving threatened or endangered species.

Many methods have been used to monitor the population size of carnivores. Intrusive methods include, mark and recapture (Humphrey and Zinn 1982; Miller et al. 1987) and radiotelemetry (US Fish and Wildlife Service 1990), while track-count (Linhart and Knowlton, 1975; Roughton and Sweeney 1982), track-plate (Barrett 1982; Bull et al. 1992), snowtracking (Thompson et al. 1992), and use of remote-sensored cameras (Raphael 1991; Bull et al. 1992) are some non-intrusive means. Many of the methods have proven inadequate because of inherent biases, are difficult to implement, and/or are expensive.

Of these population monitoring techniques, only mark-recapture, radiotelemetry, snowtracking, and sign survey methods allow for the collection of ecological data at the same time. Mark-recapture methods are undesirable due to small population sizes and low capture probabilities (White et al. 1982). Radiotelemetry is expensive and requires handling a large proportion of the population. Snowtracking and sign survey methods are attractive because they are non-intrusive, inexpensive and simple to conduct. Despite these advantages, sign surveys, herein referred to as counts of scats and/or tracks in snow-free, unbaited conditions, have only received limited use in carnivore population monitoring schemes (Van Dyke et al. 1986; Reid et al. 1987; Clevenger and Purroy 1991; Kendall et al. 1992).

In this paper I report on the application of sign surveys to monitor in addition to obtain habitat selection and diet data from carnivore populations. I describe the basic sign survey design, and provide examples of how they have been used for two small, geographically restricted carnivore populations in Europe, that are of high conservation interest. The advantages and disadvantages of the method compared to others are reviewed. Finally, I synthesise methodologies from the two examples to demonstrate the feasibility of one sampling scheme enabling the three types of data to be collected simultaneously.

PROPOSED TECHNIQUE

General survey design

Sign surveys consist of a network of survey routes (eg trails and/or forest roads) located within a selected area of study. For small, remnant populations, the study area may include the entire species distribution, while for larger, more extensive populations, only a proportion may be sampled.

Surveys are conducted by observers who are experienced in sign recognition. Tracks and scats are generally the sign type recorded because they are most prevalent in the field. Sampling design requires that survey routes be divided into consecutively numbered "segments", which comprise the basic sampling unit. The length of segment used will depend upon the mobility of the species being studied. Observers record sign found along each survey route, referencing each to its respective segment. All scats are collected for food habits analysis, while tracks may be measured to differentiate between individuals. For data analysis, sign encountered along survey routes is converted to presence/absence counts on each segment.

Technique for population trend monitoring

Example: Brown bear (*Ursus arctos*), Cantabrian Mountains, Spain

Brown bears are one of the most endangered species in Spain and southern Europe (Servheen 1989). The range of the species in the Cantabrian Mountains encompasses roughly 5,000 km^2 and is divided into two groups. The eastern and western nuclei are of equal size and separated by approximately 50 km. In the bears' range elevations range from 600 m to 2,500 m. Vegetation is predominantly open pasture and regenerating shrublands (*Genista, Cytisus, Erica*, spp.), whereas approximately one-third consists of native beech (*Fagus sylvatica*) and oak (*Quercus* spp.) forests. Nearly all of the bear range is located within seven contiguous National Hunting Reserves governed by four autonomous communities. Livestock raising is the main economic activity.

Our population trend monitoring research was initiated in October 1989. Sign survey routes were designed to sample the entire Cantabrian brown bear range. Route selection was based on geographical representation and logistical considerations. From our information on Cantabrian bear movements (Clevenger et al. 1990), we selected 1.6-km route segments for our study. Experienced observers walked the survey routes recording the presence of tracks and scats in each segment. Surveys are carried out during a 3-4 week period twice a year when bears are active and tracking conditions are optimum: in spring (mid-April) prior to livestock being released in the mountains, and in autumn (mid-November) once they have returned to the villages. (Human activity also)

Field results

Presented are the results from routes surveyed in each nucleus during a 2-year period (October 1989-May 1991) (Clevenger and Purroy 1991). In the western nucleus, a total of 42 (307 segments) and 67 (341 segments) routes were surveyed during 1989-1990 and 1990-1991, respectively, sampling a total distance of 1,036.5 km (Table 1). Survey route distances varied in length from 5-19 km ($\underline{x}$=11.6 km). The mean number of segments/route surveyed was 7.3 and 5.1 during the two seasons. Our analyses used counts of tracks or scats; however, the former was more frequently observed than the latter. The average number of sign per route segment was 0.05 (SD=0.22) in 1989-1990, and 0.17 (SD=0.38) in 1990-1991.

In the eastern nucleus, 62 (433 segments) and 68 (453 segments) routes were surveyed in 1989-1990 and 1990-1991, respectively, for a total distance of 1,417.7 km. Route distances ranged from 3-19 km ($\underline{x}$=10.9 km). The number of segments/route averaged 6.9 and 6.6 during the two years. Sign counts per route segment averaged 0.03 (SD=0.17) in 1989-1990, and 0.05 (SD=0.22) in 1990-1991.

For the entire population, 104 (740 segments) and 135 (794 segments) routes were surveyed during 1989-1990 and 1990-1991, respectively, covering 2,454.2 km. Survey route distances varied in length from 3 to 19 km ($\underline{x}$=11.1 km). The mean number of

segments/route was 7.4 and 6.8 during the two seasons. The average number of sign per route segment was 0.04 (SD=0.19) in 1989-1990, and 0.10 (SD=0.31) in 1990-1991.

Technique for determining habitat selection

Example : Eurasian pine marten (*Martes martes*), Balearic Islands, Spain

Small localised populations of Eurasian pine martens occur on five islands in the Mediterranean Basin including Minorca (Balearic Islands). The Minorcan marten is listed in Spain's Vertebrate Red Book as rare (ICONA 1986). The island of Minorca measures 690 km^2 and is approximately 45 km long and 15 km wide. The overall topography is gentle except for some deep river gorges and scattered low mountains. The highest point on the island rises 358 m above sea level. Vegetation is Mediterranean, consisting of aleppo pine (*Pinus halepensis*) and holm oak (*Quercus ilex*) forests, coastal shrublands (*Olea europaea, Pistacia lentiscus, Erica, Phillyrea, Cistus* spp.), and lowland grazing lands.

I investigated the habitat characteristics of pine martens on the island of Minorca from March 1990-February 1991 (Clevenger 1993; in review[1]). The 28 km^2 study area was situated along the northwestern part of the island and located primarily within the private La Vall reserve. Due to many parts of the area having rugged terrain and dense vegetation, sampling could not be conducted by random line-transect methods. Therefore, to reduce sampling biases, survey routes (trails and forest roads) were chosen to be as linear as possible, separated by ≥250 m, and sample all habitat types in proportion to their occurrence. Routes were divided into consecutively numbered 50-m segments and permanently marked at their midpoint. Once every two months, pine marten scats were counted and collected along the survey routes. Habitat variables (cover type, percent overstory density) were classified at each segment midpoint. Because of potential biases from scat data I collected, marten habitat characteristics were determined by registering the presence or absence of scats in each 50-m segment rather than their frequency of occurrence.

Habitat use was determined by the proportion of 50-m segments with scats compared to all segments surveyed. Chi-square testes were used to determine overall preference or avoidance of the variables followed by in case of significance ($\underline{P}<0.05$), observed and expected comparisons of individual habitat features using the Bonferroni Z-statistic (Byers et al. 1984).

Field results

Twelve survey routes totalling 31.2 km were used to count and collect pine marten scats (Table 2). Survey distances ranged from 0.9 to 4.3 km ($\underline{x}$=2.6 km, SD=1) and the number of segments on each from 17 to 86 ($\underline{x}$=52.0, SD=21.6).

A total of 1,128 pine marten scats were used to analyse habitat use during the year. The average number of scats/route segment for the six bi-monthly periods was 0.34 (SD=0.9) and ranged from 0 to 11. The highest index of pine marten scats/route segment ($\underline{x}$=0.48, SD=1.2) occurred during August, followed by the month of April ($\underline{x}$=0.43, SD=1.1). Values in February and June were near average, while the lowest indices occurred in October and December.

A total of 614 50-m route segments were surveyed and used to analyse pine marten habitat use. Marten used the six cover types differently with respect to the availability ($\underline{X}^2$=12.9, $\underline{df}$=5, $\underline{P}$=0.03, Table 3); however, at the individual level, marten used all types in proportion to their availability. Martens also were indifferent to overhead cover as overstory tree density types were used in proportion to their availability in the study area ($\underline{X}^2$=2.7, df=3, $\underline{P}$=0.4).

Table 1. Bear sign survey summary statistics for mean number of sign per 1.6-km route segment and proportion with sign in the Cantabrian Mountains, Spain, 1989-1991.

	Year[1]		Total
	1989-1990	1990-1991	
Western nucleus			
No. routes	42	67	109
No. segments	307	341	648
Total distance (km)	490.0	546.5	1036.5
No. segment/route:			
Mean	7.3	5.1	
Range	3-12	3-12	
No. sign per route segment:			
Mean	0.05	0.17	0.11
SD	0.22	0.38	0.32
Range	0-1	0-1	0-1
Eastern nucleus			
No. routes	62	68	130
No. segments	433	453	886
Total distance (km)	692.8	724.9	1417.7
No. segment/route:			
Mean	6.9	6.6	
Range	2-12	2-12	
No. sign per route segment:			
Mean	0.03	0.05	0.04
SD	0.17	0.22	0.20
Range	0-1	0-1	0-1
Total population			
No. routes	104	135	241
No. segments	740	794	
Total distance (km)	1182.8	1271.4	2454.2
No. segment/route			
Mean	7.4	6.8	
Range	2-12	2-12	
No. sign per route segment:			
Mean	0.04	0.10	0.07
SD	0.19	0.31	0.26
Range	0-1	0-1	0-1

[1]1989-1990=autumn 1989 + spring 1990.
1990-1991=autumn 1990 + spring 1991.

DISCUSSION

Population monitoring

The use of sign from varied groups of mammals has long been used to estimate population size (Eberhardt and Van Etten 1956; Edwards and Green 1959; Klein 1959; Neff 1968; Dzieciolowski 1976; Freddy and Bowden 1983). Pellet and track counts are popular among wildlife managers because they are easy to replicate, and are a relatively inexpensive and reliable means of monitoring wildlife populations. Nevertheless, count data are highly variable and observed trends may be misleading (Harris 1986). Variation may be caused by factors other than changes in sign density. Sign may occur non-randomly due to seasonal changes in behaviour (Van Horne 1983) and its detectability may be affected by weather. Sign surveys are not capable of detecting annual population fluctuations, but sampling schemes when carefully designed have adequate power to monitor long-term trends and detect potentially threatening declines (Kendall et al. 1992).

Harris (1986) analysed trends obtained from variable counts. He suggested that variability in count data can be reduced by proper survey design and strict standardisation of procedures. But he suggested greater precision will best be achieved by increasing the number of replicate counts each year, and/or lengthening the monitoring period (>12 years).

In a recent paper, Kendall et al. (1992) examined the ability of different survey designs to detect changes in grizzly bear sign deposition (mainly tracks and scats) using 1.6-km route segments. The power of various sampling schemes were explored which would detect a 20% decline in sign occurrence. They concluded that greatest power is achieved by: maximising the number of routes surveyed, even if it means reducing their total distance; conducting within-year replicate surveys to lower variance; and pooling data from multiple years.

Our efforts to monitor the Cantabrian bear population are complicated by the species being highly dispersed and occurring in low densities (1 bear/75 km^2) (Clevenger et al. 1990, Clevenger and Purroy 1991). Nonetheless, during the first two years of our survey we encountered sign along 115 (7.5%) route segments. Contrary to surveys carried out in Montana by Kendall et al. (1992), bear tracks rather than scats were most prevalent in the Spanish surveys. Sampling results from the 2-year period did provide a reasonably accurate index of relative abundance among nuclei (Table 1), as values agreed with published estimates (Campo et al. 1984; Clevenger and Purroy 1991).

Kendall et al. (1992) surveyed routes once a year from 1984-1988, and had an average count of 0.43 scats per segment per year. For a sign survey to have sufficient power to test for significant population changes over time, they recommended that surveys be designed to sample between 500-1,000 segments/year, or achieve a mean index of about 0.5 sign/segment. Because Cantabrian sign indices were so low ($\underline{x}$=0.07, SD=0.26), a reliable sampling scheme for this population must comply with the former. Our survey design meets that requirement as more than 3,000 segments per year are sampled. Like Kendall et al. (1992), we will use a 5-year interval (using first and last year data) to examine for significant changes in population level.

Habitat selection

Pellet and track counts are widely used and a reasonably accurate method of describing habitat use among ungulates and lagomorphs (Dzieciolowski 1976; Keith and Windberg 1978; Collins and Urness 1981), while snowtracking is commonly used for boreal

mammals (Pulliainen 1981; Steventon and Major 1982; Raine 1983; Thompson et al. 1989; Jedrzejewski et al. 1993). Carnivore sign surveys are unique among these traditional methods, but like them, they share the same potential sources of biases in data analysis.

Table 2. Eurasian pine marten sign survey summary statistics for mean number of sign per 50-m route segment and proportion with scats on the island of Minorca, Spain, 1990-1991.

	Bi-monthly period[1]						Total
	1	2	3	4	5	6	
No. routes	12	12	12	5	12	12	
No. segments	614	614	614	230	614	614	
Total distance (km)	31.2	31.2	31.2	11.7	31.2	31.2	
No. segment/route:							
Mean	51.1	51.1	51.1	46.0	51.1	51.1	
SD	21.4	21.4	21.4	17.7	21.4	21.4	
Range	17-86	17-86	17-86	27-71	17-86	17-86	
No. scats per route segment:							
Mean	0.43	0.32	0.48	0.26	0.18	0.34	0.34
SD	1.1	0.8	1.2	0.7	0.5	0.9	0.9
Range	0-10	0-11	0-10	0-3	0-4	0-10	0-11
Proportion of segments with scats	0.22	0.20	0.26	0.12	0.14	0.20	0.21

[1]: 1=April; 2=June; 3=August; 4=October; 5=December; 6=February.

Despite the shortcomings, carnivore sign surveys are an attractive method and present some advantages over the others: they allow for sampling vast areas, can be repeated several times during the year, and provide a precise location. In my pine marten study, scat locations had a potential error $\leq$25 m, hence less than radiotriangulation error for most small carnivore habitat studies (Marchesi 1989; Zoellick et al. 1989; Brainerd et al., in press).

Sign survey summary data for pine marten on Minorca are shown in Table 2. Although population monitoring was not contemplated in this study, count data which were used to examine habitat selection served a dual function (Clevenger 1993). Furthermore, the advantages of this method are even greater because the collected sample material, scats in this case, also provided critical information on the species' food requirements.

Snowtracking is a versatile, non-intrusive method widely used in carnivore studies to determine habitat use and diet (Soutiere 1979; Hargis and McCullough 1984; Arthur et al. 1989; Jedrzejewski et al. 1993), but appears to be less effective for monitoring populations (Bull et al. 1992). Like sign surveys, snowtracking accomplishes the three-fold function of population monitoring, and determining habitat selection and diet. However, because snow-tracking can only be conducted during winter, multiple within-year counts cannot be conducted as in sign surveys. This attribute of the latter obviously provides for a more accurate analysis of the species overall habitat and diet needs.

Sign surveys have potential biases and care must be taken in using them to interpret habitat use. Habitat use patterns may change seasonally (Van Horne 1983), as may scat disintegration rates (Lockie 1964). For territorial species, routes that sample adjacent boundaries will have a larger number of scats (Macdonald 1980), as will habitat "sinks" occupied by dispersing individuals (Van Horne 1983).

Despite the limitations of carnivore sign surveys, their potential biases can be reduced and power maximised if designed properly. Many of the biases mentioned above may not significantly affect the results, and if so, their influence can be reduced if sample sizes are large and surveys are replicated at bi-monthly or seasonal intervals.

Sign survey design guidelines

There are certain requirements which must be followed when designing an effective and reliable sampling scheme to monitor and obtain habitat selection and diet data from carnivore populations. These are listed in schematic order. Many of the guidelines were derived from Kendall et al. (1992).

1. Route selection. Survey routes must represent the entire study area. Route selection should be designed to sample as closely as possible, all habitat types in proportion to their occurrence. They should also be uniformly distributed throughout the study area to adequately sample all of the physiogeographic components present. Routes selection should not be based on prior knowledge of the species' abundance and distribution patterns, but sample areas with a low as well as a high probability of encountering sign.

2. Route segment length. Survey routes are to be divided into "segments" of predetermined length, which comprise the basic sampling unit. Route segment length will be determined by the mobility or home range size of the species studied. We considered that 1.6-km route segments in the Cantabrian Mountains, and 50-m segments in Minorca, were of adequate length to ensure independent observations along survey routes. Kendall et al. (1992) recommended that for their model, the segment length selected be shortest as possible while still yielding independence.

3. Number of route segments. An adequate number of segments to sample will depend upon the density of carnivore sign within the study area. If a mean of 0.5 sign/segment is not achieved, between 500-1,000 segments will need to be sampled per year to obtain sufficient power for population monitoring. My results from Minorca reveal an adequate sample size required for determining habitat selection and diet (Clevenger 1993, in review[1]). If sign density is lower than that reported for pine martens in Minorca, the number of route segments will need to be increased, or the sampling period extended to obtain a higher value.

4. Species identification. Application of the model of Kendall et al. (1992) requires that observers be able to correctly identify sign (scats or tracks) of the species studied. Brown bear sign is easily identified in the Cantabrian Mountains compared to areas of western North America where grizzly and black bear (*U. americanus*) coexist. Similarly, on Minorca pine martens and weasels (*Mustela nivalis*) are the only carnivores present, thereby simplifying scat identification. In many parts of Europe, species sign identification may be complicated by the presence of several carnivores whose tracks or scats are difficult to distinguish. Some scat differentiation techniques used today include DNA analysis or thin-layer chromatography, and are apparently modestly priced.

5. Experienced observers. For reliable sign counting, observers must have field experience in sign recognition. To obtain experience, potential observers may be trained by accompanying observers during surveys conducted during a one-year period.

6. Presence/absence data. Count data from sign encountered along routes must be converted to presence/absence data for individual segments. Presence/absence data is preferred because: they reduce the effect of biases caused by short-term changes in habitat use, they have been shown to be closely correlated to absolute frequency data, and are robust to differences in observer interpretation of sign occurrences (Kendall et al. 1992).

7. Scat collection/track recording. Scats encountered along routes are individually bagged and labelled with the date and location (segment number); later air-dried and placed in a freezer before analysing their contents.

Similarly, track measurements are recorded when possible. Tracks may be individualised when: track length or width differs by >2 cm from a previously recorded track on the survey routes segment.

8. Sampling interval. Within-year sampling frequency will depend on the study objectives. For population monitoring, sampling should be carried out at least once a year. For determining habitat selection and diet, bi-monthly or seasonal sampling should provide an adequate amount of sign to meet the requirements for habitat analysis and assumptions for statistical testing (Alldredge and Ratti 1986).

One sampling scheme

Sign surveys are certainly not a flawless technique, but they do appear to have sufficient statistical power to monitor populations if designed properly. The contribution by Kendall et al. (1992) is a landmark in itself, considering that many wildlife managers have been using sign surveys during the last 10-15 years, or variations thereof, without prior knowledge of their power. Correct application of this methodology will undoubtedly require some modifications so that it can be adapted to the species studied and the wildlife managers' objectives.

Herein I have demonstrated the benefits and limitations of this technique compared to others currently being used. The advantages of sign surveys are evident. They are a low-cost, geographically extensive (we sample $\geq$5,000 km^2 of bear range twice a year) method which is easy to repeat, allows for multiple within-year surveys, gives precise locations of animal occurrence (habitat use), and information regarding food habits. In addition, if sample size allows for the determination of habitat use patterns from sign counts, these data may be further used to evaluate habitat quality and develop habitat suitability indices (Thomasma et al. 1991; Clevenger, in review[2]).

The two examples provided in this paper have utilised the same basic sampling design. We used sign surveys to monitor brown bear population trends. We did not investigate brown bear habitat selection and diet by means of this method, although by sampling over a longer period it could have been carried out. Subsequently, we did use sign, with radiolocations, to analyse bear habitat selection (Clevenger et al. 1992b). In contrast, my objectives for studying Minorcan pine martens were to examine habitat selection and diet using sign surveys, not to monitor the population. Abundant sign was encountered during the 12-month study period which facilitated habitat selection and diet analyses (Clevenger 1993, in press[1], in review[1]). However, though survey routes were sampled at bi-monthly intervals, sampling could have continued with the objective of monitoring the population.

Although only two examples were presented in this paper, they provide at least some evidence of the interspecific versatility of the sign survey method. They have demonstrated the feasibility of this technique in studying two distinct types of carnivores: a low-density, wide-ranging species, and a high-density species with a small home range (Clevenger in

press[2]). A valid assessment of the sign survey method will only come from testing its application among a variety of species and habitats. I encourage others to consider the sign survey method when designing carnivore studies in the future.

ACKNOWLEDGMENTS

Funding for the brown bear surveys were provided by the Institut Royal des Sciences de Belgique, the Ministry of Education and Science (program I+D), while the pine marten study was partially financed by the Consellería d'Agricultura i Pesca (Gobierno Balear). Thanks go to M.A. Campos, A. Onrubia, R. Triay, M. Monge, D. Pando, C. Eguinoa, and A. Hartasanchez for their help in collecting the field data for this paper. Dr F.J. Purroy was instrumental in obtaining funding for the brown bear surveys and provided important input for the Minorcan study.

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Table 3. Distribution of 50-m survey route segments and pine marten scat occurrence by habitat type on the island of Minorca, Spain, 1990-1991. (from Clevenger, in review[1])

Habitat variable	50-m Segments		Proportion available	Proportion use	P[a]
	Expected	Observed			
Habitat type					
Pine forest	357	370	0.581	0.599	0
Holm oak forest	71	53	0.115	0.087	0
Pine-oak forest	84	94	0.136	0.154	0
Forest-field ecotone	57	55	0.093	0.090	0
Open field	23	13	0.037	0.021	0
Coastal shrubland	22	29	0.036	0.047	0
Total	614	614	1.000	1.000	

[a]0 = Used in proportion to availability.

. PROTECTION AND MANAGEMENT OF LARGE CARNIVORES (WOLF, LYNX IN THE BIALOWIEWA PRIMAEVAL FOREST, POLAND

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Study Area

Bialowieza Primeval Forest (1 250 km^2), located on the Polish-Belarus border, is one of the best preserved woodlands in the lowlands of temperate Europe. About 60% of the forest complex belongs to Belarus, and the size of the Polish part is about 580 km^2 (Fig. 1). Most of the Polish part of the forest is exploited for timber, and only a small area (47.5 km^2) is strictly protected as the National Park)UNESCO'S Man and Biosphere Reserve since 1977, and World Heritage Site since 1979).

Deciduous and mixed forests harbour a nearly primeval community of predators (over 20 species of mammalian predators and raptors). It is, moreover, the only one forest complex in lowland Europe where a pristine community of ungulates (European bison, moose, red deer, roe deer and wild boar) coexists with the wolf and lynx.

Management of the wolf and lynx population

The wolf and lynx populations in the Bialowieza Forest are among the westernmost lowland populations of these species in Europe. They are, however, not isolated. They have continuous contacts with other Polish populations (through Knyszyn Forest) as well as with the East European populations. Data obtained from radio-collared lynxes revealed that there is a permanent exchange of individuals between Polish and Belarus parts of the Bialowieza Forest.

In 1950-1965, the wolf persecution programme was conducted in Bialowieza Forest. In this period, both species (wolf and lynx) were exterminated from the Polish part of the forest (Fig. 2). In the 1970s, both predators recolonised the Bialowieza Forest from their extensive range in Belarus. Until 1988, they were hunted small numbers in the Bialowieza Forest.

In 1989, in response to claims of the Mammal Research Institute, the Ministry of Nature Conservation stopped hunting for wolf and lynx in the Bialowieza Forest to allow conducting research on ecology of these species. New regulation concerning the nature protection (since 1991) gave to each province authority rights to declare any species a protected species over the province area. The Bialystok province (which administers the Bialowieza Forest) declared the wolf and lynx protected species in 1993.

Currently, the numbers of large predators in the Polish part of the Bialowieza Forest are estimated by the forest service at about 15 wolves and 15 lynx. Unfortunately, wolves are still persecuted in Belarus. In 1992, the whole Belarus part of the Bialowieza Forest was declared a national park, however, a status of national park there allows hunting of ungulates and controlling numbers of predators. In 1992, 19 wolves were shot in the Belarus part of the Bialowieza Forest, some of them belonging to packs snow-tracked on the polish side of the border. As late as 1992, the full protection of lynx was declared in the Belarus Republic.

Research on the wolf and lynx

The research project on the community of predators inhabiting the Bialowieza Primeval Forest has begun in 1985. As the part of this project, the role of large predators for functioning of the whole community and populations of particular species of ungulates in the lowland forest were studied.

It was found that there were essential differences in the forest structure, ungulate density and predation by wolves between the Bialowieza National park and neighbouring managed forests. Forestry practices (clear cuts and replantation with spruce and pine) caused shrinking of deciduous mature stands in the managed forests: in the National Park, 48% of the area is covered by deciduous oak-lime-hornbeam stands against only 13% in the managed forests. Density of ungulates was generally much higher in the National Park (wild boar 12 inds/km^2, red deer 13 inds/km^2) than in the managed forests (4 and 5 inds/km^2 respectively). In both parts of the forest, wolves fed mainly on red deer, and lynx on roe deer.

Since 1990, the radiotelemetry technique has been used to investigate lynx spatial organisation, home ranges, patterns of home range use, daily activity, pattern of resource sharing, rate of being killed and predation impact on ungulates. So far, 9 lynxes were radio-collared, and 6 have still been radio-tracked. Radio-tracking of wolves is supposed to begin in winter 1993/94.

Using any traps for hunting purposes is illegal in Poland, and in spite of the fact that the appropriate permissions for live-trapping were granted for this project, an accusation was put forward that investigators were cruel towards animals. The accusations were not confirmed, but the research project is still in question. After several meetings of the competent councils which discussed the project, the Ministry of Environment Protection, Natural Resources and Forestry has allowed to live-trap lynxes and wolves within the Bialowieza National Park. Steel traps for wolves were not allowed, and leg-snare traps were advised.

Threats to large carnivore populations

Results of ongoing studies, especially the radio-tracking programme, have revealed several threats to lynx population in Bialowieza. These same threats can also be applied to the wolf:

1 home ranges of lynxes are very large (males about 250 km^2, females 150 km^2) and the strictly protected area of the National Park (47 km^2) is too small to offer any protection to the lynx;
2 the lynx numbers is considerably overestimated by the official game inventories;
3 severe poaching exists (2 adult radio-collared males were poached with snares, 1 adult female disappeared);
4 lack of cooperation in conservation of large carnivores between Polish and Belarus part of the forest (wolves which are protected in Poland often cross the state border and can be killed in Belarus);
5 questioning the only research project in Europe on lowland lynx and wolf populations, which can provide biological data for modern conservation and management rules of predators in Bialowieza Forest and in the whole of Poland.

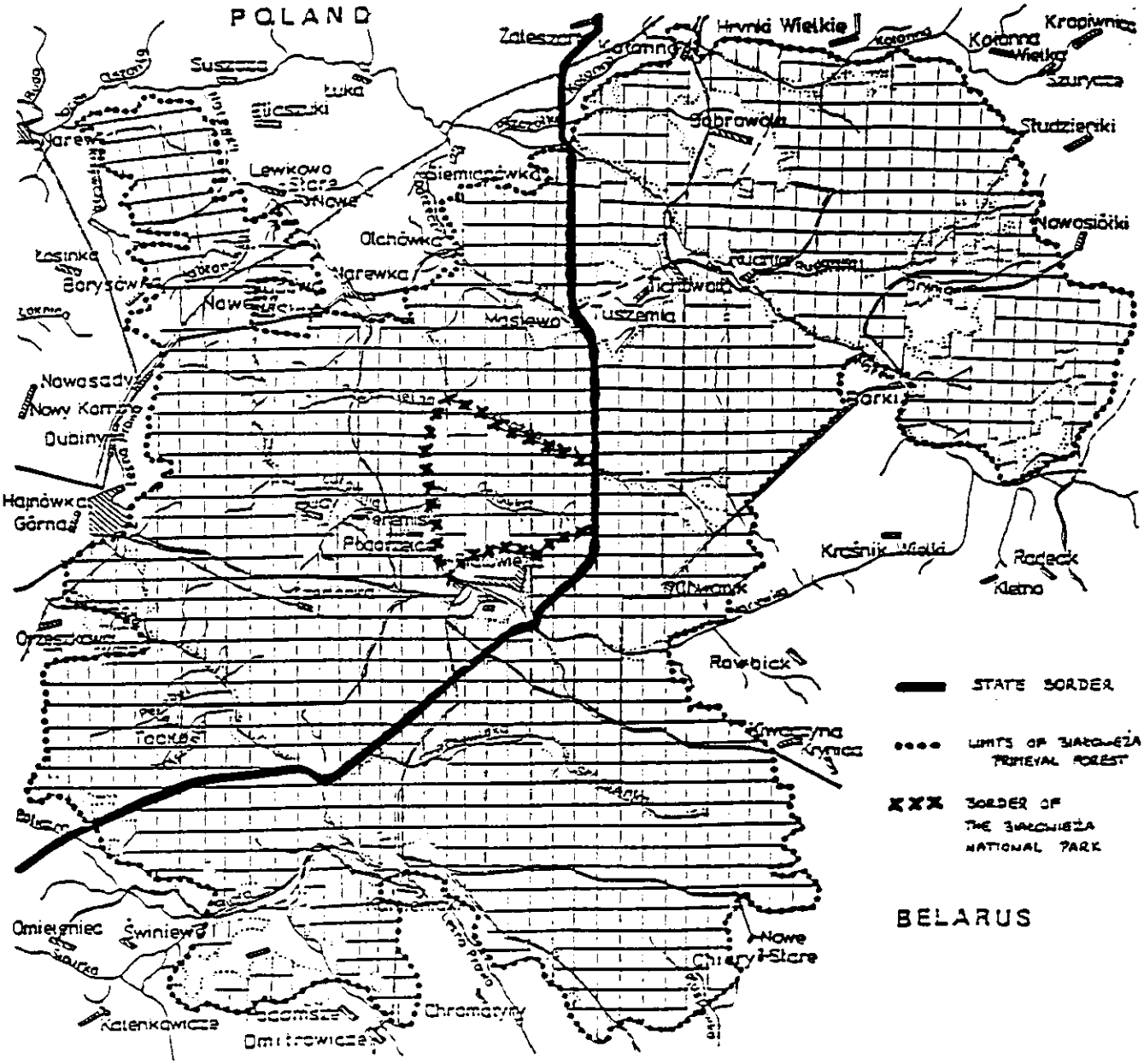

Fig. 1 The Bialowieza Primeval Forest

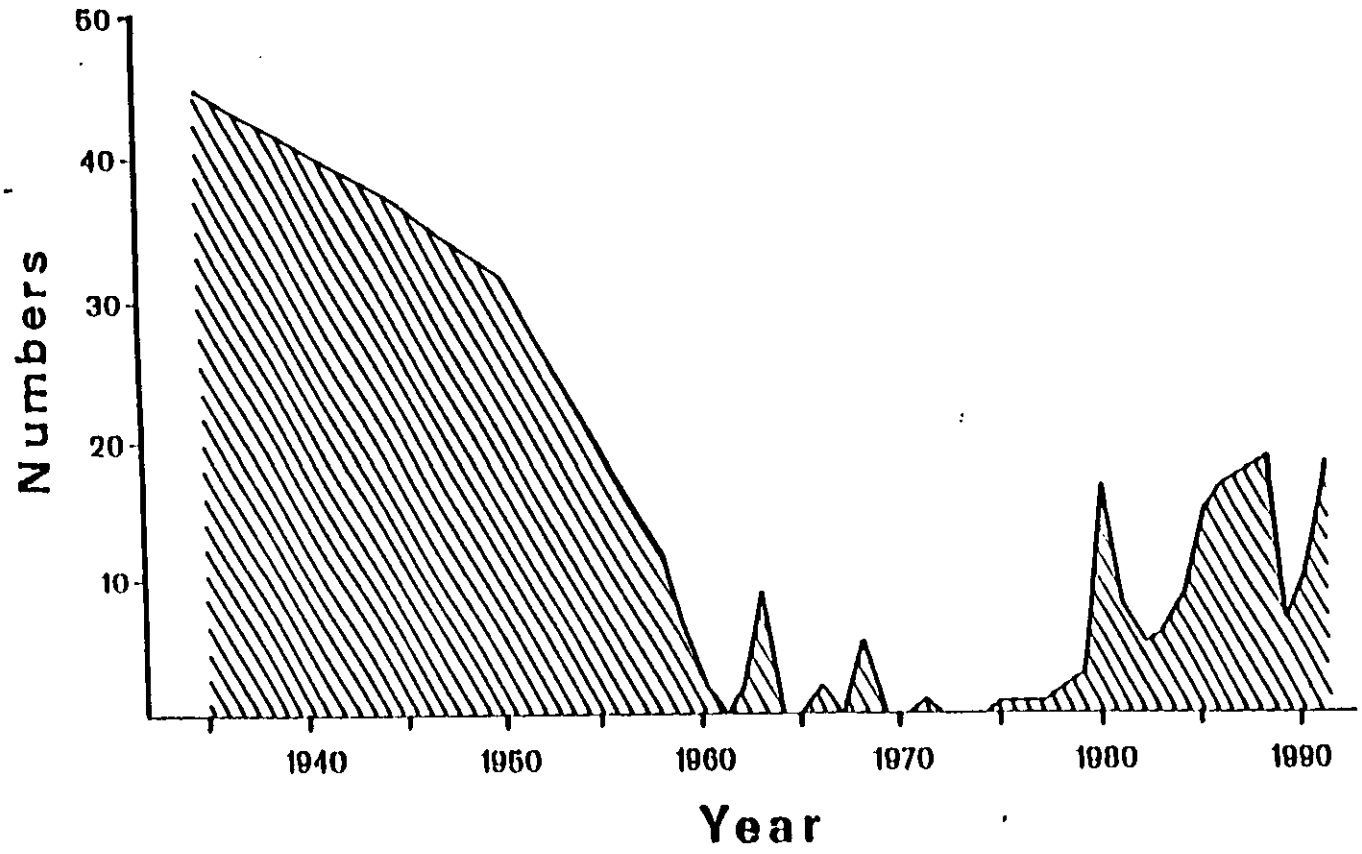

Fig. 2. Numbers of wolves (inventory data) in the Polish part of the Bialowieża Forest 1936-92.

. . LA STRATEGIE ACTUELLE ET POUR L'AVENIR EN CE QUI CONCERNE LA EN CE QUI CONCERNE LA GESTION DES POPULATIONS D'OURS ET DE LOUP EN ROUMANIE

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1 Cadre Naturel

Disparues dans quelques pays de l'Europe et fortement réduites dans les autres, le loup et l'ours ont en Roumanie une situation à part. Ainsi, sauf la Russie, la Roumanie a la plus grande population d'ours brun de l'Europe. Ces deux espèces bénéficient d'un areal de 30 000 km, c'est à dire 14% du patrimoine cinégetique total. La caractéristique principale de cet areal c'est la massivité des forêts et leur continuité d'une côté et de l'autre de la chaîne des Carpates, ce qui favorise la conservation d'un élément vital, la silence et également des excellentes conditions de nourriture: Dans le même temps, l'orographie, la structure et la disposition des forêts permettent des grands voyages saisonnières.

2 Diffusion, effectif, évolution

L'ours et le loup se trouvent en 26 départements (sur le 41 total) dans un areal continu.

L'évolution de l'effectif de ces deux espèces est la suivante :

Espèce	Effectif normal	Effectif Réel 1955	1976	1983	1992
L'ours	4 900	2 000 (40)	4 300 (89)	6 350 (73)	6 650 (542)
Le loup	2 000	4 600 (2 580)	1 868 (1 356)	2 175 (1 565)	2 720 (653)
Le cerf commun	41 700	6 900 (96)	32 500 (1 146)	40 600 (158)	42 200 (1 997)

NB Les chiffres en parenthèse représentent le nombre des pièces chassées dans l'année de référence.

L'ours a connu un accroissement soutenu. Jusqu'aujourd'hui, le loup aussi, mais à partir de 1976. Pourtant, on a réussi d'établir un équilibre entre le cerf et le loup et de redresser la situation catastrophique du cerf de 1955.

Pour l'année 1992, le nombre des ours chassés représente moins de 10%, considérée comme l'augmentation nette annuelle. Jusqu'à cette date; les restrictions de chasse ont eu une teinte plutôt politique et moins écologique.

La densité de la population d'ours part de la valeur de 0,28/1 000 ha forêt jusqu'à 3,11/1 000 ha avec une moyenne générale de 1,73/1 000 ha. Dans 11 départements, la densité est de plus de 2/1 000 ha. Pour le loup, la densité touche 40% de celle de l'ours.

Ces deux espèces sont présentes dans 426 terrains de chasse dont la superficie est variable entre 8 000 - 18 000 ha.

3 Conflits avec d'autres secteurs d'activité humaine

La configuration orographique et forestière favorise les longues voyages de l'ours et de loup qui détermine directement l'apparition des conflits avec la pomoculture pendant l'automne dans les vergers souscarpatiques autour desquelles les ours se concentrent chaque année. D'autre côté, l'élevage est soumis à une pression périodique par les deux espèces: l'ours pendant l'hiver; le loup toute l'année. Dans le même temps on a enregistré des attaques aux hommes.

D'après une enquête menée par la Régie Autonome Romsilva, la valeur et les structures des dégâts sont les suivantes :

Mentions	**Moyenne Annuelle**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**
Dégâts Secteur Pomicol (mille lei)	145 663	129 300	145 320	142 660	123 860	134 700	198 140	873 980
Dégâts Secteur élevage (mille lei)	85 503	62 540	66 540	74 620	57 000	54 180	198 140	513 020
Accidentes mortales (n° hommes)	4	5	4	3	3	5	4	24
Accidentes avec invalidité (n° hommes)	6,8	12	6	6	11	3	3	41
Accidentes avec hospitalisation (n° hommes)	21,3	27	24	29	11	17	10	128
Accidentes légères (n° hommes)	42,3	46	38	58	49	33	30	254
Total	70,4	90	72	97	84	58	47	447

4 Stratégie pour l'avenir

Même s'il existe un permanent conflit avec quelques secteurs, l'ours n'est pas considéré comme un nuisible. On change même la politique sur le loup, considéré comme une espèce de gibier. Toute la stratégie à l'égard de cettes deux espèces serra basée sur les prévoyances de la Convention de Berne. Les principales idées de la stratégie seront les suivantes:

- l'évaluation annuelle plus correctement possible de l'effectif des deux espèces;
- l'inventaire de toutes les points de concentration saisonnière des ours avec l'analyse des éléments principaux (l'ancienneté, la surface, le nombre des ours, la durée des concentrations);

- la réconsideration des effectifs optimales de l'ours et loup, condition imposé par l'accroissement des populations, par nombre des accidents et par le volume des dégâts;
- démarches nécessaires pour mandater certaines organismes et institutions gouvernementaux, pour assurer une totale correctitude dans le système de réclamation, de surveillance; de vérification et de confirmation des dégâts;
- informer toujours la population sur la nécessité d'une attitude correcte à l'égard de l'ours et de loup. Education écologique, un rôle décisif auront la télévision en continuant ses bonnes traditions de diffuser des filmes sur la vie et les moeurs de ces deux espèces et également les publications pour la vulgarisation de ce sujet;
- l'interdiction totale des pièges et du poison;
- saison de chasse pour le loup et la règle de pratiquer seulement le tire à balle;
- la réalisation échelonnée de l'effectif optimal pour les deux espèces;
- l'offre aux certains pays intéressés de livraison de sujets vivants d'ours et de loup pour une éventuelle intention de repeuplement;
- l'analyse périodique à haut niveau de la situation des deux espèces et informer périodiquement la Convention de Berne;
- l'élaboration d'une nouvelle loi de la chasse - déjà en retard adapté aux nouvelles conditions sociales et aux provoyances de la Convention de Berne; qu'il faut garantir l'application des mesures mentionnées ici.

Pour finir, la Roumanie vous présente l'assurance que ne l'ours ni le loup ne sont pas en danger; ni aujourd'hui ni dans l'avenir et qu'ils seront pour toujours à l'abri des Carpates et d'une politique et stratégie correspondantes.

THE MANAGEMENT OF THE BROWN BEAR (*Ursus arctos arctos* L.) IN ROMANIA

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1. Introduction

The brown bear is the largest predator in Romanian fauna. Its importance is both ecological, and as a symbol of the forested mountains. So the study of brown bear populations must be oriented to a better understanding of its biology and ecology, the final scope being the establishment of management strategies - conservation oriented.

This paper deals with some ecological and management aspects of the brown bear populations in Romania.

2. Ecological consideration

2.1 Distribution and population dynamics

The bear area here is in direct contact with large forests which cover the Carpathian mountains and the hills. It is present in both coniferous and deciduous forests, but its main habitat is, however, coniferous stands, particularly of spruce. These aspects are of great importance in establishing the measures for bear conservation.

The distribution of brown bear in Romanian counties is shown in Figure 1. The effective - optimal and real - in each county, as well as the harvest in the hunting season 1992-1993, are presented in the Table 1.

In time, the evolution of bear effective was different. If in earlier centuries a great number of bears occupied the large forests which covered Romanian territory, in 1940 only about 1,000 bears were estimated to exist. After the Second World War, as an effect of pressure, the number of bears decreased. In 1950 their number was estimated at 860. Starting from that year the brown bear numbers increased as a reflection of different management measures which had been taken. The greatest number was reached in 1988 when the effective was estimated at 7,780. The last evaluation of the bear population in spring 1993 shows that more than 6,300 individuals are present in 616 hunting areas with a forest area larger than 3,850,000 hectares. The evolution of area and population is presented in Table 2.

Even if the density was reduced sometime, the areas have constantly increased. Starting with 1978, as a result of a superprotection, the bear effective exceeded the number considered to be optimum and spread out of the optimum area. The over-population determined problems which will be discussed under management aspects.

Table 1

Brown bears effective in Romanian districts

	District	Hunting areas	Effective		Harvest
			Optimum	Real	
1.	Alba-Iulia	30	104	121	2
2.	Arad	4	-	14	-
3.	Bacau	20	185	192	12
4.	Baia mare	46	257	335	12
5.	Bistrita nasaud	31	235	257	14
6.	Brasov	43	306	329	6
7.	Buzau	17	280	342	4
8.	Cluj	11	100	101	2
9.	Deva	39	285	397	17
10.	Drobeta Tr. Severin	6	20	37	-
11.	Focsani	24	222	436	26
12.	Miercurea Ciuc	48	425	794	62
13.	Oradea	6	10	37	-
14.	Piatra Neamt	29	215	166	2
15.	Pitesti	22	265	335	12
16.	Ploiesti	19	190	296	16
17.	Resita	26	145	184	1
18.	Rimnicu Vilcea	22	235	223	6
19.	Satu Mare	4	15	14	-
20	Sfintu Gheorghe	29	400	600	55
21.	Sibiu	33	155	234	6
22.	Suceava	48	404	266	-
23.	Tirgoviste	3	20	43	-
24.	Tirgu Jiu	15	145	158	4
25.	Tirgu Mures	40	250	425	40
26.	Zalau	1	-	1	-
T O T A L		616	4,868	6,337	299

Table 2

Evolution of area and population
of Romanian brown bear

Year	Area of forest - hectares -	Number of bears
1955	2,100,000	2,000
1960	2,600,000	3,000
1965	2,900,000	3,800
1970	3,000,000	4,200
1975	3,100,000	3,850
1980	3,500,000	6,000
1985	3,600,000	6,000
1990	3,800,000	7,400
1993	3,850,000	6,300

2.2 Ethology and diet

As we have shown, the main brown bear habitats are the large forests. The bear shows such various adaptation to life in the forest as the ability of climbing, various manners of handling of trees, and, also, is nutritionally dependent upon the forest.

In general, the brown bear from the Carpathian mountains has a similar ethology to the bear from other regions of Europe, but there are some particularities.

The bear is a solitary mammal, and has, generally, a constant, not very large (600 - 1,000 ha) area of living, named home range. There are, of course, exceptions, especially in autumn, when bears travel more than 50 - 80 km, for better food, and come back after 10 to 30 days. The home range of a brown bear must contain almost all the components necessary for its survival.

Usually, during the course of a day, a bear has a resting period, in day light, and a period for feeding at night. In seeking food and water the bear keeps the same ways. Another habit is the daily bath during the summer season.

However, this behaviour may change when the bears are disturbed by man's activities.

At the end of autumn and the beginning of winter, the bears start their winter time rest in places situated near the altitudinal limit of forests. In these places the females bear normally two cubs.

It is known that the brown bear is an omnivorous species. It frequently eats specific foods during limited parts of the season. Most of the food consists of plant matter (berries, roots, cereals, etc), especially during the latter half of the summer. During the recovery period, in spring and the first part of the summer, animal matter (fresh flesh, ants, larvae, etc) is also remarkably used.

Even if bears within an area can establish home ranges that are large enough, that offer cover, sufficient food during different seasons, suitable denning sites, etc, there is one more very important factor which influences the home range: human activities. This aspect has to be strongly taken into account in the management strategies of the brown bear populations.

3. Management aspects

The increasing number of bears has created the problem of the scientific basis for bear management in Romania. For this, it was necessary to find a methodology to establish the areas which offer good conditions for the bear to exist and the optimum number of bears for each hunting area. The researchers from the Wildlife Laboratory of Forest Research and Management Institute elaborated a diagnostic key to define how suitable an area is for bears. This key contained three categories of factors: A - abiotic factors such as relief, altitude, waters, snow; B - biotic and managerial factors regarding the forest (area, composition, age classes, thickness), orchard, cultures for game food and other supplementary food; C - human impact like pesticides, harvest of forest resources, grazing, and people's attitude. On this basis, the analysis of hunting areas was made in collaboration with specialists involved in game management from forestry units and hunting associations. The result was that 426 hunting areas, with forest on 3,100,000 hectares, were selected as good for bears.

The good situation of bear populations in Romania is due to a number of factors, the most important are as follows:

- The management of forests and the management of the bear populations are in the same hand, being carried on by the forestry authority. In general, this creates a good coordination in balancing the economic interests of harvesting the natural resources of forests with the ecological needs to preserve them and, in this case, it generated a great increase in the bear populations.

In the same respect, the wise management of other mammals, connected with bear population, created good conditions through increasing numbers. The herbivorou s species (red deer, roe deer and wild boar), which can be a prey for bears, assure them more diverse food, especially during the recovery period. For example, in 1960 the number of roe deer was 85,000, red deer 14,000 and wild boar 16,000. In 1988, when the bear population count was the greatest in the period after the Second World War - 7,780 individuals, the population count for herbivorous were 177,000 for roe deer, 42,000 for red deer, and 44,000 for wild boar.

The measures which were taken to direct protection of the bear: the hunting law which permits hunting only by special licence between March 15th - May 15th and between September 1st - December 31st, little harvest in which are hunted especially those bears which make great damage to livestock, strict protection of females with cubs, reduction of poaching by severe guarding, the ban from keeping bears in captivity, and supplementary food which was given in spring and autumn starting from 1973 - 1975.

Repopulation of the areas considered suitable for bears living with cubs which are captured at three, four or five months and freed in the field at about 16 months. This action started with 43 cubs in 1975, 42 in 1976, 29 in 1977, and 36 in 1978. The success was not as expected because in the period in which the cubs stay in captivity (10 - 20 months) they get accustomed to man's feeding and presence. Better results were obtained by repopulation with adults. In any case, when the density of the bear population increased it occupied all the suitable places and even some which were considered not suitable for its survival.

The phenomena of over-population of some areas leads to a great concentration of bears and great damage in orchards. Young ones and females with cubs appear near the towns and villages looking for food in the refuse. Others are attracted by the farms which are at the border of the mountain villages and try to take domestic animals. Also, the herds which are grazing in alpine meadows or in the mountain forests as well as in bee gardens and agricultural fields suffer some damage from the bears.

At same time, the great concentration which appears in some places in autumn and the feeding areas led to the spreading of parasites in bear populations. The analyses of 323 bears between 1990 and 1993 revealed that 15% of these were infested with *Trichinella spiralis*. Other parasites found were *Toxascaris transfuga* and the very rare *Dicrocelium lanceolatum*.

4. Prospects

Taking into account that the brown bear population in Romania is, by far, the biggest in Europe (without Russia), some of the objectives for the future might be:

Development of scientific research in the field with the general purpose if improving the knowledge on brown bear ecology as a basis for a better management of the populations of this species. In this way, large international cooperations will be allowed the use of standardised research methods, the improvement of some research methods and their standardisation, the use of very modern techniques (eg radio tracking), development of research on the systems of the bears, etc.

The amelioration of the bear populations through bringing the effective to the optimum levels established on scientific criteria. The conservation of the specific biotopes in a natural state, both by creation of large protected areas (eg national parks), and by applying proper sylvicultural methods in the forests outside them.

The improvement of the compensation system for damage caused by bears to livestock and agricultural cultures, for more simple procedures to document the damage and for an increase in compensation. This, together with strong ecological education activities regarding the role and the significance of the brown bear in the Romanian landscape, will lead to a reduction of illegal shooting or trapping, and, in this way, to a better situation for the brown bear populations.

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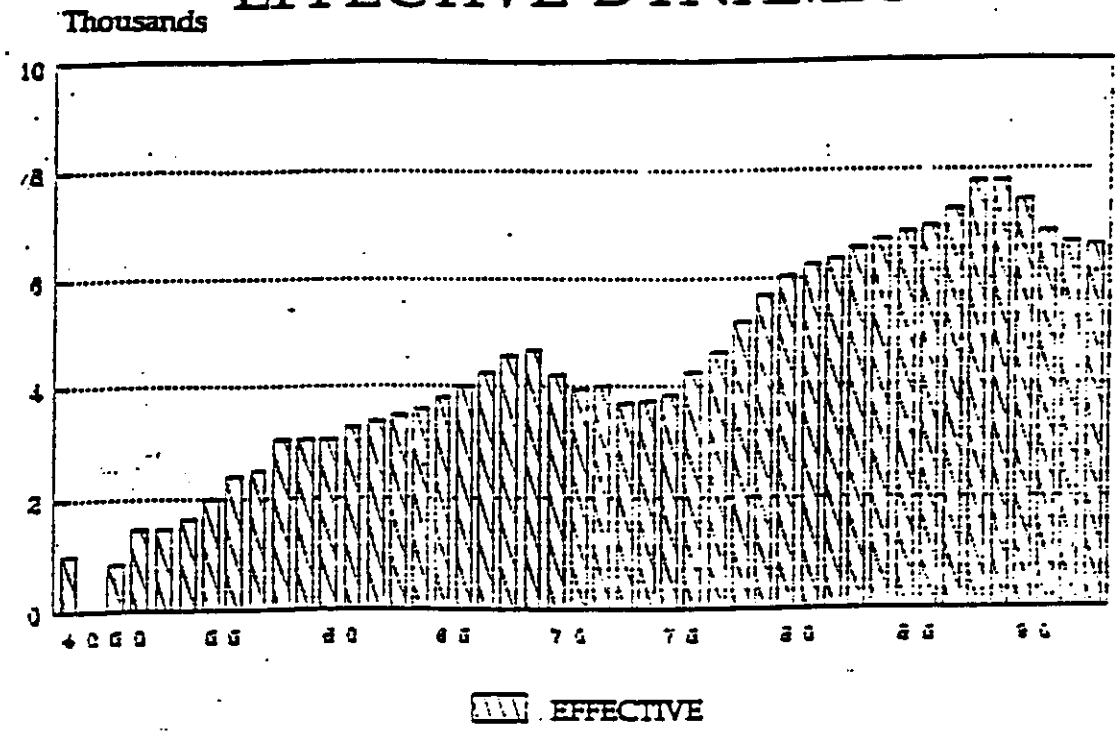
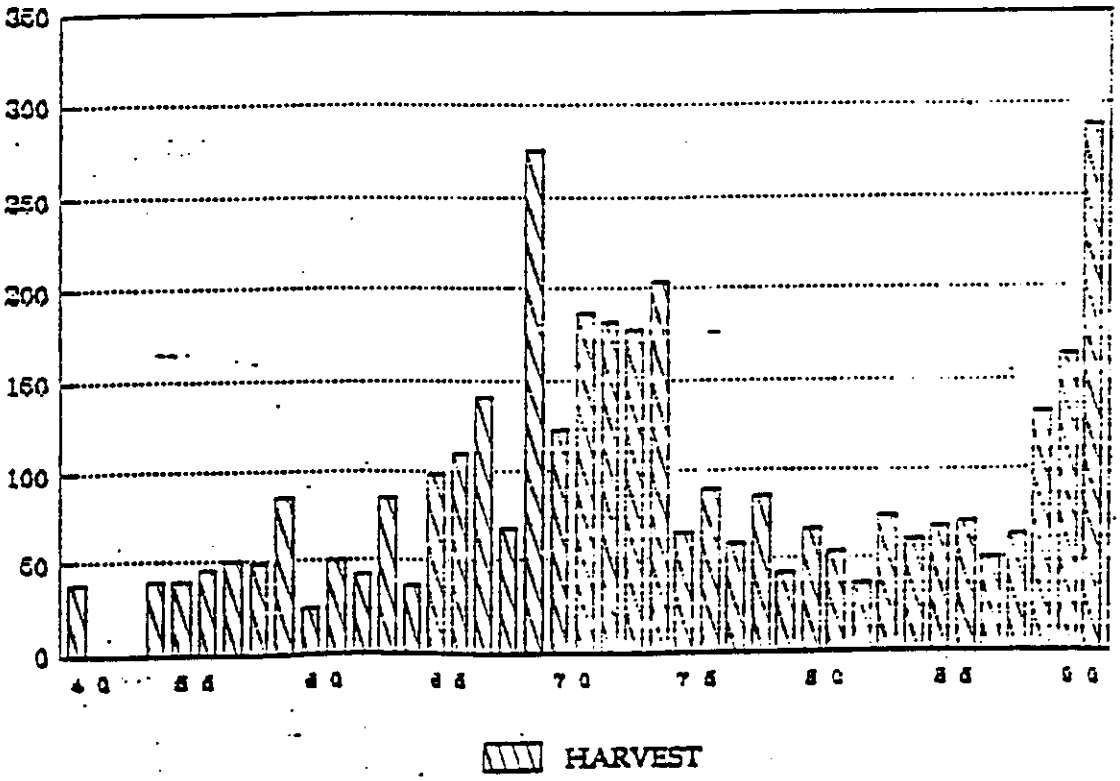
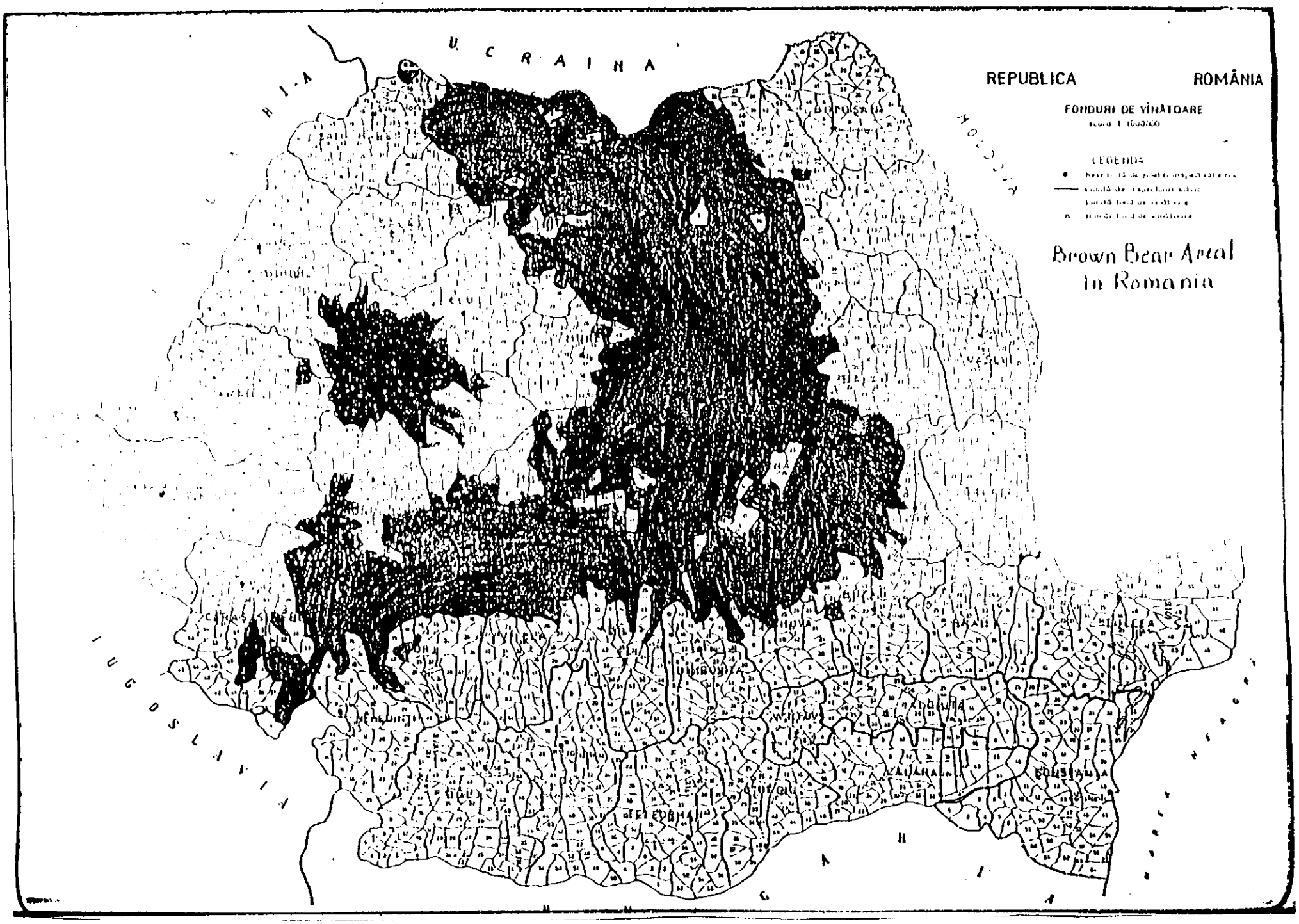
THE BEAR IN ROMANIA
EFFECTIVE DYNAMIC



Effective

BEAR HARVEST




U C R A I N A
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POPULATION DYNAMICS OF A REINTRODUCED LYNX POPULATION IN SWITZERLAND: ARE HUMAN-CAUSED LOSSES A THREAT?

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The Eurasian lynx *(Lynx lynx)* is one of the most widespread extant felids, but little is known about the life history and social system of the species. From the prey preferred (roe deer and chamois; Breitenmose & Haller 1987, Haller 1992), we can assume that the lynx fits the typical model of spatial and social organisation of large cats as summarised by Eisenberg (1986). We have been verifying this general model in a small lynx population in the Swiss Jura Mountains since 1988 Breitenmoser et al. 1993). This population was re-established in the early 1970s (Breitenmoser & Baettig 1992) and provides a test case for re-introductions of large predators in a cultivated landscape.

Spatial organisation

Information on spatial organisation and abundance of lynx is important to estimate potential population size for reintroduction programmes. We have been monitoring seven adult lynx from spring 1988 until the end of 1991. Their ranges were spread along the southeastern chain of the Jura Mountains (Fig. 1). All monitored lynx were at the border of the Swiss Plains, which is not occupied by lynx. To the northwest, the ranges of the lynx extended into France, where all the resident animals had neighbours.

The total ranges enclosed an area of up to 465 km^2 for the males (364 ± 88 km^2) and 337 km^2 for the females (216 ± 90 km^2). However, this included an average of 3.4" outliers. From different home-range models tested, a restricted home range (convex polygon areas excluding outliers; Fig. 1; Breitenmoser et al. 1993) proved to be the best to describe the land tenure system and the abundance of lynx. The home ranges of lynx in the Jura Mountains were 264 ± 23 km^2 for males and 168 ± km^2 for females. The mean home-range overlap between individuals concurrently monitored for at least six months was 8.7" for males, 2.8" for females and 5.4" for neighbours of different sex. The overlap areas shown in Fig. 1 were regularly used by males only. On average, a resident male visited the overlap area with his neighbour every ten days.

Abundance

The three neighbouring males in our study area occupied a total surface of 744 km^2 (total of the three home-range areas minus overlap areas). Within this area, we followed seven adult individuals, or one resident lynx per 106 km^2. Additionally, a fluctuating number of kittens followed their mothers, and some independent subadult lynx existed. In summer, when the families left the den site and started to move, an average of 5.6 kittens (1.4 per female and year) lived in the study area. In winter, only 3.2 of them were still alive (0.8 per female and year. If we assume that the immigration rate of young lynx on dispersal was the same emigration rate, an additional number of 1.2 subadults (0.3 per female and year) could be counted in summer, and 0.4 subadults (0.1 per female and year) in winter. This results in a rough over-all density estimation of 1.9 lynx/100 km^2 for the study area in summer and 1.4 lynx/100 km^2 in winter.

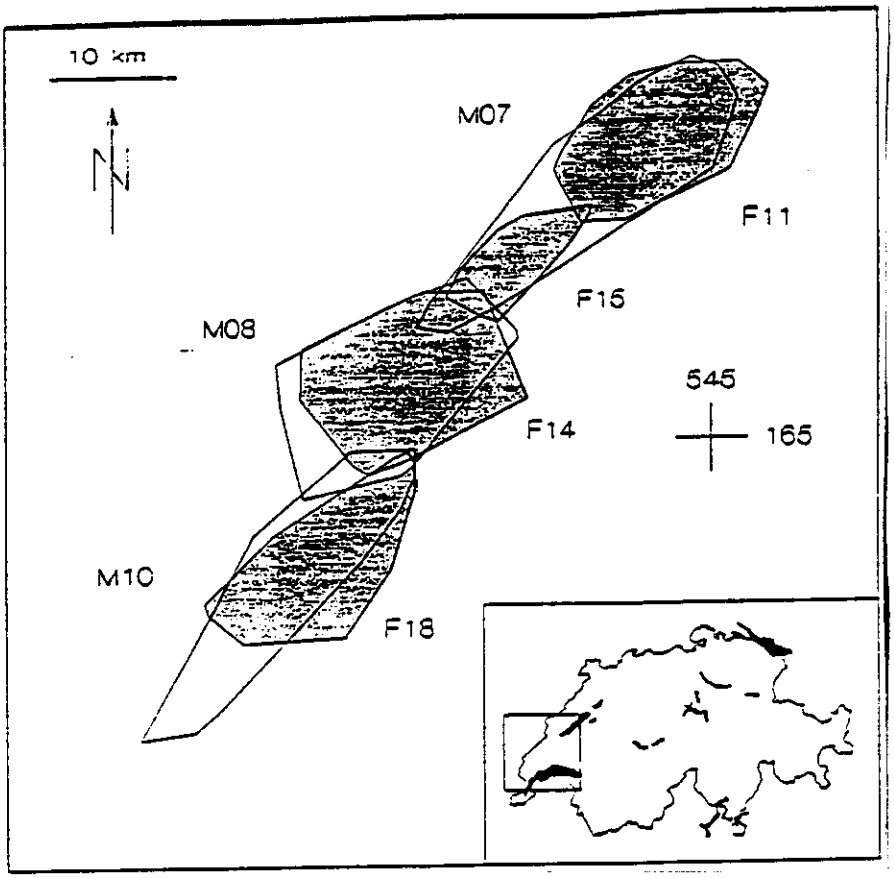

Fig 1 Distribution and home ranges of resident lynx in the Jura Mountains. Ranges of males are blank, those of females shaded. The map represents an area of 80 x 80 km. After Breitenmoser et al. 1993.

Recruitment

Of the four females, we gained information about their reproduction during a total of 15 reproduction periods. In this 15 reproduction-years, the four females combined had 11 litters. The average size of litters in summer was 2.0 (n = 7, first observation after birth). Of these 14 kittens, seven disappeared before and one during the next winter, and only six remained with their mothers until the age of independence at 10 months. From 13 reproduction-years, for which we can assess the number of dispersing juveniles, a total of nine survived until independence or 0.69 juvenile lynx per female each year.

Mortality

The reproduction success of the observed group of lynx was low. Out of the 14 kittens observed, only one survived until maturity. More than half of the kittens died before they left their mothers. Out of six subadult lynx monitored while dispersing, four died within 10 months, and only one survived for certain the first year of independence. In addition, the loss in the adults is rather high. Of the seven resident lynx in the Jura Mountains, five died until the end of 1992. Three were illegally killed by hunters, one died in a car accident, and one disappeared for unknown reasons.

Seventy one per cent (60 of 84) of lynx found dead in Switzerland were killed by human activities. Haller (1992) also concluded that in the central Alps of Switzerland, illegal killing was the major cause of death among the resident lynx. Hunting was not for a trophy,

but because the reintroduced lynx are considered a pest. This is true for the Jura Mountains as well.

Conclusions

The vacated home ranges of the females have partly been reoccupied. The resident males, however, have so far not been replaced. The question now arises whether the recruitment of the population is high enough to compensate for the losses. The low survival rate of young cats is not unusual. The high rate of mortality among residents and the causes of death of the radio-collared lynx, however, could be peculiar for a cultivated area. The problem is not only of general interest for our understanding of life history strategies of felids, but also because of the special situation of the Jura lynx population. Any population must be able to compensate for local losses as documented for our study area. But reintroduced populations are typically small and exist in regions with high human activity. If the turnover is too high because of human-caused mortality, and additionally, the total number of animals is small, the population might not be able to survive in the long term.

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PREDATION DU LYNX (*Lynx lynx*) SUR LES ANIMAUX DOMESTIQUES EN SUISSE

Simon Capt et Urs Breitenmoser, Project Lynx Suisse

1 Introduction

En Europe centrale, des populations de lynx résultant de réintroductions d'animaux en provenance des Carpates slovaques existent aujourd'hui en Autriche, France, Italie, Slovénie, Suisse et Tchécoslovaquie: Toutes ces populations sont de taille plus ou moins réduites: En plus des problèmes inféodés aux petites populations isolation génétique, consanguinité, risque d'extinction par maladie ou braconnage; détérioration de l'habitat (le comportement carnivore et prédateur de cette espèce amène des conflits avec l'être humain: Le régime alimentaire du lynx étant constitué principalement d'ongulés de taille moyenne (chevreuil, chamois), ce conflit se situe sur le plan de la chasse et de l'élevage d'animaux domestiques, en premier lieu d'ovins. L'attaque de moutons apparaît aujourd'hui comme le plus important des problèmes liés au lynx, bien que le nombre de propriétaires touchés reste faible:

Ce conflit a déjà été à l'origine de la disparition de ce félin au cours des deux derniers siècles dans les pays mentionnés. Le lynx, prélevant de plus en plus fréquemment des animaux domestiques (moutons, chèvres) à la place des proies sauvages habituelles(chevreuils, chamois) devenues rares en raison d'une chasse incontrôlée de la part de l'Homme et du dépérissement de leur habitat, subit sa relative incapacité en tant que carnivore exclusif d'adapter son régime alimentaire aux nouvelles conditions ayant également eu son importance.

Les données présentées ici se basent principalement sur un premier rapport non-publié établi en 1988 par U. Breitenmoser.

1 Mesures en cas d'attaques sur des animaux domestiques

Les attaques d'animaux domestiques par le lynx sont recensés en Suisse d'une façon plus systématique depuis 1979. Jusqu'en 1988, la ligue Suisse pour la Protection de la Nature (LSPN) versait des indemnités pour les dommages causés. Depuis l'entrée en vigueur de la nouvelle loi fédérale sur la chasse et la protection des mammifères et des oiseaux sauvages en 1988, l'état est chargé du dédommagement. Pour qu'il y ait indemnisation, il faut que la proie puisse être clairement imputée au lynx par un garde-chasse ou un institut vétérinaire désigné. Les gardes-chasse, qui sont des fonctionnaires d'état, ont reçu une formation spéciale leur permettant d'apprécier les proies de lynx. Ils disposent également d'une documentation détaillée comme outil de travail (Breitenmoser et al. 1989). Bien que des critères fiables d'appréciation existent, l'examen objectif d'un cas dans le terrain est peu aisé. Les lieux d'attaques se situent souvent dans des endroits peu accessibles, ce qui rend la recherche d'animaux disparus difficiles. Certains animaux portés manquants ne sont donc pas retrouvés ou trouvés trop tard pour que la cause de la mort puisse encore être déterminée. Cette différence entre les proies indemnisées et les proies effectives constitue toutefois une inconnue difficile à déterminer. Mais le nombre de propriétaires subissant des pertes reste cependant faible. Le fait d'indemnisé que les dégâts causés par le lynx et ceux d'autres prédateurs potentiels comme le chien domestique et le renard peut également influer l'appréciation d'une proie, puisque certains propriétaire voudront à tout prix imputer la perte d'un mouton au lynx. Pour améliorer cette situation, il a été proposé aux éleveurs de moutons de contracter une assurance couvrant toutes les pertes, l'état prenant en charge la part de la prime d'assurance correspondant aux pertes dues au lynx. Aucune suite n'a été donnée à cette demande jusqu'à présent par les éleveurs. Un barème établi par l'association

suisse des éleveurs de moutons sert de référence pour fixer le montant à rembourser dans le cas de moutons tués par le lynx.

La loi fédérale prévoit exceptuellement la capture, voir le tir de lynx, lorsque ceux-ci causent des dégâts graves (attaques répétées au même endroit). jusqu'à ce jour, une seule autorisation a été délivrée, mais elle n'a donné suite à aucun tir ou capture.

2 Aspects quantitatifs et qualitatifs des dommages causés aux animaux domestiques

Le nombre total d'animaux domestiques tués par le lynx en Suisse de 1971, année des premiers lâchers de lynx, jusqu'en 1992 est de 636 (Tab. 1).

Tableau 1. Nombre d'animaux domestiques tuées par le lynx de 1971 à 1992 et les indemnisations payées.

	nombre	indemnisation (sfr)	moyenne (sfr)
ovins	577	168 287	292
caprins	40	19 360	484
daim	13	5 990	461
cerf	1	1 425	1 425
mouflon	4	360	360
Total	636	195 422	307

Les indemnisations payées au cours de cette même période s'élèvent à sfr; 195 422. De 1971 à avril 1988, les dégâts furent pris en charge par une institution privée de la protection de la nature, en occurrence la LSPN. Elle déboursa à cette occasion plus de sfr. 100 000. Avec 577 cas (= 90.7%), le mouton est l'espèce la plus touchée. Un montant moyen de sfr. 292 a été payé par mouton. Les autres espèces concernées sont les chèvres (6.3%), le daim (2%), le cerf (0.2%), le mouflon (0.2) et les bovins (0.6%). Pour ces derniers, aucun dédommagement n'a été octroyé, vu que les faits n'ont finalement pas pu être imputés clairement au lynx. En principe, aucune indemnisation n'est prévue pour des espèces chassables en Suisse comme le cerf, le mouflon et le daim. Les cas mentionnés dans le tableau concernent des animaux maintenus en enclos.

Un nombre très élevé de proies est enregistré au cours des mois de mai à octobre, mais dans certaines régions - surtout le Jura - le lynx dispose de moutons même en hiver (Fig 1).

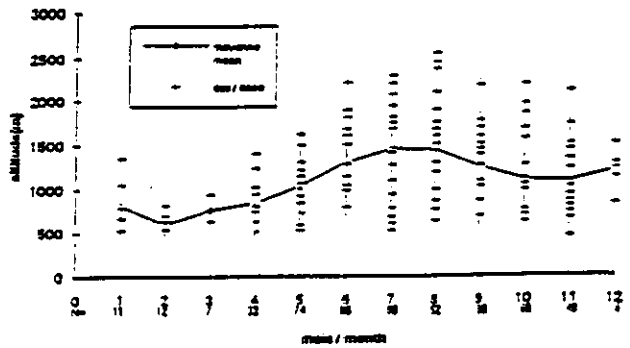

Fig. 1 Lynx en Suisse: cas de prédation sur animaux domestiques par mois et altitude de 1971 à 1992.

Les données maximales sont recensées en juin (86) et septembre (88). L'altitude moyenne pour 558 lieux d'attaques connus se situe à 1057 mètres (minimum 460 m, maximum 2 560 m). Les moyennes les plus élevées sont enregistrées au mois de juillet (1 464 m) et d'août (1 451 m) lorsque les moutons fréquentent les pâtures les plus élevées. Les cas d'attaques les plus bas ont lieu tout au long de l'année aux alentours de 500 m à 600 m d'altitude. Ceci pourrait être expliqué par le fait qu'un certain nombre de propriétaires gardent leurs moutons, suivent de petits troupeaux, chez eux en plaine toute l'année.

3 Evolution des dégâts

L'évolution du nombre de cas de prédation est représentée dans la figure 2; Sur le plan suisse, le nombre de pertes d'animaux domestiques a atteint son maximum en 1989 avec 84 cas. Depuis, le nombre a diminué et semble se maintenir à un niveau bas plus ou moins stable. Il faut relever dans ce contexte que l'effectif des moutons en Suisse a passé de 355 307 animaux en 1983 à 414 700 en 1992.

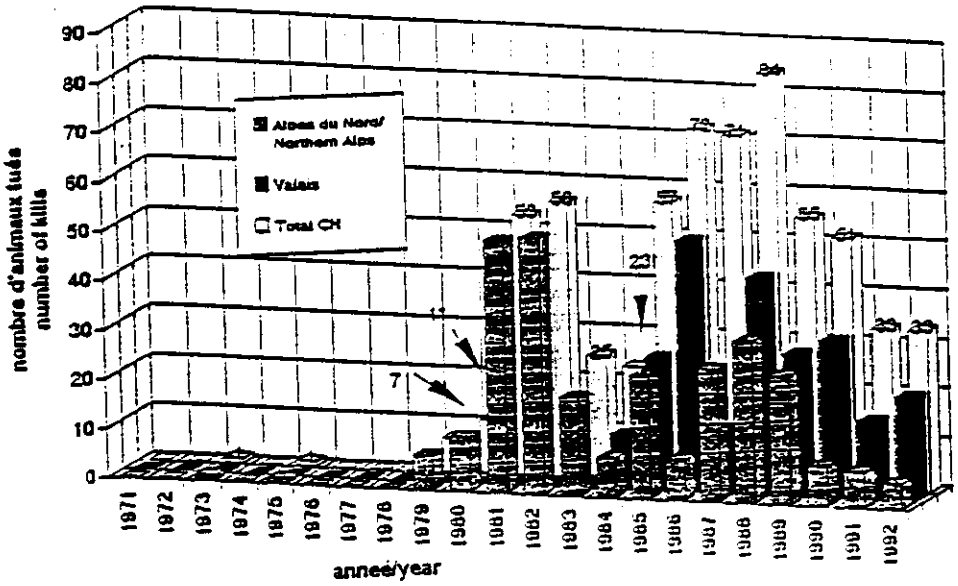

Fig. 2. Nombre d'animaux domestiques tués par le lynx en Suisse

Si nous comparons la région des Alpes du nord et celle du Valais, la première fut colonisée par le lynx à partir de 1971 et la deuxième à partir de 1980, nous constatons une évolution très semblable des cas d'attaques. Une augmentation lente au début, suivi d'une phase à forte croissance, puis baisse des cas et retour à un niveau moyen. Breitenmoser & Haller (1993) mettent cette évolution en rapport avec le développement de la population de lynx sur le front de colonisation. La période à forte croissance des cas d'attaques sur des animaux domestiques coïncide avec la phase de réadaption du système proie-prédateur. Au début de la colonisation, le lynx est confronté à une population d'ongulés sauvages, peu attentif et souvent regroupé en troupeaux importants. La densité de lynx est aussi la plus forte. Cette densité diminue à nouveau lorsque les proies sauvages ne sont plus des proies aussi faciles, ceux-ci étant devenus plus vigilants face au lynx et plus espacés sur le terrain. Durant cette phase transitoire, qui peut durer plusieurs années, le nombre des animaux domestiques attaqués augmente. Le lynx cherche à remplacer en un premier temps les proies sauvages devenus plus difficiles à capturer par les animaux domestiques. L'évolution des cas d'attaques observée depuis 1987 en France dans les départements de l'Ain, du Jura et du Doubs semble confirmer cette explication.

Reste à savoir si ces dommages sont dûs à des lynx déterminés. L'idée que les auteurs des attaques sont avant tout des femelles accompagnés de leur petits, que leur mobilité réduite obligerait à s'attaquer aux proies plus faciles, c'est-à-dire des animaux domestiques, n'a pas pu être confirmée par les suivis radiotélémétriques. Les lynx munis d'émetteurs qui ont causés des dégâts, les cas sont rares, étaient avant tout des animaux subadultes sans territoire propre. Une étude télémétrique de lynx prédateurs de moutons pourrait amener une idée plus précise sur les circonstances de ce comportement.

4 Prévention des dommages

La forme très libre d'élevage des moutons connue actuellement en Suisse permet difficilement de prévenir les dommages. L'élevage de moutons a l'avantage d'exiger peu de moyens et d'être soutenu financièrement de façon importante par l'état. Les régions d'élevage les plus importantes se situent dans les Préalpes et les Alpes, en particulier en Valais. Là, les troupeaux en liberté sont sans surveillance et situés dans des régions difficile d'accès. Ce mode d'élevage a pu se développer au cours de ces dernières décennies grâce à l'absence de grands prédateurs et aussi longtemps qu'il est maintenu, il faut s'attendre à certaines pertes supplémentaires dues au lynx. Des mesures de prévention ne sont pas possibles sans certaines concessions de la part des éleveurs. Il arrive p. ex; que certains pâturages sont plus visités que d'autres; un éloignement temporaire (1 à 3 années) des moutons pourrait faire perdre au lynx l'habitude de fréquenter ces lieux.

Le gardiennage classique des troupeaux de moutons par des chiens et des gardiens constitue certainement le meilleur moyen de protection contre des attaques de prédateurs, mais semble irréalisable parce que trop coûteux. La combinaison de plusieurs moyens, surveillance régulière, enclos, clôtures électriques, colliers protecteurs, rassemblement des moutons le soir, peut être efficace et réalisable dans les régions où les troupeaux sont proches des habitations et exposés à un risque d'attaque certain (proximité immédiate d'une zone boisée importante). Dans les zones éloignées des habitations et difficile d'accès, les possibilités de protection sont peu nombreuses. Seul l'utilisation de colliers protecteurs semble être envisageable. Les quelques essais effectués en Suisse ont apporté des résultats assez réjouissants. Il faut cependant souligner que le nombre de cas de prédation reste infiniment petit face au cheptel de moutons présent. C'est avant tout un problème psychologique et d'attitude envers le lynx. Un système de dédommagement adéquat et un travail d'information conséquent constituent certainement les moyens les plus réalistes pour amener à long terme un climat de tolérance et finalement apaiser le conflit.

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DYNAMICS AND CONSERVATION PROBLEMS OF A SMALL AND FRAGMENTED POPULATION OF IBERIAN LYNX

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The Iberian lynx looks like a smaller version of the Eurasian lynx, being about half its size, with adult males weighing an average of 12.9 kg and females 9.4 kg (Beltrán and Delibes, In press), The ecology of the Iberian lynx is very different from that of the Eurasian lynx, living in Mediterranean habitats with scrub vegetation and preying almost exclusively on European rabbits.

The distribution of the Iberian lynx is nowadays restricted to the Southwestern quarter of the Iberian peninsula 95% of the population living in Spanish territory (Rodriguez and Delibes, 1992). Lynx range covers 14 000 km^2 of which only about 11 000 km^2 is considered to be breeding range. The total number of Iberian lynx probably does not exceed 1 200 individuals with about 350 breeding females. The lynx population is extremely fragmented in 48 breeding nuclei, only two of them exceeding 50 individuals in number. The biggest nucleus (Andújar) extends over 3 000 km ^{2} containing about 370 individuals. The 48 nuclei constitute nine genetically isolated subpopulations, separated by intensively farmed areas and human settlements by an average distance of 45 km. Therefore, the survival of the Iberian lynx is just a matter of conservation and management of a sum of small populations.

Doñana area is believed to be the most protected area where a stable lynx population lives. About 90% of its individuals live within the Doñana National Park and the Regional Park of Doñana Surroundings. We have monitored and studied this population using radiotelemetry and other techniques since 1983 until the present. Our purpose here is to report about the dynamics of this small population and the conservation problems derived from its size. We hope this can be useful for understanding, managing and conserving fragmented and small populations of some other carnivores.

Status of the Doñana lynx population

The distribution and relative abundance have been determined by searching tracks and faeces in 5 x 5 km squares covering a sandy area of 1 500 km^2 (Palomares et al. 1991). This census has been carried out on two occasions, six years having elapsed (1986 and 1992). Both surveys have confirmed the complete isolation of this population. A straight distance of nearly 30 km of cultivated and urban areas constitutes a total barrier separating the Doñana population from the nearest neighbour in the north.

In spite of not having found significative changes in lynx population, estimated around 50 individuals in both censuses, spatial distribution has changed from 1986 to 1992. A great stability has been observed in the central reproductive areas (Matasgordas, Vera de Reserva-Algaida, Marismillas, El Acebuche), while peripheral ones varied strongly (La Puebla, moguer, Torrecuadros) and seem to be exposed to a dynamic process of recolonisation-extinction of variable periodicity.

Two main subpopulations can be defined from the censuses results (Palomares et al>, 1991), one in the North ("Coto del Rey", some 10 individuals) and the second in the South ("Doñana" properly, about 40 individuals), separated by a narrow but effective barrier occupied by marshes and a village. This partial isolation has been confirmed by radio-tracking studies, as only two out of 41 tagged animals in ten years have crossed the barrier.

However, this small migration rate can greatly reduce the probability of stochastic extinction of two fragments of any population (Burkey, 1989).

Factors limiting carrying capacity

The small amount of favourable habitat, due to the high requirements for breeding (trophic, spatial, shelter), mean that only a minimal part of the distribution area is potentially useful for reproduction. A few reproductive females (about 10 615) hold exclusive reproductive territories and breed successfully every year, mainly in the central nuclei. This has considerable effects on the whole population dynamics. For instance, the great pressure of non-reproductive individuals, forces a high turnover of breeder territorial individuals. Also, some females delay breeding for several years. e.g. a female radio-tracked since her first year of life only bred in her natal area when she was 4 years old and her mother, one of the dominant females, was killed by poachers. Males compete also for the acquisition of territories including breeding females, direct struggles between competitors not being uncommon. On some rare occasions, dispersing individuals of both sexes meet in a marginal good area and survive enough time to get to breed there.

Mortality rates and causes

The high adult turnover forces the rejected individuals to leave from the central optimum areas and behave as wanderers. Young individuals also leave, with at least 95% of them leaving their natal area before their second year of life. This double process of dispersal converts a high proportion of the population (40-50%) in "floating" individuals, which are forced to live in the peripheral suboptimum areas, where they are exposed to higher mortality risks (Davis and Howe, 1992). Based on radio-tracking data, we estimated the minimum mortality rate for dispersing individuals was as high as 86% for males and 70% for females (Ferreras et al 1992).

The minimum annual mortality rate for the whole population has been estimated in 0.37, as high as that of some harvested populations of ecologically similar felids. This mortality is mainly caused by human activities d(75% of total rate), not intended in most of the cases (Ferreras et al., 1992). Illegal trapping not focused on lynxes (but on rabbits and foxes) is the most important cause of death (41.7%), followed by road traffic (16.7%), illegal hunting with dogs (8.3%) and artesian wells (8.3%). Only 8.3% of the annual mortality rate can be related unequivocally to natural causes.

Most of the deaths occur outside or on the borders of the protected area (55% of the 31 recorded cases), in spite of its supporting the main part of the population. However, the irregular shape of the distribution gives a high perimeter-surface proportion, increasing the negative effect of edge processes.

Genetic problems

Lynx population density in Doñana is very low, except in the stable breeding nuclei, due to the high mortality in peripheral areas. This situation leads to a loss of genetic variability, as usually only a minimal part of the population breeds. Genetic variation of the population may have decreased during the last three decades because of the genetic drift associated to small population sizes (Lacy, 1987; Crow and Deniston, 1988). So, we have observed the loss of two pelage morphotypes of the three previously existing (Beltrán and Delibes, 1993).

Demographic stochastic processes are increased by the fragmentation of the population. Central reproductive areas act as sources, while peripheral ones act mainly as

sinks, suffering periodic episodes of recolonisation-extinction (Howe et al., 1991). This "metapopulation" dynamics is regulated by stochastic and habitat-management processes. In the first category we include: reproduction rates in the sources, dispersal from there, survival of dispersing animals, chance of immigrants of a different sex joining simultaneously in the same sink, chance of dead after arrival, etc (Sabelis et al., 1991). All these factors bring a high uncertainty to the existence and duration of the peripheral nuclei as shown by the two different censuses.

Other factors

Iberian lynxes are heavily dependent on rabbits (Delibes, 1980; Beltrán and Delibes, 1992), which at present are suffering from myxomatosis, the new Neumonic Haemorrhagic Disease (NHV) and a natural and man-induced drought that limits available pasturage. Low rabbit numbers reduce potential breeding areas and can determine a high kitten mortality rate due to the inability of the female to feed all her litter. On the other side, an increase of the rabbit numbers could allow a reduction of the exclusive territory sizes, making possible the reproduction of more females inside the protected areas. In addition, the increase of human pressure from tourism and agriculture in the border of the Park has some negative consequences such as the increase of disturbance in peripheral potential breeding areas and the increase of human-related mortality risks.

Measures to increase the viability of the population

Viability of the population could be primarily increased by increasing its size and this can be achieved by expanding the distribution area and improving the quality of the present one. In this sense, a Management Plan for Conservation of the Lynx in Doñana, prepared by the Estación Biológica de Doñana (CSIC) and the Administration of the Park of the habitat, mainly by vegetation treatment, increasing rabbit populations and changing some vegetation types by other more suitable ones for the lynx. It also considers minimizing the mortality risks, but this point is very difficult to achieve as it involves actuations in the surroundings of the protected area and sometimes expensive public works.

But efforts carried out in the protected area can be useless if they are not applied together with a policy of low impact activities in the surrounding area. Some authors have recently showed doubtful on the suitability of the traditional wildlife park model to warrant the preservation of some species (Grumbine, 1990) and stated the need for designing regional strategies of preservation to go beyond the parks. In this sense, an international commission has recently proposed a strategy of economic development of the area compatible with the preservation of its ecosystems (Comisión Internacional de Expertos sobre el Desarrollo del Entorno de Doñana, 1992). As the only solution, the conclusion of this commission postulates a model of sustainable development based on natural ecological tourism, the elaboration of agricultural products with an origin denomination and the promotion of low impact activities of land use, such as soft agriculture, extensive livestock, apiculture, sylvicole uses and controlled hunting. Moreover, these measures in the area must be accompanied by a continuous monitoring and research on conservation biology of the lynx population.

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PREDATION DU LYNX SUR LE CHEPTEL DOMESTIQUE DANS LE MASSIF DU JURA

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Le lynx a disparu du massif du Jura à la fin du XIX siècle. Sa réintroduction a été effectuée officiellement en Suisse entre 1974 et 1975 dans la Réserve Naturelle du Creux du Van et quelques individus supplémentaires furent introduits clandestinement en d'autres points du Jura suisse.

Ces opérations de réintroduction ont été à l'origine de la colonisation progressive du massif du Jura français dans les années qui ont suivi. La première observation dans le Jura français s'est produite dans le département de l'Ain en 1974. De nos jours, l'espace occupe la quasi-totalité du massif jurassien (environ 500 000 ha sur les 600 000 ha de la partie française).

Le régime alimentaire du lynx est axé principalement sur les ongulés de taille moyenne (chevreuil, chamois) mais il peut s'attaquer également à des animaux domestiques de taille similaire. Les premières attaques authentifiées de lynx sur le cheptel domestique dans le Jura français datent de 1984, dix ans après le premier signalement de l'espèce. Elles se sont très fortement intensifiées entre 1988 et 1989, amenant à un rejet total de l'espèce par les populations locales.

Afin d'enrayer cette évolution et permettre une meilleure acceptation de l'espèce en France, un plan d'action a été mis en place à partir de 1989 par le Ministère de l'Environnement en concertation avec les administrations locales et l'Office National de la Chasse.

Ce plan consistait en priorité à

(i) mettre en place des mesures de protection directe des troupeaux (colliers de protection en cuir, changement de parc ...) sur les exploitations ayant subi trois attaques au cours d'une année,
(ii) éliminer les lynx des zones où un nombre très élevé d'attaques se produisait.

Ce texte présente une première évaluation des mesures mise en place pour limiter les dégâts.

Evolution du nombre d'attaques depuis 1984

Entre 1984 et jusqu'en 1992, quatres phases peuvent être distinguées: une phase de faible incidence des attaques entre 1984 et 1986 avec 3-6 attaques par an, une phase d'augmentation rapide du nombre d'attaques entre 1987 et 1989 (19 attaques en 1987, 95 en 1988, 227 en 1989), une phase de diminution progressive en 1990 et 1991 (140 attaques en 1990, 79 en 1991) qui semble se stabiliser en 1992 (89 attaques) et coïncider avec la mise en place du plan d'action. Certaines régions du massif du Jura sont restées peu touchées tandis que des concentrations d'attaques se développaient sur quelques sites. Seulement 13% des exploitations subissent en moyenne plus de cinq attaques par an, 26% subissent 2 à 4 d'attaques ans l'année et 61% des exploitations ne subissent qu'une attaque dans l'année.

Efficacité des mesures de prévention des attaques

Influence des mesures de protection directs

Près de mille colliers de protection en cuir ont été posés à titre expérimental dans une vingtaine d'exploitation entre 1989 et 1992. Cette mesure n'est pas toujours acceptée par les éleveurs qui lui reprochent d'entraîner une surcharge de travail et de masquer l'identification du prédateur en cas d'attaque. L'efficacité de cette mesure n'est pas totale, 7 animaux (3 moutons et 4 chèvres) avant été attaqués malgré la présence de colliers mais elle semble bien adaptée pour la protection de petits troupeaux; Ceux-ci peuvent être équipés en totalité sans un travail trop important et les colliers peuvent être bien ajustés à la taille du cou pour assurer une protection optimale.

Influence de l'élimination des lynx

De fin décembre 1989 à fin 1992, 7 lynx ont été éliminés par piégeage et tir sur des élevages ovins à forts dégâts dans le cadre de la procédure légale mis en place. Ils s'agissait de 4 mâles adultes, de 2 mâles subadultes et d'une femelle. En outre, deux animaux supposés être des lynx ont été probablement empoisonnés par des colliers toxiques mais ils n'ont pas été retrouvés.

L'analyse des données sur le nombre d'attaques observées avant et après ces enlèvements (VANDEL et al 1992) montre que:

- l'élimination d'un lynx entraîne une baisse significative fréquence des attaques sur les exploitations durant les 20 premiers jours qui suivent l'élimination;
- dans six cas sur sept, des attaques sont réapparues après l'élimination d'un lynx voir après l'élimination d'un second prédateur sur la même exploitation. Le délai de réapparition des attaques a varié entre 10 et 88 jours.
- le nombre d'exploitations attaquées dans un secteur d'environ 250 km^2 autour du lieu de capture, correspondant à la taille moyenne du domaine d'un lynx, diminue également.
- entre 1989 et 1991, une diminution du nombre d'attaques est constatée sur les secteurs éloignés (plus de 300 km^2) des sites d'enlèvement de lynx prédateurs de moutons mais cette diminution est moins rapide.

Discussion

le plan d'action, et notamment la capture des lynx consommateurs de moutons semble être une mesure efficace pour limiter le nombre d'attaques subies par des exploitations durant une année donnée. Une diminution de la fréquence des attaques est constatée également dans les exploitations voisines du lieu de capture, ce qui peut signifier que les attaques sont, à un moment donné, le fait d'un seul individu. Sept des huit lynx consommateurs de mouton capturés dans le Jura étaient des mâles. Les attaques de cheptel domestique ne sont ainsi pas en majorité le fait de femelles élevant des jeunes. Bien que la position ainsi pas en d'animaux adultes laisse supposer que ce comportement prédateur n'est pas non plus lié directement à une phase de dispersion d'animaux à la recherche d'un territoire; Enfin, les résultats obtenus rendent improbable l'hypothèse d'une simple spécialisation individuelle de certains lynx sur des moutons: des dégâts sont réapparus sur les mêmes secteurs après l'enlèvement d'un lynx adulte et dans les mêmes régions. Il apparaît également que les exploitations les plus touchées durant la première année ont une forte probabilité d'être touchées pendant un nombre d'années élevé. Il se pourrait donc que certaines caractéristiques du "milieu" (densité en proies sauvages, caractéristiques des parcs à moutons...) ou liés à la population de lynx elle même (topographie du site par rapport aux

axes de déplacements..) rendent certains sites particulièrement propices au développement des attaques de lynx. Pour limiter les éliminations de lynx et d'étude sur les caractéristiques du milieu et de l'élevage ovin ainsi que sur le comportement spatial et social des lynx prédateurs de moutons.

L'origine de la diminution du nombre d'attaques constatée dans les lieux éloignés des sites d'enlèvement des lynx reste inconnue. Cette diminution apparaît moins rapidement que sur les sites ou des mesures de protection ont été mis en place mais elle est nette. Différentes hypothèses non contradictoire peuvent avoir contribuer à cette diminution: régulation de la population de lynx après la phase d'extension succédant à la colonisation, prélèvements illégaux de lynx sur certains secteurs, régression de la pratique de l'élevage ovin sur certains sites touchés par des attaques...

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Remerciements

Nous remercions l'ensemble des correspondants de terrain des commissions d'expertise et d'observation du massif jurassien, les participants bénévoles, les Gardes Nationaux de la Chasse et de la Faune Sauvage.

ON THE STATUS AND THE MANAGEMENT OF THE EUROPEAN MINK *Mustela lutreola*

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The European mink, *Mustela lutreola*, is a polecat-shaped, small semi-aquatic carnivore. Its original range spread over the whole of continental Europe, except Western Spain, Portugal, the Netherlands, Belgium (only historic records exist; van Bree, 1961), Denmark, Italy, Sweden, Norway. It is unclear why the range and number of the species have decreased severely during this century and its status is now critical, surviving only in approximately one-fifth of its original range. At present the total population of the European mink has been estimated to be less than 30 000 (Maran, 1993).

The European mink is included in Appendix 2 of the Bern Convention and has been regarded as a vulnerable species in the IUCN's Red Data Book.

Present status of the European mink in European countries

France

The European mink is present in western France from Normandy to the border of Spain (Chanudet, Saint-Girons, 1981; Braun, 1990). French experts have estimated its number to be 2000.

Spain

The first record is as recent as 1955. The population inhabits a small area in the northern part of the country (Blas Aritio, 1970; Palomares, 1991; Ruiz-Olmo, Palazon, 1991). The number of mink is estimated to be 1000. The species seems to widen its range to the south (Ruiz-Olmo, Palazon, 1990).

Switzerland

The last records date back to 1894 (Gautschi, 1982).

Romania

According to unconfirmed data there seems still to be a mink population in the Danube delta (Youngman 1982). Dr Murariu (Bucharest) has estimated its number to be 200 (pers.comm.)

Germany

The species vanished in the middle of the last century (Youngman, 1982).

Austria

The last records date back to the 19th century (Youngman, 1982).

Hungary

The last records date back to 1952 (Youngman, 1982).

Bulgaria

The most recent information dates back to 1951 (Youngman, 1982).

Czech & Slovak Republics

The last records are from the early fifties (Barta, 1965).

Yugoslavia

The only known record is from 1941 (Youngman, 1982).

Poland

The number started to decline at the beginning of this century. The last specimens are from 1925-1926. At present it is most probably extinct (Romanowsky, 1990).

Finland

The European mink has been regarded as an extinct species for nearly 15 years. Until the beginning of 1993 the last records were dated 1965, 1968, 1978 (Hentonen et al., 1991). In April 1992 a mink was trapped in eastern Finland in Sotkamo District. At the end of January 1993 it was identified to be the European mink. The enquiries among local hunters revealed three additional (unconfirmed) records of the European mink's existence in this region. It gives us grounds for stating that the European mink seems still to exist in very low numbers in Finland.

Russia

There are populations in Volga, Dnepr and West-Dvina river-basins. The population with highest density lies in the Kalinin region. This location seems also to be the centre of the former range. The European mink decreases in number and in distribution almost everywhere (Tumanov, Zverjev, 1986). The status of the mink in protected areas is also critical: in one fourth of the whole protected territory the European mink is extinct; in 68% of the territory the population is decreasing or is otherwise in a critical state, and in less than 2% of the protected territories does the population seem to be stable (Maran, 1992).

Georgia

Formerly the species inhabited the river-banks at the Black Sea. If the European mink still exists there, its status should be most critical (Kudatkin, in lit., 1991).

Moldova

In the thirties the number of European mink started to decline very quickly. Nowadays, it inhabits the lower course of the River Prut. The population is declining (Muntjanu et al., 19??).

Ukraine

By the eighties only some isolated small populations survived in upper river courses in the Carpathians (Turjanin, 1986).

Belarus

The European mink was common until the forties. At present there is a small population consisting of 150-200 individuals in the north-east of the country. It is estimated that the population will die out during the next five to ten years (Sidorovich, 1991a, 1993).

Lithuania

The European mink is extinct on the whole territory of Lithuania (Lietuvos ..., 1991). It was rare even at the beginning of this century. The last confirmed data are from 1978 and 1979 (in southern Lithuania; Bluzma, 1990).

Latvia

There have not been precise records on the European mink until this year and a majority of the theriologists in Latvia had been inclined to consider the European mink as an extinct species (A. Zoss, V. Pilats, personal communication). This year the mink trapped in northern Latvia some 2 km from the Estonian border was identified to be the European one. It indicates that single individuals still exist in this country.

Estonia

The European mink was common until the fifties and sixties. In the eighties it inhabited only northern Estonia (Maran, 1991). The other parts were occupied by the American mink. At present the American mink occurs everywhere and the European mink population together with the American inhabits the northern part of the country. The European mink number is decreasing rapidly and its disappearance is forecast within five to ten years.

Causes of decline

The factors causing this rapid decline have so far remained under hot discussion among the experts. There seems not to be any valid explanation for it. The following hypotheses have been put forward:

- The European mink is competed out by the introduced American mink (Sidorovich, 1991b)
- The European mink is competed out by the polecat (Schröpfer, 1989).
- The European mink is competed out by the otter.
- The European mink gives fertile hybrids with the very closely related polecat. As a result the European mink population "melts" into the polecat population (Granqvist, 1981).
- The breeding season of the American mink covers February and the beginning of March. Males remain sexually active until the end of April, which coincides with the breeding season of the European mink. Being more active and more vital, the males of the American mink also copulate with the females of the European mink. Fertilization does occur, but the embryo aborts at a certain stage. So every year a part of the European mink females are removed from breeding, which eventually results in extinction of the species (Ternovsky, 1977).
- The European mink is dependent on its prey - grayfish. As the latter is disappearing, it will also cause a decrease in European mink. (Henttonen, 1992, pers.comm.)
- The biotopes of the European mink have been altered by human activities.
- The European mink is over-hunted.
- The European mink is vanishing because the lifetime of the species is ending. (Rozhnov, 1993).

Although there is no satisfactory explanation for all specialists on what is the key-factor in the decline of the species, it seems that most of the experts agree that the impact of the introduced American mink, the loss of biotopes and the direct human influence play a crucial role here. It is also likely that in different geographical locations the set of factors may be different.

Problems and tasks in the conservation of the European mink

The lack of clear understanding about the factors causing the decline makes it difficult to decide the proper measures to preserve the species. Several gaps in existing data about the biology of the European mink makes it even more difficult.

There are some essential tasks which should be performed to promote the conservation of the European mink.

1. As there is no clear understanding about the reasons for the decline, above all, the survival of the species in a form of properly managed self-sustaining captive population should be guaranteed. Such a project has already been initiated under the guidance of the IUCN, MVSG and EAZA/EEP Committee. One of the difficulties faced here is the unclear

intraspecific systematics. We do not know yet whether we are dealing with several subspecies or with one solid species. On this point a genetic research with the use of modern molecular methods is necessary to revise the present knowledge of the European mink intraspecific variation. Until such a study has been conducted, only animals from the central part of the range (referred to as *Mustela lutreola novikovi*) will be used as founders for the captive stock.

2. The data on the status of the European mink in CIS and in Romania are not sufficient. It is known that the number of species is declining almost everywhere, but for most of these countries it is not known how severe the status in different geographical locations actually is. Therefore, there is an urgent need for detailed survey of the species and following monitoring.

As there do not appear to be experts on small carnivores in Romania, a special expedition with the aim to survey the European mink should be organised.

3. The proposed hypotheses of the European mink's decline need revision. Special attention should be paid to the relations of the native mink and the American mink. The studies on population biology of the stable population (without the influence of the American mink) as well as the vanishing population of the European mink (influenced by the presence of the American mink) should be initiated. These studies might - through the comparison of these two populations - throw light upon the role the American mink plays in the decline of the native species.

The role of other factors (eg pollution, parasites, loss of habitats) must also be revised. Several special studies are necessary here.

4. The possibilities of founding a special reserve for the European mink should be looked into. This reserve must satisfy several prerequisites: (a) it must lie within the natural range of the European mink, or, if it is outside, there must be a guarantee that the introduction of the European mink will not endanger the local fauna; (b) the carrying capacity of the mink biotopes there must be high enough to allow the existence of the self-sustaining population of the European mink; (c) the impact of the factors, which have caused the decline of the European mink in its natural range must be precluded.

It is obvious that due to lack of appropriate knowledge it is not possible to found such a reserve in the near future, but in the long-term perspective this task should be kept in mind.

Conservation projects in the former Soviet Union

There have been two projects carried out with an aim to preserve the European mink in the ex-USSR. The main idea in both of these has been to avoid the influence of the American mink by introducing the European mink to the area inaccessible to the intruder.

In 1981, Dr D.V. Ternovsky (The Institute of Biology at the Siberian Branch of the Academy of Sciences of the USSR) initiated a programme to introduce the European mink to Kunashir Island (Kuril Archipelago). Altogether 388 animals were released in Kuril Archipelago (Kunashir & Iturup Islands) in 1981-1989 (Ternovsky in litt, 1991). The first 25 animals were released in Kunashir in 1981 (1500 km^2; Ternovsky et al., 1986). Up to 1985 127 captive bred (from breeding station in Novosibirsk) and 7 wild caught minks were released in Kunashir (Ternovsky, Ternovskaya, 1988). In 1986 a project for introduction of the European minks to the neighbouring island Iturup (6725 km2) was launched. Within two

years (1986-1987) 114 European minks were released there; in 1988 90 additional individuals were introduced to this island (Saudsky, 1990).

In 1988 another release site was selected - the Shingindira River in Tadjikistan, where 108 individuals were released in two years (1988-1989; Saudsky, 1989; Ternovsky in litt., 1991).

The introduction programme in the Kuril Islands seems to have been rather successful. The European mink have settled well. In 1989 approximately 500 European mink were estimated to live on both islands (Voronov, 1989). There is no information on the results of the introduction in Tadjikistan.

This project has its negative side. The Kuril Islands are very distant from the original range of the European mink and the natural conditions these are very different from those normal for the European mink habitats. There is always great risk in such cases of damaging the local fauna of release-site and very careful research should be conducted before initiating any introduction. Unfortunately it had not been done properly in the Kuril Islands. As a result the introduced European mink is a serious threat to several endangered amphibians and reptiles of local fauna (Dr I.S. Darevsky, Dr L.Q.Borkin, 1988, pers.comm.). The release of the European mink there has been considered to be a serious mistake (Benkovsky et al.,1990).

A little later, in 1982, another release-project was initiated by Dr I.L. Tumanov (All-Union Game-research and Fur-farming Institute, St. Peterburg) and by Dr V.V. Rozhnov (IEMEZ, Moscow) on the group of islands in Lake Ladoga (Leningrad Region; Tumanov, Rozhnov, 1990). The main island Walam is at a distance of approximately 30-40 km from the shore. The dimensions of the island are 7.5 km from south to north and 8.5 km from south-west to north-east.

In July, 1982 two pairs of wild-caught minks (Pskov Region) were released in two different locations on Walam Island. In 1984 12-15 European minks were estimated to live there (Tumanov, Rozhnov, 1990). In August 1984 and in September 1986 7(2.5) additional wild-caught (from the same region) mink were released on Walam. In 1989/90 the signs of mink were still recorded by the local people. In 1992 there were no European mink on Walam any more (Dr V.V. Rozhnov, 1992, pers. comm.).

The introduction on Walam Island also had serious shortcomings, which eventually led to its failure. The positive side of this introduction was that the site selected lay within the natural range of the species; so it was less likely that the introduced species could have had a negative impact on the local fauna. But at the same time, the island seemed to be too small for a self-sustainable European mink population. The initiators of the project claim in their report (Tumanov, Rozhnov, 1990) that the carrying capacity of the island is approximately 100 individuals, which is obviously not enough. Concerning the suitable habitats and food resources, the report is inconsistent. In one paragraph the authors claim that there are a lot of man-made, but at present out of use ditches, which could be good biotopes for mink. But some paragraphs later they claim that the granite surface of the island limits the amount of suitable shelter for mink to such an extent that it would be necessary to make artificial nest-boxes for the mink. Although the authors state that food resources are abundant (rodents, frogs, fishes) on the island, the analysis of the mink's diet in the same report indicates the opposite. The usual prey (amphibians (0%), fish (11.8%), rodents (17.2%)) have a surprisingly low level in the diet, whereas such usually insignificant prey-items like insects and molluscs (54.2% and 12.4% respectively) form the major part of the mink's diet.

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BEAVERS IN LATVIA - ROLE IN LANDSCAPE, REINTRODUCTION, RESULTS AND MANAGEMENT

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Latvia, Salaspils, 1993

After the last glacial age beavers on the territory of present-day Latvia, lived in great number. The multitude of dams and shallow pools on the watersheds and cascades on little streams accumulated large amounts of water, thus positively influencing the flow in major streams.

Beavers' ponds were attractive for waterfowl. Burrows and lodges provided shelter for other species, but fallen trees and shrubs attracted consociations of ruminants, rodents and other animals, thus building exceptionally rich ecosystems.

The important role of beavers in peoples' households, inhabiting today's Latvia, is evident by the remains of their bones, found in archaeological excavations, by toponyms, surnames and folk songs. With the beginning of the 18th century, little by little these animals lost their economical and ecological significance, beaver ponds dried up, underwent their transformation into marshy meadows, which at last overgrew with birches and other species, forming growths of lower density and growth classes in comparison with those on bottom-lands. The last aboriginal beaver was killed in 1871 (or 73).

To reintroduce the species, on 30 August 1927 two pairs in the river Stende and in 1935, one pair in river Lipsa of brown Castor fibre f. as Norway's presents were released. There were 60 beavers in 1939 and 80 in 1950.

In 1952, 5 pairs of black beavers from the Voronezh Reserve were exchanged for our brown one's and released in the river basins of Venta, Irbe and Slocene. Since 1960 (or earlier), beavers immigrate from South and East. From 1975 to 1984, 145 local beavers were translocated. In this way a total of 161 relocated animals might be only a part of all immigrants.

The dynamics of beaver populations were calculated by using differential of equation of Lotka and Volterra, as explained by E Odum in 1971. Countings, actualisations and extrapolations of control groups estimated (by annual growing rate R = 1.25) that the number of beavers in 1985 had exceeded 25 000, in 1990 about 50 000 and is growing yet. The calculated landscape capability factor could exceed 150 000 animals, although this number may never be accepted as management aim.

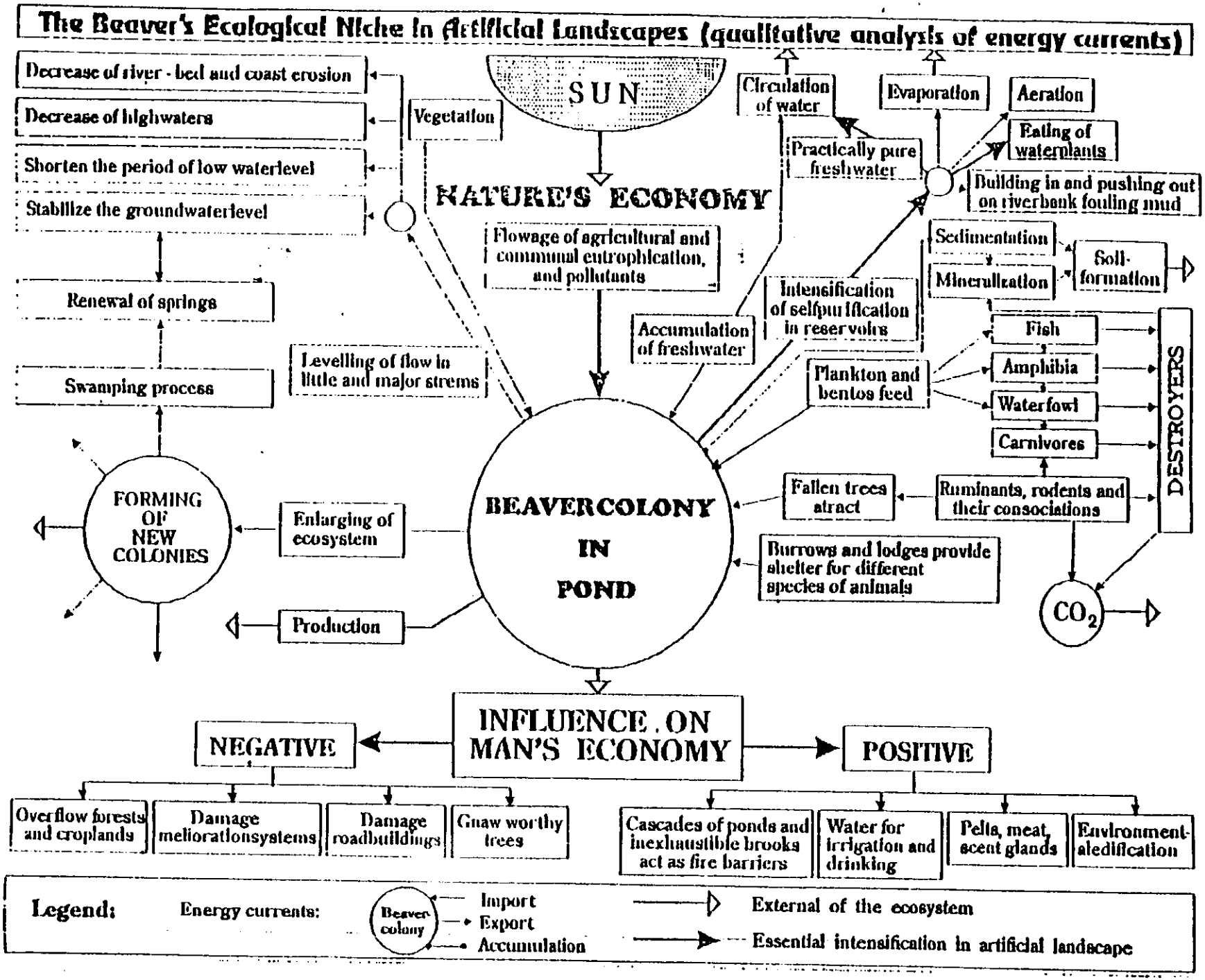
As the blocking of drainage systems, their damage and flooding of forests are the causes of conflicts with landowners, the increase of population must be strictly controlled. With this intention , so as to verify forecasts and to get morphological measurements in the seasons from 1980/81 to 1992/93, a total of 40 000 beavers were trapped.

In the today's antrophogenic landscape, beavers realise two very significant functions:

i) they preserve and locally renew the disappearing wetland ecosystems;
ii) they significantly increase the self-purification capacity of rivers polluted by communal sewage, cattle farms and agricultural discharge.

Nevertheless, the uncontrolled blocking of drainage systems demands immediate action. In this case, we recommend that the edification of environment is maximized, but the negative aspects minimized. Although to realise this task practically is very difficult because

today's prices of beaver skins are very cheap but those of fuel are relatively cheap. Thus beaver trapping becomes uneconomical for hunters living far from beaver settlements. Therefore the problem must be solved in another way; moreover immediately because the local, very high densities of beavers might cause conflicts with landowners because of dangerous epidemic diseases with unforeseen consequences for the species and environment.


The Beaver's Ecological Niche in Artificial Landscapes (qualitative analysis of energy currents)
SUN
NATURE'S ECONOMY
Vegetation
Decrease of river - bed and coast erosion
Decrease of highwaters
Shorten the period of low waterlevel
Stabilize the groundwaterlevel
Renewal of springs
Swamping process
Levelling of flow in little and major strems
Flowage of agricultural and communal eutrophication, and pollutants
Circulation of water
Evaporation
Aeration
Eating of waterplants
Practically pure freshwater
Building in and pushing out on riverbank fouling mud
Sedimentation
Mineralization
Soil-formation
Intensification of selfpurification in reservoirs
Accumulation of freshwater
Plankton and bentos feed
Fish
Amphibia
Waterfowl
Carnivores
DESTROYERS
Ruminants, rodents and their consociations
Fallen trees atract
Burrows and lodges provide shelter for different species of animals
BEAVERCOLONY IN POND
FORMING OF NEW COLONIES
Enlarging of ecosystem
Production
CO2
INFLUENCE ON MAN'S ECONOMY
NEGATIVE
POSITIVE
Overflow forests and croplands
Damage meliorationsystems
Damage roadbuildings
Gnaw worthy trees
Cascades of ponds and inexhaustible brooks act as fire barriers
Water for irrigation and drinking
Pelts, meat, scent glands
Environment-aledification
Legend:
Energy currents:
Beaver-colony
Import
Export
Accumulation
External of the ecosystem
Essential intensification in artificial landscape

SURVEILLANCE DE LA DISTRIBUTION DE QUELQUES POPULATIONS DE MAMMIFERES RARES EN FRANCE PAR DES RESEAUX D'OBSERVATEURS SPECIALISES

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Pour mettre en place puis évaluer l'efficacité d'un programme de conservation d'une espèce rare de mammifère; il est nécessaire de suivre précisément l'évolution de sa distribution et de son statut (=abondance). Par exemple, lors de la mise en place d'un programme, de telles données sont utiles pour démontrer l'urgence des mesures de protection qui doivent être appliquées. Pour mesurer la réussite d'un programme de réintroduction d'une espèce, de tels éléments permettent d'évaluer la réussite de l'opération et de décider du moment ou il n'est plus nécessaire de réintroduire de nouveaux individus.

La surveillance de la distribution et du statut de nombreuses espèces de mammifères est cependant difficile à mettre en place : les observations directes et les indices de présence sont rares et, dans le cas des grands carnivores, les zones sur lesquelles ils évoluent sont très étendues.

Différentes méthodes ont été tentées :

a) statistiques de captures ou de chasse. Ces données peuvent être utiliées quand l'effort de capture ou de chasse est connu mais elles sont inutilisables pour les espèces rares protégées.

b) statistiques systématique par interview ou par questionnaire. Les signalements de l'espèce (observations visuelles, animaux trouvés morts...) sont recensés sur des mailles de dimensions fixes (par exemple 10 km^2). Les signalements peuvent être transmis par des observateurs occasionnels (chasseurs, naturalistes..) mobilisés pour l'occasion. Ils peuvent également être recueillis par les biologistes responsable de l'enquête afin de mieux contrôler la fiabilité des données.

b) Les principaux inconvénients des enquêtes sont que

   i) la fiabilité des données reste sujette à caution car l'aptitude des observateurs à reconnaître l'espèce ou ses indices de présence n'est pas maîtrisée;
   ii) la répartition et le nombre d'observations dépendent de la pression d'observation. Celle-ci n'est pas contrôlée et peut varier selon les régions;
   iii) de nombreuses informations sont perdues car non-transmises aux enquêteurs.

c) prospections sur le terrain selon un plan de sondage précis. Les données recueillies sont généralement fiables car les informateurs ont une bonne connaissance de l'espèce étudiée; le plan de sondage permet une prospection homogène du territoire. Les inconvénients des prospections sont qu'elles

   i) mobilisent un personnel important, ce qui ne permet pas de les répéter à intervalle régulier;
   ii) se prêtent mal à l'étude de certaines espèces discrètes ou à très grand rayon d'action: les indices de présence sur le terrain sont rares et ont peu de chance

d'être trouvé au cours d'une prospection donnée. Le pas de temps de la surveillance doit ainsi être étendu (par exemple des prospections étalées sur trois ans et une surveillance répétée tous les dix ans).

Pour tenir comte au mieux de toutes ces contraintes, une méthodologie originale est développée progressivement en France pour certaines espèces rares et/ou posant des problèmes (attaques de cheptel domestique, dégâts agricoles ou forestiers...). Cette méthode repose sur la création de réseaux de correspondants locaux, spécialisés sur une espèce donnée. Ces synthèses sont rédigées sous forme de cartes, de rapports ou de publications scientifiques et servent de support à l'administration pour les programmes de gestion et de conservation des habitats et des espèces.

Les techniques de prospection et d'enquête sur le terrain restent bien sûr propres à chaque espèce (par exemple des campagnes de captures sont planifiées pour connaître la distribution du Vison d'Europe, la colonisation de nouveaux habitats par le Lynx est suivie par la vérification de tous les signalements complétée par une recherche d'indices sur le terrain) mais les avantages d'un système de surveillance de la distribution reposant sur des correspondants spécialisés sont multiples: le correspondant est implanté dans une aire géographique délimitée; il peut ainsi avoir connaissance par ses contacts avec la population d'un grand nombre d'observations qui autrement seraient perdues dans le cas d'une enquête épisodique; la pression d'observation est mieux répartie sur le territoire d'étude; la fiabilité des données est contrôlée, chaque signalement faisant l'objet d'une vérification immédiate par le correspondant compétent;

Il existe actuellement trois réseaux coordonnés par l'Office National de la Chasse, sur l'ours brun (*Ursus arctos*), le Lynx (*Lynx lynx*), le Castor (*Castor fiber*). Deux autres réseaux créés plus récemment associent plusieurs organismes, l'un sur le Vison d'Europe (*Mustela lutreola*) et l'autre sur le Loup (*Canis lupus*). Ces réseaux s'inscrivent dans le programme des études de l'observatoire national mis en place par le Ministère de l'Environnement Français.

Organisation des réseaux

Selon les réseaux, les correspondants sont uniquement des professionnels de la surveillance de la faune (Garde nationaux de la Chasse et de la faune sauvage, Garde-moniteurs des parcs nationaux) ou comprennent également des personnes qui de par leur activité ou leur passion sont à même de recueillir des observations régulières sur l'espèce (Agents forestiers de l'Office National des forêts, naturalistes...). Chaque correspondant est spécialement formé à la recherche et à la reconnaissance des indices de présence de l'espèce sur le terrain ainsi qu'à la vérification des témoignages et des observations la concernant. La formation des correspondants est assurée au cours de stages de formation pratique de deux à huit jours comprenant des séances sur le terrain et des cours en salle. Des stages de formation sont réorganisés épisodiquement quand le nombre de correspondants diminue. Les correspondants agents de l'Etat, remplissent également pour les espèces commettant des dégâts (attaques sur le cheptel domestique, dégâts agricoles ou forestiers) une mission d'expertise des dégâts et de conseil pour la prévention. Toutes les données recueillies sont transmises à l'animateur du réseau qui en assure l'analyse et prépare les synthèses destinées à l'administration. L'animateur du réseau, qui est un biologiste spécialiste de l'espèce en question, retourne également l'information aux correspondants de terrain par un bulletin de liaison ou lors de réunions. Ce retour régulier est important afin que tous les correspondants volent les résultats de leur travail et ne se démotivent pas au fil des ans.

Principales caractéristiques des réseaux

Ours brun[1] :

Zone d'étude: Totalité des zones ou subsiste l'espèce en France (départements des Pyrénées).

Objectifs actuels : surveillance de la distribution et dénombrement des individus.

Nombre de correspondants : environ 100.

Méthodologies : recherche d'indices sur des itinéraires fixes - prospection simultanée de l'ensemble de la zone pour dénombrer la population - recherches d'oursons - contrôle de tous les témoignages de présence de l'espèce.

Résultats : une première synthèse sur la distribution a été faite en 1989. Une réactualisation est prévue en 1994. Un bilan annuel des opérations de dénombrements est fait chaque année

Castor[2] :

Zone d'étude : ensemble du réseau hydrographique de 15 départements français (essentiellement bassin du Rhône). Extension prévue à l'ensemble des départements hébergeant des castors.

Objectifs actuels : Cartographie de la distribution sur la zone d'étude. Expertise et prévention des dégâts.

Nombre de correspondants : une trentaine.

Méthodologies : prospections systématiques des cours d'eau. Analyse techniques des dégâts.

Résultats : réalisation en 1994 de la première cartographie précise des rivières habitées par les castors dans la zone d'étude - bilan annuel depuis 1989 des expertises des dégâts et des mesures de prévention et de protection - réalisation de recommandations à suivre en matière de réintroduction du castor.

Lynx[3]

Zone de prospection : totalité de l'aire de présence potentielle de l'espèce de l'est de la France soit 13 départements français- extension en 1994 dans deux nouveaux départements.

Objectifs : cartographie de la distribution actuelle et surveillance de la poursuite de la colonisation - expertise des dégâts sur le cheptel domestique.

Nombre de correspondants : environ 350 correspondants.

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1 Reseau animé par l'Office National de la Chasse

2 ditto

3 Reseau animé par l'O.N.C. et les administrations locales.

Méthodologies : recherche et vérification d'indices (proies, traces, attaques sur animaux domestiques) contrôle des témoignages - expertise des dégâts sur le cheptel domestique.

Résultats : première synthèse de la distribution en 1994. Bilan annuel des expertises de dégâts depuis 1990.

Vison d'Europe[4]

Zone de prospection : totalité de l'aire de présence potentielle de l'espèce soit les bassins hydrographiques de 17 départements français.

Objectifs : cartographie de la distribution actuelle de l'espèce.

Nombre de correspondants : ???? avec des coordinateurs régionaux.

Méthodologies : échantillonnage de secteurs répartis sur l'ensemble des bassins hydrographiques par des campagnes de piégeage de 10 jours.

Résultats : test de faisabilité terminé en 1991-1992. Prospections entre 1993-1996.

Loup[5]

Zone de prospection : zone potentielle de présence du loup autour des premiers lieux de signalement de l'espèce en 1993 soit deux départements du sud-est de la France.

Objectifs : surveillance d'une colonisation éventuelle du sud-est de la France à partir de l'Italie - expertises des dégâts pouvant avoir été commis.

Nombre de correspondants : environ 30.

Méthodologies : recherche et vérification d'indices de présence et des témoignages.

Expertise des dégâts commis sur le cheptel domestique.

Résultats : synthèse annuel des observations.

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4 Reseau animé par le GREGE, l'Office National de la Chasse et le Groupe mammalogique breton

5 Reseau animé par le Parc National du Mercantour, l'Office National de la Chasse, et le Museum National d'Histoire Naturale

RESEARCH AND PROTECTION OF OTTER/*Lutra lutra*/AND ITS HABITAT IN SLOVAKIA

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Summary

The Eurasian otter /*Lutra lutra*/ is a seriously endangered species of Slovak fauna. Insufficient arrangement of survey and research has bar to learn current status of otter population. However, it is a basis of the conservation strategy. It is necessary to study otter habitat to realise quickly otter survey the research of otter distribution and ecology in regions of Slovakia because of the acute menace of the habitat of the species as an indicator of the health of wetlands and waterways. An investigation of the conservation problems, contamination of otters, their food and habitat, status and destruction of the environment, will be a prerequisite of conservation measures. Extensive educational campaign for the public, policy-makers and officials is a part of our project. The choice parts of streams and wetlands will be proposed as protected areas for otter and corridors for migration and other measures will be suggested.

It is possible to accomplish field works by small group of workers in two years, with using appropriate technical means. A special publication, useable also for presentation of the work and series of educational materials for public awareness will be the result. An action Plan will help in managing this species in its important area of occurrence.

The project is intent on nature protection and restoration of the ecological stability of the country, on the protection of biodiversity, monitoring of the ecosystems and the state of nature components. It represents implementing a strategy for otter conservation in Europe.

Objectives

Obtaining objective information on the status and distribution of the population of endangered species - the otter in Slovakia and comparison with surrounding countries.

Protection and stabilisation of the otter population in Slovakia.

Bio-monitoring and toxicological analysis as a basis for information on the state of pollution and contaminants in water of Slovakia and their possible sources.

Contribution to survival of endangered species in the centre of its occurrence and protection of remaining viable population by international cooperation, exchange of information on the protection of the otter and its habitat matters.

To contribute to better public awareness by appropriate campaign to educate about the significance of protection of wetland ecosystems and species.

Background

Eurasian otter /*Lutra lutra l.*/ is endangered species of Slovak fauna. It is listed in the I.U.C.N. Red List of Threatened Animals /I.U.C.N./ and most European countries. Otters are indicators of healthy aquatic environments, as animals at the top of the food chain. Any measures which successfully benefit this species will prove beneficial to the wetlands ecosystems as a whole.

Numbers of this originally well distributed species has declined also in Slovakia as in much of Western Europe, where it has recently received much conservation attention. Eastern European populations are important centres of otters occurrence. I.U.C.N. Action Plan for Otters Conservation puts the stress on the needs of the safeguarding the animal and its key habitats in those countries where it still is widespread and thriving substantial otter populations as a high priority. But on the territory of Slovakia are still missing objective data on the distribution of the species and on the contamination of its population by persistent contaminants as an important factor for surviving of animals. Otter's habitat in Slovakia is acutely threatened in centres of its occurrence by water management schemes, pollution and by destruction of bankside vegetation, resting and breeding sites.

The objective survey of distribution and status of population is the basis of each conservation strategy within a region or country. In 1989, the "Otter Campaign" has been embarked upon in Slovakia, aimed at surveying otters in this country. But this was not successful in the assurance of systematic work in the whole territory and has been supported insufficiently.

Especially in Western Europe issues of otter research and protection have been devoted by specialists for several years or decades. I.U.C.N. Species Survival Commission's Otter Specialist Group worked up an Action Plan for otters' conservation /I.U.C.N. 1990/. A strategy applied for European otters includes:

i) Support for studies on otter ecology and biology, determination of otter distribution and abundance and of regional conservation problems, between them research on extent of contamination of the animals and their food-chains with toxic chemicals, persistent pollutants, especially organochlorines, PCBs and heavy metals. On the basis of this seeking, identifying and control of the sources of habitat degradation. Radio-tracking is used as one of the methods.
ii) management actions design otter refuges protected from harmful development.
iii) environmental education and information programmes and campaigns drawing attention to the plight of this species and promoting public support for its conservation on all levels.
iv) creating a dense net of wetland reserves as possible, sufficiently large and of all types because of large home range and naturally low population density of the species; creating of corridors of suitable habitats to allow a migration; management of reestablishment of natura and semi-natural aquatic and riparian habitats. Debar habitats from destruction; reconstruction of bankside vegetation and wetland habitats; purification of polluted waters and dissolution of organochlorines and PCBs; control of fishing and insurance of sufficient food supply.
v) trans-national cooperation.

Activities

Field survey forms a very important first step in designing appropriate conservation programmes. To achieve reliable information on otter population and its habitat in Slovakia we suggest to elaborate the territory uniformly, without individual approaches and differences. It is possible with small group of workers in the course of two years using intensive field survey by standard methodology carried out in several countries.

1 Arrangement of maps of Slovak rivers catchments and of equipment.
2 Survey of otter distribution and density in individual catchments with a view to unfinished surveys and not surveyed areas.
3 Study of otter ecology and biology aimed at habitat and resource requirements, the size and configuration of suitable habitats necessary to maintain viable population, at

its food, limiting factors/a lack of cover character of the den sites, the extent of disturbance etc.

4 Research of persistent environmental contaminants, their accumulation in tissue of otters found dead and their food//fish/ and spraints/PCBs, organochlorines, heavy metals/ in cooperation with the State Veterinary Institute.

5 Looking for, identifying sources of environment degradation and suggestions for their elimination. Designation of sites of priority signification for otter protection with suggestions and projects of their conservation, protected areas on wetland habitats.

6 Development of monitoring programmes to assess future change in status/distribution of otters and habitat management programmes. Suggestions for bankside habitats restoration, creating corridors that will link wetlands and other measures.

7 Engagement of public awareness campaign, not only on otters and their habitat but on environment conservation, directed at both the general public and the policy makers at all levels for acquisition of dead animals and prevention of purposeful destruction of otters and their habitat/leaflets, posters, brochures, audiovisuals etc.

8 Engagement of cooperation with Slovak Ramsar Committee, water management authorities, fishermen organisations, organisations abroad; exchange of information on survey, results of tissue analyses, on contaminants and pollution control etc.

Outputs

Action plan for otters' conservation.

Final Report and publication demonstrated:

- knowledge on state and trends of water habitats of Slovakia using an indicative species
- knowledge on status, density, distribution and trends of endangered and protected species and its populations, ecology and ethology;
- knowledge on range of contamination of otters' tissue and habitat with cumulative pollutants; contribution to proposal international cooperation in European PCB Monitoring Programme;
- sources and causes of habitat degradation;
- intact prospective sites as otters' refuges and wetlands;
- suggestions for making a net of protected reserves on wetland habitats in line with obligations of Ramsar Convention.

Materials, publications and audiovisuals to increase public awareness on protection of the species, on importance and values of wetland habitats etc.

Contribution to science and research in biological and ecological fields/scientific results and their presentation.

Increased international prestige and acknowledgement.

Expected users

Professional organisations of State Nature for regulation and control of activities in the countryside.

Nature conservation and environmental protection authorities in area planning and decision-making.

Slovak Fauna Database.

International and foreign conservation and scientific organisations.

Scientific, specialised and general public.

Duration of project:

Two years/twenty four months with next continuation.

Budget

35 000 USD not covered and supported this time.

Salaries for executors - 3 - can be covered by employer, State Nature Conservancy.

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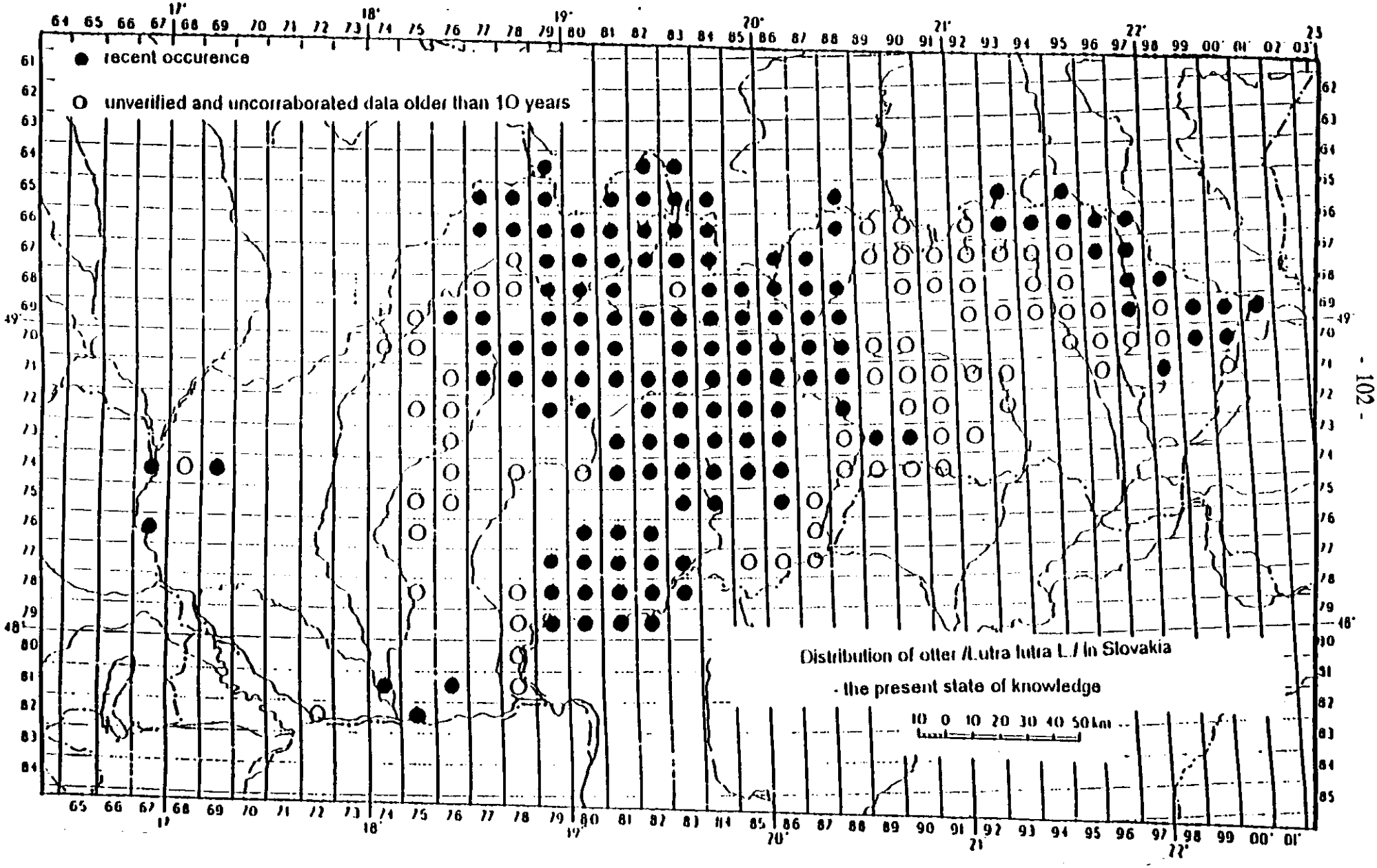
● recent occurence
O unverified and uncorraborated data older than 10 years
Distribution of otter /Lutra lutra L./ in Slovakia
- the present state of knowledge
10 0 10 20 30 40 50 km

A NEW THREATENED WOLF SPECIES, *Cuon alpinus* hesperius AFANASIEV AND ZOLATAREV, 1935 IN TURKEY

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1 Introduction

Although the African wild dogs are sharp-sighted and impetuous in the close distance, the Asiatic dogs or the red dogs (*Cuon alpinus* subsp) are always in a hurry. They first follow the preys using their smelling sense. Body length from the end of the nose to the tail behind is 85 - 110 centimetres. Shoulder height from the ground is 40-50 centimetres. Tail length is 40-48 centimetres. Body weight is 15 to 20 kilograms. Partly atrophied teeth of those species are arranged in a line of 3.1.4.2/3.1.4.2.

The legs are shorter than the African wild dogs. The female has 6 to 7 teats. The general appearance of the skin changes from reddish-brown and rusty-reddish to orange coloured. The head, neck and shoulders are mostly brown. The chest, side abdomen and upper parts of legs are yellow and toes are usually whitish-yellow. The front parts of front feed are with the blackish-brown lined. Tail colour is reddish-brown. The inner cottony hairs and the parts of the spike string hairs close the skin are in dark case and yellowish-grey. The sub-species lives in high mountains and northern part of Asia has thick haired skins. Dorsal hairs reach to 16 centimetres in length. They spread from Siberia and China to front and hind. Sumatra and Java Islands.

The Asiatic red dog usually and specially in winter months lives in forests. They can follow their preys up to 40 000 metres of high mountains and they hide in rocky places. They can be also found in the lower plains in their southern spreading areas. The Asiatic wild dog is the only species among the wild dogs that can live in different temperatures. They can live equatorial zone, pole regions, sea level and in high mountains where oxygen is insufficient. At the beginning of the ice age some relative species had spread most parts of Europe and forward to Spain. At that time, a dwarf island form had even lived in Sardinia (Most, 1969).

Asiatic red wild dog used to exist rather frequently in the Asiatic part of Russia. because of the hunting after the years of 1960, they have been scarce. The red wild dog has continues its life preying on rock goat, mountain sheep, roe deer, deer and wild boar. it preys on reindeer and musk deer in eastern Siberia. Indian subspecies even if feed on mountain sheep, sambar deer (*Rusa sp*) and axis deer. Java red dog particularly feeds on sea turtle. This species has completely different catching ways as to African wild dogs. Because of their too short legs they behave safety and move actively. They can follow their preys for hours. During the prey, they constitute triplet and quartet groups and a flock with approximately 30 individuals. They scatter and waylay the escaping prey like wolves. During the attack, they behave like African wild dogs and catch the prey in back parts. When prey tries to escape they catch on side parts and knock it to ground. Sometimes they chase after the prey toward a precipice to cause it to drop. They immediately begin to eat the prey that it has just made an attack upon the men and livestock.

They are not in good voice like African wild dogs. They don't bark but they give a specific howl. But this characteristic changes from an *Alpinus pallas*, 1811 and *Cuon alpinus hesperius*, Afanasiev and Zolotarev, 1935) have a howling and barking. In reproduction period they roam couples. Pregnancy period longs about 60 days. Female gives birth to 2

to 6 and most cubs. Skin colour of cubs is dark brown and hairy when born (Schneider-Leyer, 1960).

The Tiyan-san wild dogs feed on vegetables in the summer months. They especially feed on young and fresh shoots of plants. The father fattens the cubs with the partly chewed up shoots. They chewed the shoots before come into flower and give them to cubs by mouth.

2 The first Establishment of Turkestan Alpine Wolf in Northeastern Anatolia

The Euro-Siberian Floristic area includes all the northern parts of Anatolia and its reaches to eastern to large parts of Caucasia with the *Crimea peninsula* and Dobrudja mountains. Hardwood tree species are dominent in forests of the region and at high altitudes the softwood species combines to this vegetation. The floristic composition of Colchis province that take place in the eastern direction of Melet river equates with the Caucasian flora. A rainy and cloudy climate prevails in this region and many relic plant species is found in this area. Those are related northern hemisphere Tersier.

The wild boar and jackal are the most common game in this region. Wolf is seen in high wooded areas and partly in Alpine zone. Bear lives its local habitats about 100-2000 meters altitudes. Roe deer is uncommon but in all parts. Deer used to be more common about 30-40 years ago but now it is a scarce species in this region. The chamois and wild goat have local living areas. Badger is common close the fields.

The presence of the Turkestan Alpine Wolf (*Cuon alpinus hesperius)* has been known for a long time in this region. The clearest characteristic of this animal becomes apparent is its voice. It has a scary voice between howling and roaring. It has been known as a kind of jackal by the local people. Its howling is not heard frequently like jackal but it is immediately noticed because of differentiation. In opposition to the jackal it roams couple not reciprocally. It is a very roving animal that its howling can be heard many different places in a location.

About 30 to 40 years ago the howling of this animal was heard in wooded areas from the coast line to alpine zone. Recently it can be heard about 500 to 1 000 metres altitudes.

At 15 January 1989, Cafer Karslioglu, leather dealer received two red dog skins and he informed us that he has not known what kind of skins they are. We went to his store and asked him to give us the skins. We got them to the department and worked on the skins. We concluded that the skins belonged to a male and a female wild red dog. The skins were tanned and currently conserved in our game museum.

On 20 February 1989, we went to Rize-Duzkoy where the red dogs had been hunted. We determined that the red dogs had been hunted by local hunters Memis Altun and Engin Pehlivan in Duzkoy-Sirtmahalle site on 10 January 1989. In fact, a number of chickens were found to be killed within a coop at about the same dates. The villagers were claiming that their chickens had been killed by the red dogs but they knew those animals as kind of jackal. They threw around some waste meat to attract the predator animals in those days. Previously indicated people reported that the predator animals came to the waste meet and they hunted them by using number 5 pellets. They also said they could not recognise what kind of animal they are and later on they brought their skins to Trabzon in order to sell them.

After this incidence, a research has been carried out in Rize. Meetings about the subject with local hunters were performed and the following results, were provided.

It is determined that those animals are Turkestan Alpine Wolves and they have been in existence in Northeastern Anatolia for a long time. However, they have not been noticed sufficiently because of wrong identification. Regional people call those animals Pardi. The pardies howl in the night. This howling is different from the jackal's and it is known as a sign of bad luck. Around a Black Sea coastal town, called Hopa, people use traps to catch those animals. This hunting does not give them any benefit because the skins are not valuable. They catch them and throw them away.

It is supposed that those animals have ranged to Northern Anatolia from Caucasia. It is also known that Turkestan Alpine wolf preys on the chamois, wild goat, roe deer and wild boar because of strong winter almost all high altitude mountains are covered by snow. This makes the Turkestan Alpine wolf go more to the villages and to prey on chickens too. They arrive at the foot of the Kackar mountains in summer.

3 Results and discussion

We found out the following features investigating the two skins and skulls which belong to both male and female Alpine wolves.

Body lengths of female and male from the end of the nose to the behind of tail are 110 and 104 centimetres. Tail length and shoulder height are 37 and 32, 40 and 35 centimetres respectively. Female is a big framed in comparison to male.

The edges of ears, cheeks, nose and eyes of female is blackish-brown coloured. The head is bigger than the male's. Ears are 11 centimetres. The dorsal side of the body is reddish-brown and rusty-reddish. The spike string hairs are light. Cervix and abdomen are grey-whitish and light in colour. the tail is longer than the male's and its hairs also longer. From the dorsal line toward to each side, the colour changes light and yellow-brown.

Male hair lies down on dorsal side, and is brick red-brownish in colour. Hairs on the side of the forehead, ears, cheeks and the mouth is light brown-yellow. Spikey stringy hairs are yellowish-white and neck sides light yellowish. Outer appearance of male is generally lighter yellow than female.

We counted 40 teeth in both skulls belonging female and male wolves. These are arranged in a line of 3.1.4.2/3.1.4.2. The other skull measurements of both male and female *Cuon alpinus hesperius* and their comparison with those of *Canis lupus* were given in the table.

In conclusion, the existence of Turkestan Alpine wolf *Cuon alpinus hesperius* in Northeastern Anatolia was established for the first time. All sub-species of *Cuon alponus* was scarce or extinct in their ranges. Therefore they have been conserved in all habitats. Turkestan Alpine wolf has been first recorded for *Canidae* family of Turkiye. It should be continued population surveys and conservation activities in this region.

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THE SKULL MEASUREMENTS OF *Cuon alpinus hesperius* AND THEIR COMPARISON WITH THOSE OF *Canus lupus*

SKULL	***C alpinus male***	***C lupus female***	
1. Condylobasal length: Aboral border of the occiipital condyles-Prosthion	190	186	225
2. Breadth at the canine (C1) alveoli	39.1	37	46.1
3. Breadth at the P4 alveoli	67	65.7	77.6
4. Zygomatic breadth: Zygon-Zygon	110.7	113.6	128.3
5. Least breadth between the orbits: Entorbitale-Entorbitale1	29.4	34.3	45.6
6. Frontal breadth: Ectorbitale-Ectorbitale	46.5	46	59.6
7. Least breadth of skull least breadth aboral of the supraorbital processes)	9.6	6.3	7.3
8. Greatest mastoid breadth: Otion-Otion	68.7	66.6	87.1
9. Skull height (with the sagittal crest)	68.4	69.7	81.2
10. Facial length : Frontal midpoint-Prosthion	120.1	118.4	144.2
11. Upper neurocranium length	89.7	86.1	100.9
12. Length of tooth-row (from C1 to M2)	88.1	87.5	102.5
13. Length of C1 Measured on cingulum)	12	10.9	12
14. Length of P4 (Measured on cingulum)	21.2	19.9	20.6
MANDIBLE			
15. Total length: length from condyle process-Infradentale	154.7	148.4	182.5
16. Height of the vertical ramus: Basal point of the angular process-Coronion	60.8	56.5	74.3
17. Length of P4	21.7	22.7	29.1

DISPERSING LYNX (*Lynx lynx*) IN A MAN-MADE ENVIRONMENT: READY TO GO - BUT WHERE TO?

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Why monitor dispersal?

When the European lynx (*Lynx lynx*) was reintroduced to the western part of Switzerland in the 1970s after a hundred year absence (Breitenmoser and Baettig 1992) it faced a much changed environment where hedges and orchards had given way to agricultural deserts, and where busy towns, highways and canals had fragmented the landscape into smaller units. At first, lynx stayed in the large forested areas and established an isolated population in the Jura mountains of Switzerland and France, adjacent to two other young populations in the Swiss Alps and in the Vosges (fig.1, Breitenmoser 1983, Breitenmoser and Breitenmoser-Wuersten 1990, Haller 1992, Herrenschmidt and Leger 1987). Up to now the reintroduction in the Jura mountains has been successful. But is the occupied area large enough to sustain the population in the long term? Can the population expand further? Is genetic migration possible to the neighbouring populations?

Due to the territoriality of resident lynx, juveniles are forced to disperse and are therefore the main agents of genetic migration. Their life history and their dispersal behaviour can tell us about the status and dynamics of the existing young population and the needs of a future central European metapopulation in terms of habitat and prey requirement.

What do we know about lynx dispersal?

Because of methodological reasons, information on dispersal in wild cats is scarce. Of the few studies done on Eurasian lynx only one included the monitoring of two dispersing individuals (Haller and Breitenmoser 1986). The following short summary contains data from five subadults radio-tracked as part of the Swiss Lynx Project (Breitenmoser et al 1993) and preliminary results of the Dispersal Project which started in 1992 with a survey of two dispersing juveniles. All data are from the Jura population (fig.1).

The juveniles became independent shortly before or during the mating season and dispersed before the mother gave birth to the next litter. Four of them died during the dispersal period, three are still alive and reproducing (fig. 2). The distances between the original birth site and the breeding site are 50 km and 28 km for the two dispersing females. The third female took over the natal home range after her mother had died.

The dispersers did not cross the home ranges of radio-collared adults (Breitenmoser et al 1993). Only one female came back to her birth place four months later, but was chased out again by her mother.

The forest was the preferred habitat for dispersing lynx. They often followed the edge of the forest but avoided open and inhabited areas, especially during daytime.

Lynx in the Jura: where to go to?

This question is the main force behind the Dispersal Project in the Jura mountains of Switzerland and France. Which landscape elements are preventing dispersal and therefore are responsible for the isolation of the population? What types of corridor are needed for dispersing lynx?

The project is studying the spatial organisation and the genetics of the Jura population, monitoring dispersing individuals and conducting habitat and prey analyses. By mapping and modelling the situation of the Jura population we hope to predict and to initiate conservation measures.

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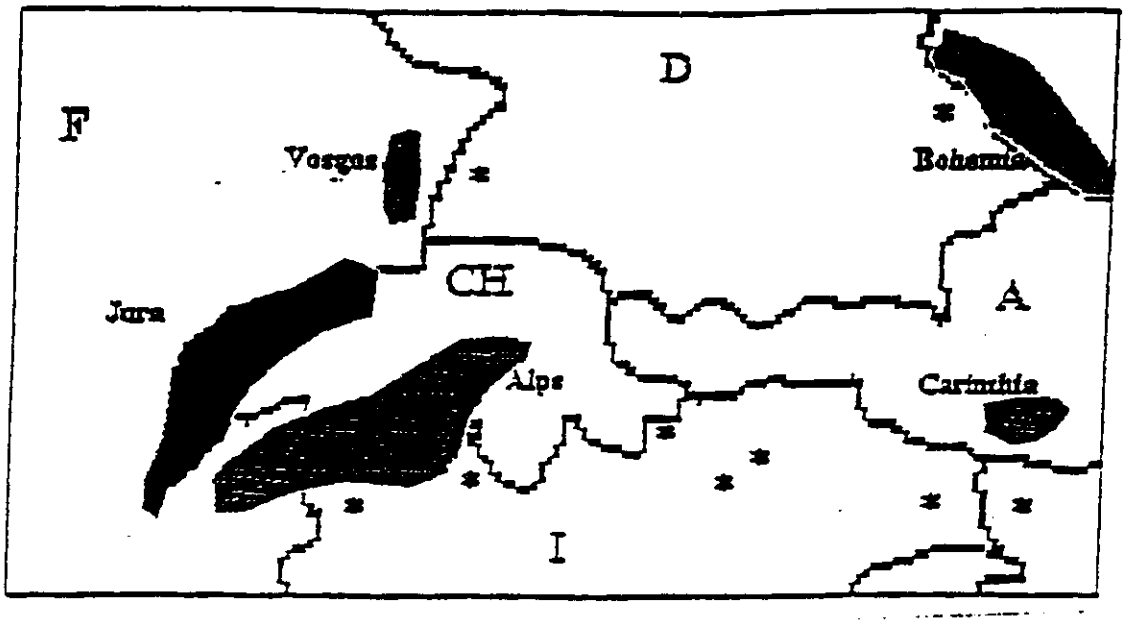

Fig 1: Distribution of lynx in Central Europe (asterisk = isolated observations). The studied population in the Jura mountains (black shading) is separated from the othe populations (gray pattern) by areas with intensive agriculture, towns, highways and water-ways. A = Austria, CH = Switzerland, D = Germany, F = France, I = Italy.

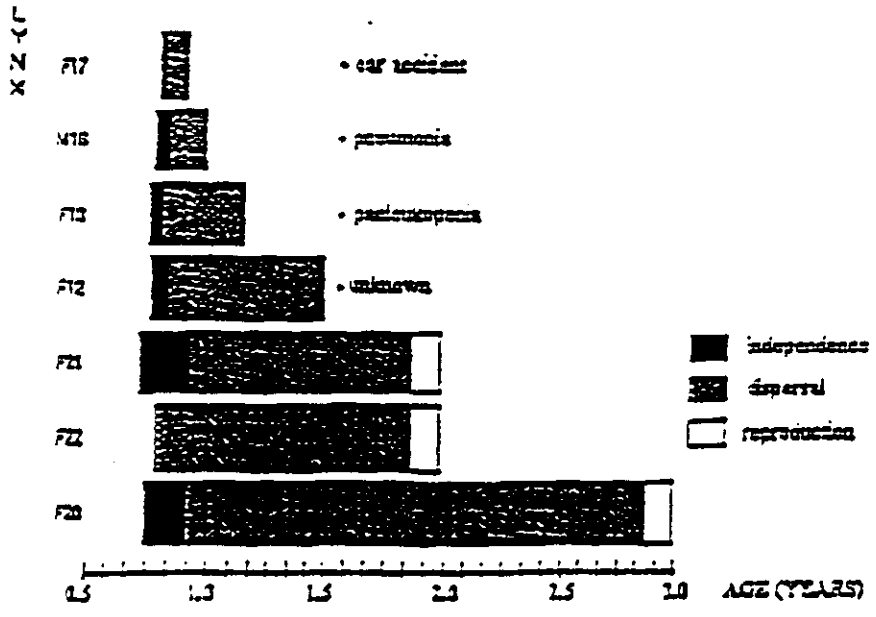

Fig 2: Life history of seven monitored subadult lynx (6 females and 1 male) in the Jura population. They separated from their mother at the of 8-10 months but stayed in their natal home range for mortality causes). Two lynx established and reproduced for the first time at the age of 2 years, one started reproduction at the age of 3 years (white area).

SURVEILLANCE DU DEVELOPPEMENT DES DEUX POPULATIONS DE LYNX REINTRODUITES EN SUISSE A L'AIDE DE QUESTIONNAIRES

S. Capt, U. Breitenmoser, Ch. Breitenmoser-Würsten, Projet lynx Suisse

Résumé du poster

Le lynx *(Lynx lynx)* a été réintroduit en Suisse à partir de 1971. Aucun programme de surveillance accompagna ces lâchers, ce qui laisse aujourd'hui de graves lacunes dans la connaissance du développement initial de la population. Ce n'est qu'environ dix ans après les premières libérations, lorsque les cas de prédation sur des animaux domestiques prenaient de plus en plus d'ampleur, qu'un premier sondage sur la distribution du lynx en suisse fut réalisé (Breitenmoser 1983), suivi plus tard d'une enquête pour le Jura (Breitenmoser & Bâti 1992). L'établissement et la mise à jour continuelle de l'aire de répartition pour une espèce rare et menacée comme le lynx est de première importance. Cela permet, en tenant compte des résultats obtenus par radio télémétrie sur l'organisation spatiale du lynx, d'estimer le nombre d'individus présents, d'apprécier les possibilités de contacts avec d'autres populations et de suivre le développement spatial de la population. La survie d'une population réintroduite dépend entre autres de sa capacité de sa vitesse d'expansion. Pour assurer une surveillance nationale à long terme sur le plan de la distribution du lynx, plusieurs moyens sont actuellement appliqués en Suisse. D'une part, toutes les données positives, c'est-à-dire, des indices certains de présence, sont recensées et centralisées. Il s'agit en occurrence de tous les lynx trouvés morts, capturés ou tirés ainsi que des attaques de lynx confirmées sur des animaux domestiques. D'autre par nous avons établi un questionnaire demandant aux personnes interrogées de noter les données **positive et négatives**, c'est-à-dire aussi l'absence de signes de présence, et d'autres observations comme p.ex. la reproduction. Pour obtenir des données fiables et comparables d'une année à l'autre, ces questionnaires sont envoyés a tous les gardes-chasse de Suisse, qui sont régulièrement renseignés sur les résultats de l'enquête. Les secteurs de surveillance individuels des différents gardes-chasse constituent l'unité de base pour établir l'aire de répartition du lynx. Le secteur de surveillance d'un garde-chasse a une superficie moyenne d'environ 200 km2. La comparaison des différentes méthodes de recensement permet une meilleure analyse et interprétation des données.

BREITENMOSER U. 1983. Zur Wiedereinbürgerung und Ausbreitung des Luchses *Lynx lynx* in der Schweiz. *Z Forstwes.* **134**: 207-222.

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SCALP - STATUS AND CONSERVATION OF THE ALPINE LYNX POPULATION

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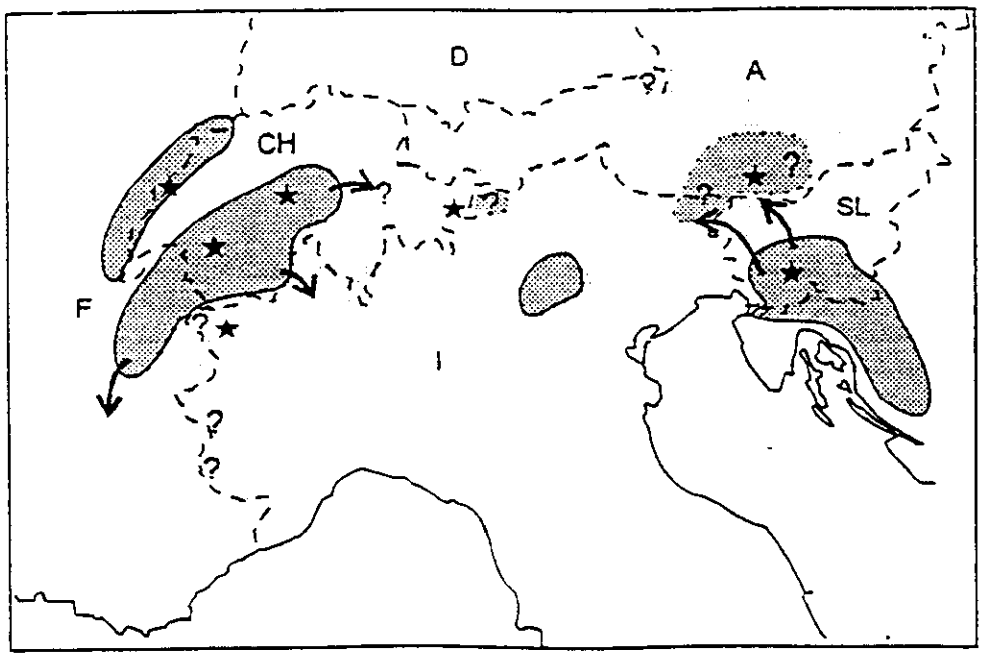
The Alps are one of the last natural areas of central and western Europe, and they are the largest and best suited region to re-establish populations of large predators such as the lynx (*Lynx lynx*). They stretch from southern France and eastern Austria over 1200 km and cover nearly 200 000 km^2. They could sustain a population of more than 1000 lynx and could connect and support smaller potential populations of secondary mountain chains.

Since the early 1970s, there have been programmes to re-introduce the lynx into the Alps. The projects were not coordinated, and most of the reestablished populations were not even monitored. In recent years, expansion appears to have ceased. There are too many casualties due to illegal killing and traffic. A potential threat is inbreeding within the tiny populations. The long-term goal of the re-introductions must be to connect the subpopulations and to establish a single population throughout the Alps. However, we lack decent information on the status and the distribution of the lynx in Alps.

Present situation:

Austria: 9 lynx were released in Styria between 1976 and 1979. Individuals have spread into adjacent districts, but the recent status of the population is unknown.
Switzerland: 20-25 lynx were released from 1971-76 in the Alps and in the Jura Mountains. The population spread into the western Alps, but the expansion towards the east halted.
Germany: The re-introduction plans in the Bavarian Alps are postponed. Recent observations in the Berchtesgaden National Park remain unconfirmed.
France: Lynx from the Swiss populations intruded into France. Equivocal observations were made as far south as Grenoble. The general status is unknown.
Italy: Ineffective releases happened in the Gran Paradiso National Park in 1974. Lynx occasionally intrude from Switzerland, Slovenia and possibly Austria. There is a small population of unknown origin and status in the Trentino region.
Slovenia: Six lynx were released in 1973. There was a fast expansion of the population towards the Alps of Italy and Austria. The expansion slowed down in recent years.



The goal of the SCALP Project is to initiate an international cooperation to reestablish the lynx in the Alps. The principle aims of the project are:

1. to define the present distribution and status of the lynx in the Alps;
2. to review the re-introduction of the lynx into the Alps 20 years after the first releases;
3. to agree on methods of monitoring the development of the subpopulations;
4. to propose internationally coordinated conservation measures where necessary/

The SCALP Project is a cooperative effort of several members of the *Eurasian lynx Group* (ELG) of the I.U.C.N. *Cat Specialist Group.* The initial phase of the project is supported by the Swiss Federal Office of Environment, Forest and Landscape (BUWAL) and by WWF Switzerland.

SEARCHING FOR LYNX IN AUSTRIA - TRACKING A PHANTOM

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In Styria, Austria, lynx was reintroduced in 1977-79. Nine animals were released and quickly spread, mainly into adjacent Carinthia. Radiotelemetric monitoring was done for a maximum of three months only and snow-tracking was restricted to the winters of 1977-1981. Thereafter, lynx signs were sporadically collected by the Carinthian hunters with help of a "lynx observation postcard". In 1990, the Carinthian hunters founded a "lynx group" to better document the distribution and status of the predator. In 1991, new "lynx observation forms" were developed and hunters received additional oral and written information about lynx.

Between 1990 and 1992, 126 killed lynxes were registered. The lynx seemed to be distributed almost all over Carinthia. In 1992, an attempt was made to catch lynx for a telemetry project by the University of Vienna. Intensive field work during the winter of 1992/93 did not reveal any definitive lynx sign. All "lynx kills" or tracks checked were either fox, dog, bear or impossible to identify. The more information was given to the local people, the more the "lynx" they saw, heard and smelled. At present it seems to be impossible to distinguish between real and "imagined" lynx signs.

The lack of any real lynx signs and the fact that there have not been any dead lynx found in Austria since 1985 make us believe that there is no established lynx population in the Austrian Alps. At the best, there are a few single individuals. But because snow tracking conditions were rather poor last field season, we need another winter for confirmation.

THE RECOVERY PLAN FOR THE IBERIAN LYNX (*Lynx pardinus*) POPULATION OF SERRA DA MALCATA NATURE RESERVE (EAST PORTUGAL)

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The Iberian lynx (*Lynx pardinus* Temminck, 1824), a medium size felid, is one of the most endangered carnivore in Europe. The present distribution range of this species shows, as a main characteristic, a high level of fragmentation (RODRIGUEZ & DELIBES 1992). Localised in central West Iberian Peninsula, one of the remnant populations is associated to Portuguese (Serra da Malcata) and Spanish (Sierras de Gata e Bejar) mountainous areas. The Malcata nuclei is one of the last well known lynx area in Portugal. In 1981, after a national conservation campaign against the paper industry habitat destruction actions, was created the Serra da Malcata Nature Reserve.

The Malcata-Gata population is under a decline process, accentuated in the last twenty years. The main regression factors causing this situation are habitat destruction, rabbit population decline, man-caused mortality and, probably, population isolation and genetic drift.

The Recovery Plan of this iberian lynx population must consider as priority the minimalisation of the mentioned regression causes. Increasing the rabbit density in certain important areas and maintaining mediterranean vegetation untouchable in other cover areas, would be the key to the preservation of the lynx population. Conservation education would be a complementary but indispensable measure.

MONITORING REPRODUCTION AND POLLUTION IN THE ARCTIC FOX (*Alopex lagopus*)

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Abstract

Air-borne pollution can give us unpleasant surprises as has been shown for acid rain and die-off of freshwater fish populations and forest damage. Therefore the Norwegian Directorate for Nature Management started at terrestrial monitoring programme in 1990. The main objective of this programme is to reveal as early as possible how nature is affected by pollution and in what way it changes when exposed to long-term pollution. The programme is coordinated with other Norwegian and international monitoring programmes.

The arctic fox *(Alopex lagopus)* has been chosen as one of the monitoring subjects because of its endangered status and its top position in the arctic/alpine food chain. Even though the arctic fox is protected by law in Scandinavia since 1930, the population density has not increased significantly over the last decades. The present distribution is restricted to some small populations in high mountain areas of southern Norway and larger, more continuous populations in the north (fig. 1). The combined study of reproduction, population genetics and the potential impact of heavy metals will help us to understand factors limiting population growth.

Reproduction:

Of the three monitored populations in Norway (fig. 1) the northern is by far the largest and has the highest population density. Differences in density are believed to be due to competition by red fox (*Vulpes vulpes)*, productivity of areas without red fox and effects of geographic isolation. The two southern populations are most isolated.

The reproduction in these populations is dependent on the density of lemmings and other small mammals. Therefore it follows a fluctuating pattern with peaks every fourth year (Macpherson 1969 and fig. 2).

The litter size is determined every year by checking the densities over a minimum 24 hour observation period. Lifetime reproductive success is measured in the Amotsdalen population by a radiotelemetry study of adults and cubs.

Analysis of metals:

Due to the low population densities of arctic foxes in Scandinavia, they cannot be killed for analyses of metals in organs. We are therefore developing with human hair (Brown and Crouse 1980). Metals are accumulated during the growth period of hair, e.g. in adult arctic foxes during autumn and in cubs during summer. To understand the relationship between metal concentrations in organs and fur, animals have been sampled in Russian populations (fig. 1). These samples also allow us to compare the levels of exposure to metals in Scandinavian populations with Russian populations, as is shown in fig. 3.

Population genetics:

Because of the recent isolation of Norwegian populations the arctic fox is considered to be an interesting model species in conservation biology. We are therefore developing DNA based techniques for measurements of genetical variability. These studies will provide a foundation for the genetical monitoring of this species.

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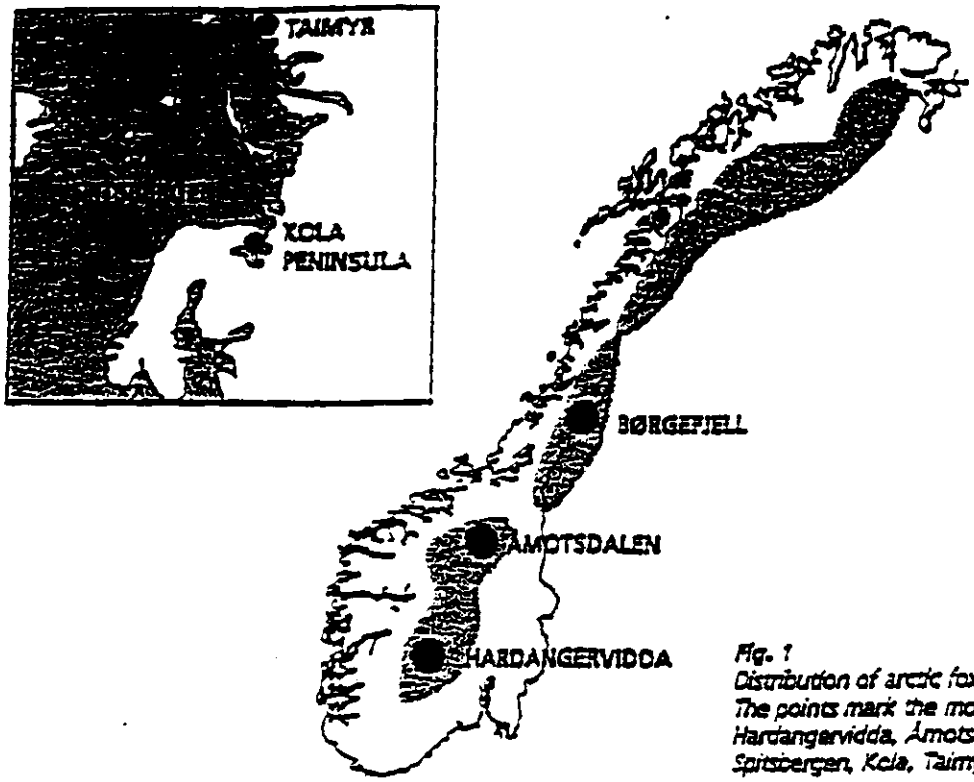

Fig. 1
Distribution of arctic fox in Scandinavia and Russia. The points mark the monitored populations. Hardangervidda, Åmotsdalen, Børgefjell, Spitsbergen, Kola, Taimyr

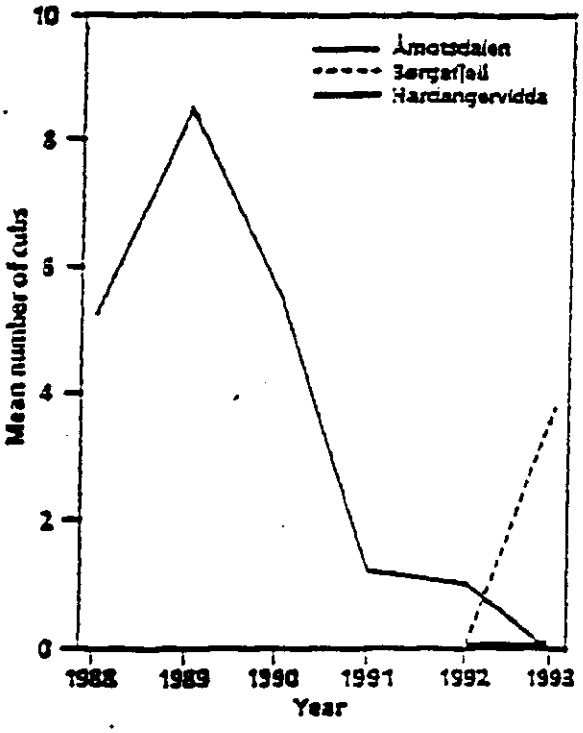

Fig. 2
Reproduction measured as the average litter size per den follows the four year cycle of the lemming density. The cycles of the southern populations Åmotsdalen and Hardangervidda are one year retarded compared to the Børgefjell population.

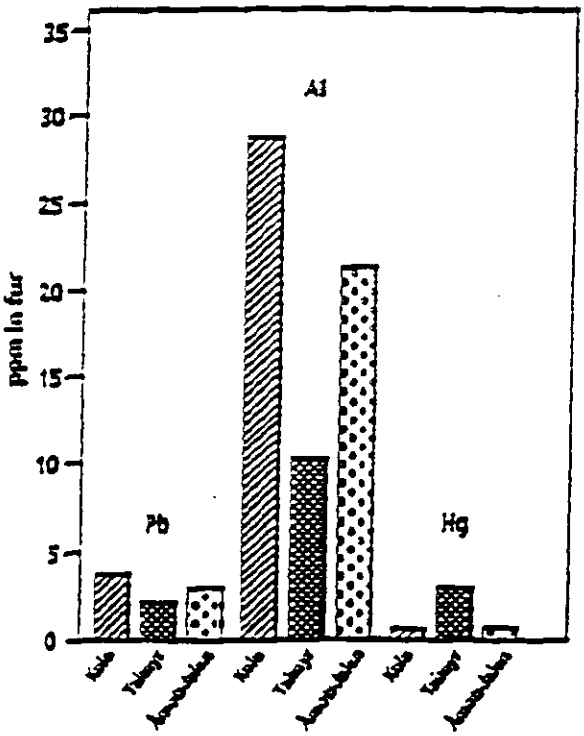

Fig. 3
The analysis of heavy metals in fur (here for lead, aluminium and mercury) for two Russian and one Norwegian population (here Åmotsdalen).

A RECOVERY PLAN FOR THE BROWN BEARS IN THE TRENTEN ALPS

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There are probably less than 5 bears left in the Italian Alps. The Adamello-Brenta Nature Park - the area where the bears live - asks us to develop a population recovery plan. Computer simulations suggest that a population of 40-60 bears can be considered viable. Habitat analysis indicates that there is enough suitable habitat for a population of this size in the western part of Trentino. Our recommendations for bear population recovery are:

- stock the remnant population with 10 to 15 bears from Slovenia/Croatia over the next 3 years - according to computer simulations, this will result in a population size of 40-60 bears within a few decades;
- assign an effective recovery team to implement the plan;
- design and carry out a major public relations campaign to ensure public support, especially among local people;
- improve habitat on a long term basis, mainly by creating areas of little disturbance.

The recovery of the Trentin bears is an important step for the return of the brown bear in the Alps.

POPULATION VIABILITY ANALYSIS: A FRAMEWORK METHODOLOGY OF THE MANAGEMENT OF THREATENED AND REINTRODUCED MAMMALS

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Abstract

Population Viability Analysis (PVA) is an integrated approach designed to deal with species for which reduced viability is expected on the grounds of poor habitat quality and processes that occur in small populations such as inbreeding, regional catastrophes and demographic disequilibrium.

We present PVA as a framework methodology, that may help to estimate extinction risks and evaluate management priorities for threatened and reintroduced mammals. We make particular reference to the practical field implications of PVA theory and take examples from case studies in Switzerland, involving species such as *Lynx lynx, Felis silvestris, Lutra lutra, Castor fiber* and *Tetrao urogallus*. We also illustrate how PVA and detailed field studies may help to solve conflicts and promote the protection of natural areas.

MONITORING STRATEGIES FOR SMALL POPULATIONS BASED ON INDIVIDUAL RECOGNITION AND THE USE OF REGISTERS: EXPERIENCES WITH MEDITERRANEAN MONK SEALS AND AFRICAN MAMMALS

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Abstract

Many large vertebrate species which have been reduced to low numbers are elusive and difficult to study using conventional techniques. However, the individuals of many of these species are sufficiently distinct that they can be recognised reliably. In this paper we report on techniques which have been developed to monitor small populations using individual recognition.

Individuals may be recognised by direct observation, at short or long range, or using "camera traps" which photograph animals when they pass certain points. We will describe the methods which are now available for obtaining high quality images and the use which can be made of computers to provide objective criteria for recognising and screening large numbers of individuals. It is particularly important that observations are contained in a properly structured database. Experience in the development of these "registers" will be described.

Individual recognition makes it possible to apply the full range of analyses which have been developed for capture-recapture experiments to rare or endangered species while minimising disturbance. Analyses of this kind can provide reliable estimates of survival rates and movements, as well as estimates of abundance. Examples from studies of the Mediterranean monk seal and a number of African antelope species (roan, eland, kudu and oryx) will be given.

OTTER SURVIVAL IN RELATION TO BEAVER TRAPPING IN LATVIA

Janis Ozolins and Mikus Rantins

Background

- Number of otter population - ca 4 000. Stable since the early eighties.
- Number of beaver population - more than 50 000. Increasing from 20 000 in the middle eighties to 50 000 in the early nineties.
- The beaver hunting was started in 1980 (fig. 1).
- During the period from 1987 to 1990 ca. a thousand trappers were trained for principles of game management, laws, hunting methods and accident prevention.
- Gradually more than 11 000 bow-traps have been distributed.
- The season of beaver hunting lasts from October 1 till March 31. the greatest amount of otters were killed in late autumn in quite short a period before the formation of ice and snow cover.
- During the 1980-1987, the otter has been included in the Red Data Book of Latvia. By the Hunting Law otter is not a game species for the present. However, it is possible for a beaver trapper to get a hunting licence after the otter is caught.
- The price of beaver skin in comparison with the minimal monthly salary: 1980 - 70-80%; 1985 - 125%; 1992 - 30%.
- The same figures for the otter: 1985 - 190%; 1992 - 40%.
- The distribution of catching places both in range and in different habitats (Table 1 was extremely irregular).

Threats

- Over hunting. No possibility to limit the amount of otters trapped.
- Destruction of natural sex ration of otter population by irregular elimination of male otters.
- Wrong attitude of people to otters and over-estimation of their abundance.

Table 1

The Review about Otters caught in beaver traps from 1987 to 1991

Hunting Season	Number of Otters Caught	Number of Records given about otters	Rate of Records Given about Otters %	Place of Trapping				Sex		Cub Otters (up to 5 Kg)
				River 0 %	Lake 0 %	Ditch 0 %	Unknown 0 %	Males 0 %	Females 0 %	0 %
1987/88	404	8.9	96	-	-	-	96 100	67 69.8	29 30.2	14 14
1988/89	453	7.8	453	179 39.6	21 4.6	132 29.2	120 26.5	260 68.2	121 31.8	52 11.5
1989/90	405	6,4	402	91 22.6	4 1	228 56.7	79 19.7	102 61.8	63 38.2	17 4.3
1990/91	229	6.5	157	40 35.5	2 1.3	90 57.3	25 15.9	67 66.3	34 33.7	7 4.5
TOTAL	1490	7.6	1107	310 28	27 2.4	450 40.7	320 28.9	496 66.8	247 33.2	80 8

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