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CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE AND NATURAL HABITATS

CONVENTION RELATIVE A LA CONSERVATION DE LA VIE SAUVAGE ET DU MILIEU NATUREL DE L'EUROPE

WORKSHOP ON THE CONTROL AND ERADICATION OF NON-NATIVE TERRESTRIAL VERTEBRATE

ATELIER SUR LA LIMITATION ET L'ÉRADICATION DES VERTÉBRÉS TERRESTRES NON INDIGÈNES

Malta, 3-5 June 1999
Malte, 3-5 juin 1999

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Report of the Workshop organised by the Council of Europe in co-operation with the Ministry of the Environment of Malta

Rapport de l'Atelier organisé par le Conseil de l'Europe en coopération avec le ministère de l'Environnement de Malte

Secretariat Memorandum
prepared by the
Directorate of the Environment
and Local Authorities

The Standing Committee is invited to :

1. take note of the report of the seminar ;
2. thank the Maltese authorities for the excellent preparation of the meeting ;
3. examine and, if appropriate, adopt the draft recommendation, see page 130.

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Le Comité permanent est invité :

1. à prendre note du rapport du séminaire ;
2. à remercier les autorités de Malte pour l'excellente préparation de la réunion ;
3. à examiner et, le cas échéant, à adopter le projet de recommandation figurant page 131.

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Opening speech
by Dr Francis Zammit Dimech, Minister of the Environment of Malta

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I would like to welcome you all to this two-day workshop on the control and eradication of non-native terrestrial vertebrates. Admittedly this is a new subject which is beins given much more importance today in our efforts to give further protection to indigenous species. Is has been an honour to us to be able to host such a meeting in Malta, and perhaps it is being held in an appropriate place considering that we are an archipelago in the middle of the Mediterranean Sea.

Since man's first arrival in the Maltese Islands, about 7,000 years ago, man has opened the way for the introduction of both fauna and flora which established themselbes in these islands. Some succeeded only for a short time. Others found an empty niche and established themselves quite successfully without any apparent negative impact on other indigenous species ; others were not only successful but they managed to compete and eliminate local indigenous species.

The most obvious and conspicuous species which thus established themselves in Malta are the Cape Sorrel (*Oxalis pes-caprae*) imported in the beginning of the nineteenth century, probably by an Italian monk, and first intorduced in a botanical garden at Floriana. It escaped from this garden and not only flourished throughout the whole islands which it covers in a yellow carpet in winter and in spring, but is also found its way to Sicily, and all around the Mediterranean and even beyond.

Another similar flora species is the Castor Oil plant which was imported as a decorative pot plant. It is now spreading all over the islands, and causing considerable undesired changes mainly in our water courses.

These are but two examples of what non-indigenous species can do, and their impact has been so visible after a short number of years. The eradication of an introduced species is very difficult, costly and in many cases probably impossible to achieve.

The modern modes of transport of today only contribute to the dispersal and introduction of flora and fauna species. The exchange and trade in species which although in themselves are not harmful, may slao serve as a carrier of other introductions.

It is thus encouraging to see that a number of experts are gathered here to discuss the different methods to eradicate and control the special group of non-native terrestrial vertebrates. I look forward to see the report of the outcome of this Workshop which will propose suitable measures for the eradication of such species, also suggesting a list of species whose eradication is considered a priority in different countries.

I understand that such proposals will be forwarded and included in a Recommendation for the Standing Committee of the Bern Convention, the Convention on the Conservation of European Wildlife and Natural Habitats which in Article 11, states that each Contracting Party should undertake to strictly control the introduction of non-native species.

This principle, and obligation, is also entrenched in other international agreements providing for the control of the introduction of species.

The Convention on Biological Diversity, the Convention on Migratory Species of Wild Animals, the UN Convention on the Law of the Sea, the Protocol on Specially Protected Areas and Biodiversity in the Mediterranean of the Mediterranean Action Plan, the International Plant Protection Convention and the European Union Bird Directive and the Habitat Directives, all speak on the obligation to control non-native species.

So it is with great pleasure that I have the honour to be present here today to open this workshop of such importance, a workshop which can lead to a number of decisions and suggestions which can ensure that native species of flora and flora, in this case terrestrial vertebrates, can be adequately protected aginst the invasion of other non-native species.

While welcoming you to our Islands, I would like to wish you the best of luck and all the success in your deliberations, and hope that you will enjoy your stay here on the island and have the opportunity to see some of our beautiful sites, both important from the natural and historical point of view.

Allocutation de bienvenue prononcée
par le docteur Francis Zammit Dimech, ministre de l'Environnement de Malte

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Mesdames et Messieurs, c'est un plaisir et un honneur pour moi de vous accueillir à Malte à l'occasion de ce Séminaire sur la limitation et l'éradication des vertébrés terrestres non indigènes. Cet aspect relativement nouveau mais de plus en plus important de nos politiques de protection de l'environnement prend un sens particulier dans le cas d'un archipel comme Malte, entouré sur toutes ses faces par les eaux de la Méditerranée.

En s'établissant sur nos îles, il y a environ 7 000 ans, l'homme a amené avec lui de nouvelles espèces animales et végétales. Certaines n'ont survécu que peu de temps ; d'autres ont trouvé leur niche écologique et se sont acclimatées apparemment sans nuire aux espèces indigènes ; mais d'autres encore sont bientôt entrées en concurrence avec des espèces locales, qu'elles ont fini par éliminer.

Pour prendre deux exemples très parlants dans le domaine connexe de la flore, je rappellerai que l'espèce végétale la plus courante à Malte est l'oxalide des Bermudes *(Oxalis pes-caprae),* qui a été importée au début du XIX^{e} siècle, probablement par un moine italien. Introduite au départ dans un jardin botanique de Floriana, elle s'est ensuite répandue sur toutes les îles — qu'elle recouvre d'un manteau jaune en hiver et au printemps — avant d'aller coloniser la Sicile, puis le Bassin méditerranéen et même des territoires plus lointains.

Autre plante, à l'origine cultivée en pot à des fins décoratives, le ricin pousse maintenant partout et perturbe l'équilibre écologique de nos cours d'eau.

Ces deux exemples nous montrent bien, *mutatis mutandis*, quels dégâts peuvent provoquer les espèces non indigènes, même en l'espace de quelques années, et combien il est difficile et coûteux — impossible même, souvent — de les éradiquer.

Les moyens de transport modernes facilitent d'autant plus la dissémination et l'établissement d'espèces animales et végétales hors de leur aire de répartition naturelle. L'échange et le commerce d'espèces qui ne sont pas dangereuses en soi peuvent servir de vecteurs à l'introduction d'autres espèces, nuisibles celles-là.

Il est donc réconfortant de constater que de nombreux experts se sont réunis ici pour examiner durant deux jours les différentes méthodes d'élimination et de limitation des vertébrés terrestres non indigènes. Je suis impatient de prendre connaissance du compte rendu de vos travaux, qui nous proposera, j'imagine, un plan d'action approprié pour les espèces à éliminer en priorité.

Je présume que ces décisions feront l'objet d'une recommandation à l'adresse du Comité permanent de la Convention relative à la conservation de la vie sauvage et du milieu naturel de l'Europe, dite communément Convention de Berne, dont l'article 11 oblige chaque Partie contractante à contrôler strictement l'introduction d'espèces non indigènes.

Cette obligation est d'ailleurs consacrée par d'autres accords internationaux tels que la Convention sur la diversité biologique, la Convention relative à la conservation des espèces migratrices appartenant à la faune sauvage, la Convention des Nations Unies sur le droit de la mer, le Protocole relatif aux aires spécialement protégées et à la diversité biologique du Plan d'action pour la Méditerranée, la Convention internationale pour la protection des végétaux ou encore la Directive européenne « Oiseaux » et la Directive « Habitats ».

C'est donc avec un grand plaisir que j'inaugure aujourd'hui votre atelier qui, j'en suis convaincu, débouchera sur des décisions et des propositions qui permettront de protéger les espèces animales et végétales indigènes en général et, tout particulièrement, dans le cas qui nous intéresse, les vertébrés terrestres.

Bienvenue donc à Malte. Je souhaite que vos travaux soient fructueux, en espérant toutefois qu'ils vous laisseront le loisir de découvrir quelques-unes des richesses naturelles et historiques de nos îles.

SECRETARIAT REPORT

Introduction

The introduction and reintroduction of non-native organisms into the natural environment is an important issue for the conservation of biological diversity. Uncontrolled introduction and reintroduction are among the chief causes of the disappearance of flora and fauna species and given the obvious trans-frontier nature of the problem, it should be dealt with on the widest possible geographical scale. The Bern Convention with its 40 Contracting Parties is a suitable forum to seek solutions to this problem and to strengthen governmental co-operation at pan-European level.

Few international instruments deal suitably with this matter. In the Bern Convention, Article 11, paragraph 2.*b*, states that each Contracting Party undertakes to strictly control the introduction of non-native species. Other provisions of the Bern Convention are related either directly or indirectly to the question of the introduction and reintroduction of species. In particular, Article 6, paragraph e, prohibits the internal trade of animals listed in Appendix II to the Convention, Article 7, paragraph 3, sub-paragraph *c*, deals with the regulation of the transport of wild animals, and Article 9, paragraph 1, fourth indent, refers to derogations permitted for purposes of re-population and re-introduction. All these articles should be taken into consideration.

In 1992, the Standing Committee to the Bern Convention set up a Group of Experts on legal aspects of introduction and reintroduction of wildlife species. This Group met on three occasions to review the legislation of Contracting Parties concerning this issue and recommended a legal study on "introductions of non-native organisms into the natural environment", published in 1996. The purpose of this study was to review the state of international law and of the national legislation of European countries concerning introductions, re-introductions and restocking and to present proposals aiming to strengthen national control mechanisms and to enhance the role of the Standing Committee.

Another interesting report on "methods to control and eradicate non-native terrestrial vertebrate species" was prepared under the auspices of the Bern Convention in 1998. The report presented information on the experiences of different countries in eradicating non-native species and proposed to Contracting Parties appropriate strategies for eradicating invasive species located on their territories.

The Standing Committee is responsible for following the application of the Convention and may make recommendations to the Contracting Parties concerning measures to be taken for the purposes of this Convention. In 1997, the Standing Committee adopted Recommendation No. 57, which requested Contracting Parties to prohibit the introduction of non-native species, and Recommendation No. 61 on the conservation of the White-headed Duck (*Oxyura leucocephala*). The latter noted that the main threat to the long-term survival of the White-headed Duck was its hybridisation with the North American Ruddy Duck (*Oxyura jamaicensis*). The recommendation therefore requested Contracting Parties and observer states, to develop and implement without further delay national control programmes, which could include eradication of the Ruddy Duck from all the countries in the Western

Palearctic. In this context, on behalf of the Council of Europe, a study was realised in 1999 on "The Status of the Ruddy Duck (*Oxyura jamaicensis*) in the Western Palearctic and an action plan for eradication, 1999-2002".

Opening of the Workshop

Dr Francis Zammit Dimech, Minister for the Environment of Malta, opened the Workshop and welcomed the participants. Mr Alfred Baldacchino, Principal Officer of the Maltese Environmental Authority, chaired the two-day meeting.

On behalf of the Council of Europe, the Secretariat thanked the Minister and the Maltese authorities for their warm welcome, their hospitality and the excellent preparation of the meeting. The Secretariat provided information on the provisions and the activities of the Bern Convention in the field of the control and eradication of invasive species for the conservation of biological diversity. The Secretariat presented the aims and the programme of the Workshop as set out in Appendix 1.

A complete list of the participants who attended this event is included as Appendix 2 to the report. The detailed addresses are also given to facilitate contact and exchange of information among the participants after the meeting.

Discussion

Following the programme of the Workshop, experts from several countries presented and discussed different methods of controlling and eradicating non-native terrestrial vertebrates, to provide technical tools for the implementation of Article 11, paragraph 2.*b* of the Bern Convention. A brief summary of each presentation of the experts is published in this report.

The discussions highlighted different problems in the eradication of invasive species. The main points raised concerned the identification and the application of technical methods to eradicate certain species in areas of difficult access, the involvement of important financial resources and the lack of support from local communities to implement eradication campaigns, the limited information on some alien species and their potential threat to biodiversity.

The participants devoted the last afternoon of the Workshop to discussing what action the Bern Convention should take, on the basis of the problems identified and of the proposals put forward.

Conclusions

The outcome of the Workshop was the draft recommendation reported in Appendix 3 and incorporating examples of invasive species, which have proved to be a threat to the biological diversity. Once adopted by the Standing Committee to the Bern Convention, the recommendation will be addressed to Contracting Parties requiring them to take specific actions for the implementation of control and eradication measures.

The participants emphasised the importance of pursuing every endeavour to preserve biodiversity from the threat of non-native species. The Council of Europe through the Bern Convention's activities is an ideal forum to deal with this issue at pan-European level. In this context, the participants suggested reconvening the Group of Experts on the introductions of non-native species. The terms of reference of this Group should be enlarged to take into account not only the legal aspects of the problem but also the technical constraints in implementing national action plans to eradicate invasive species.

RAPPORT DU SECRÉTARIAT

Introduction

L'introduction et la réintroduction d'organismes non indigènes dans un milieu naturel sont des questions d'une grande importance pour la préservation de la diversité biologique ; pratiquées sans contrôle, elles sont l'une des principales causes de l'extinction d'espèces animales et végétales. Étant donné la nature indiscutablement transfrontalière de ce problème, il convient de l'aborder à l'échelle géographique la plus vaste possible. La Convention de Berne, avec ses quarante Parties contractantes, est un forum approprié pour rechercher des solutions à ce problème et renforcer la coopération gouvernementale au niveau paneuropéen.

Peu d'instruments internationaux traitent ce problème comme il se doit. Aux termes de l'article 11, paragraphe 2.*b* de la Convention de Berne, chaque Partie contractante s'engage à contrôler strictement l'introduction des espèces non indigènes. D'autres dispositions de cette Convention traitent, directement ou indirectement, de l'introduction ou de la réintroduction d'espèces. Ainsi l'article 6, paragraphe *e*, interdit le commerce interne des animaux énumérés à l'Annexe II de la Convention ; l'article 7, paragraphe 3.*c* traite de la réglementation applicable au transport d'animaux sauvages tandis que le quatrième point de l'article 9, paragraphe 1, prévoit des dérogations à cette réglementation pour permettre le repeuplement et la réintroduction d'espèces. Toutes ces dispositions doivent être prises en considération.

En 1992, le Comité permanent de la Convention de Berne a constitué un groupe d'experts chargé d'étudier les aspects juridiques de l'introduction et de la réintroduction d'espèces sauvages. Ce groupe s'est réuni à trois reprises pour examiner la législation des Parties contractantes à ce sujet et a recommandé qu'une étude soit faite sur « les introductions d'organismes non indigènes dans le milieu naturel ». L'objectif de cette étude, qui a été publiée en 1996, était de faire le point sur l'état du droit international et de la législation des différents pays européens relative à l'introduction et à la réintroduction d'espèces ainsi qu'au repeuplement et de faire des propositions visant à renforcer les mécanismes de contrôle nationaux et le rôle du Comité permanent.

En 1998, un autre rapport intéressant portant sur « les méthodes de contrôle et d'élimination des espèces de vertébrés terrestres non indigènes » a été réalisé sous les auspices de la Convention de Berne. Il présente le bilan des campagnes d'élimination d'espèces non indigènes menées dans différents pays et propose aux Parties contractantes des stratégies adaptées pour l'élimination des espèces envahissantes présentes sur leur territoire.

Le Comité permanent est chargé du suivi de l'application de la Convention et est habilité à faire des recommandations aux Parties contractantes sur les mesures à prendre pour réaliser les objectifs de la Convention. En 1997, il a adopté la Recommandation n° 57, par laquelle il demandait aux Parties contractantes d'interdire l'introduction d'espèces non indigènes, et la Recommandation n° 61 pour la protection de l'érismature à tête blanche *(Oxyura leucocephala)*. Cette recommandation indiquait que la principale menace pour la survie à long terme de l'érismature à tête blanche était son hybridation avec l'érismature à tête rousse *(Oxyura jamaicensis)* nord-américaine. Elle invitait les Parties contractantes et les États observateurs à concevoir et à appliquer sans tarder des programmes nationaux de lutte

contre l'érismature à tête rousse, pouvant inclure, le cas échéant, son élimination dans tous les pays du Paléarctique occidental. Dans ce contexte, une étude, intitulée « La situation de l'érismature à tête rousse *(Oxyura jamaicensis)* dans le Paléarctique occidental, plan d'élimination 1999-2002 », a été réalisée en 1999 pour le compte du Conseil de l'Europe.

Ouverture du séminaire

Le séminaire a été ouvert par M. Francis Zammit Dimech, ministre de l'Environnement de Malte, qui a souhaité la bienvenue aux participants. M. Afred Baldacchino, chef de l'Agence maltaise pour l'environnement, a présidé les réunions tenues pendant ces deux jours.

Le Secrétariat, s'exprimant au nom du Conseil de l'Europe, a remercié le ministre et les autorités maltaises de leur hospitalité et de l'excellente préparation de la réunion. Il a fourni des informations sur les dispositions et les activités de la Convention de Berne visant à préserver la diversité biologique par le biais du contrôle et de l'élimination des espèces envahissantes. Il a ensuite présenté les objectifs et le programme du séminaire, qui sont reproduits à l'annexe 1.

La liste des participants figure à l'annexe 2 du présent rapport. Leur adresse complète est indiquée afin de faciliter les contacts et l'échange d'informations après la réunion.

Débats

Conformément au programme, des experts de plusieurs pays ont présenté et examiné différentes méthodes de contrôle et d'élimination des vertébrés terrestres non indigènes techniquement envisageables pour l'application de l'article 11, paragraphe 2.*b,* de la Convention de Berne. Un compte rendu sommaire de chacun de ces exposés est présenté dans ce rapport.

Les débats ont permis de mettre en évidence les différents problèmes qui se posent pour l'élimination des espèces envahissantes. Les principaux points soulevés concernaient le recensement et l'application de techniques permettant d'éliminer des espèces données dans des zones difficiles d'accès, l'importance des ressources financières à engager, le soutien pratiquement inexistant de la part des pouvoirs locaux lors des campagnes d'élimination, le manque d'informations sur certaines espèces non indigènes et sur la menace potentielle qu'elles représentent pour la biodiversité.

Au cours du dernier après-midi, les participants ont discuté des mesures que la Convention de Berne devrait prendre à la lumière des problèmes recensés et des propositions faites pendant ce séminaire.

Conclusions

Concrètement, le séminaire s'est conclu par la rédaction du projet de recommandation figurant à l'annexe 3 et dans lequel sont mentionnés des exemples d'espèces envahissantes dont l'effet potentiellement néfaste sur la diversité biologique est prouvé. Après son adoption par le Comité permanent de la Convention de Berne, cette recommandation sera adressée aux

Parties contractantes pour les enjoindre à prendre des dispositions spécifiques nécessaires à la mise en œuvre des mesures de contrôle et d'élimination.

Les participants ont insisté sur la nécessité de continuer à s'efforcer par tous les moyens de préserver la biodiversité face à la menace représentée par les espèces non indigènes. Avec les activités de la Convention de Berne, le Conseil de l'Europe est un forum idéal pour traiter de ce problème à l'échelle paneuropénne. Les participants ont donc suggéré que le Groupe d'experts se réunisse à nouveau pour discuter de l'introduction d'espèces non indigènes. Le mandat du groupe devrait être élargi pour qu'il puisse prendre en compte non seulement les aspects juridiques de la question mais aussi les contraintes techniques pesant sur la mise en œuvre des plans d'action nationaux pour l'élimination d'espèces envahissantes.

PRESENTATION OF NATIONAL CASES / PRÉSENTATION DES CAS NATIONAUX

1.

Methods to eradicate the American mink (*Mustela vison*) in Iceland / Methodes d'éradication du vison d'Amérique (*Mustela vison*) en Islande

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Introduction

The American mink was introduced to fur farms in Iceland in 1931. Mink were first known to escape from captivity the following year and the first known breeding den was discovered in 1937 in the south west of the country. By 1974 mink were known to exist in the wild all over Iceland in habitats believed to be suitable for the species (Skírnisson & Petersen 1980). The only other terrestrial carnivore in Iceland is the native Arctic fox *Alopex lagopus*. Arctic foxes kill mink occasionally and there is some interference competition by the Arctic fox but there is no indication that this limits the mink population (Hersteinsson 1984).

Damage caused by the mink in Iceland

The Icelandic avifauna was adapted to the presence of the only terrestrial predator species, the Arctic fox. Many species, such as eiders *Somateria mollissima* and some other ducks nested in dense colonies on islands where they were safe from predation by foxes. The mink, however, is a competent swimmer and islands within 500 m from the shore have a high probability of invasion by mink from the mainland (Björnsson & Hersteinsson 1991). As eider down is a valuable commodity, some farmers could incur serious loss of income when mink invaded such colonies. Considerable changes in nesting distribution also occurred among other duck species after the colonisation of the mink (Gardarsson 1979, Gudmundsson 1979) and some Black Guillemot *Cepphus grylle* colonies disappeared on the mainland while they increased in size on islands inaccessible to the mink (Petersen 1979). Other species which are believed to have been badly affected by the arrival of the mink are the Water Rail *Rallus aquaticus* (Skarphedinsson 1998) and Slavonian Grebe *Podiceps auritus* (Nielsen 1998). Both species are particularly dependent upon wetlands and the draining of wetland in this century is probably at least a contributory factor (Nielsen 1998, Skarphedinsson 1998). No data are available on the effect of the mink on various wader and passerine species. However, both waders and passerines are a considerable part of the diet of the mink in summer, particularly in inland habitat (Skírnisson 1979a,b). Ongoing research on the behavioural ecology of the mink in Iceland suggests that male mink switch from foraging on the shoreline to foraging away from water while migrant birds are present in Iceland during summer (Schmalensee *et al.* 1999).

Efforts to eradicate the mink

Laws on minkhunting

The first law which stated categorically that mink should be eradicated, was passed by the Althing (parliament) as early as 1949 (Nº 56/1949). Before then local sheriffs had been responsible for both making certain that fur farms were secure so that mink would not escape, and for capturing those mink which did manage to escape. With the new law, each local authority was made responsible for employing a hunter or hunters to search for and kill mink within the boundaries of the community.

By the mid-1950's, however, it had become clear that a feral population was by now well established throughout the southern and western part of the country and was spreading fast.

The bounty system

A bounty system was set up by law in 1940, and was further established by law in 1949. By presenting the tail of a mink as proof of the catch, the local authority where the mink was caught would pay the hunter a bounty and later itself be reimbursed 2/3 of the cost from the state and 1/6 of the cost by the county. A similar bounty system has been in operation ever since except that the proportions paid by the local authority, county and state have varied. At present the state pays half and the local authority half of the cost and the bounty amounts to approximately £12 for each mink of either sex and any age.

Hunting methods

Originally the hunters were not at all equipped to deal with minkhunting in Iceland. Several hunters were specialist hunters of Arctic fox and the local authorities turned to these in order to hunt the mink. Mink dens were searched for along coasts and waterways and when encountered, they were either dug up and the inhabitants shot with shotguns or, in case the substrate did not allow such digging, gin traps were set at the mouths of the dens. However, as each mink generally uses many dens and visits them irregularly, trapping success was low. Furthermore, mink dens can be very cryptic and are not always right at the water's edge. Equally importantly, the dogs available in Iceland at the time, mostly sheepdogs, were not very keen on hunting mink and were thus generally not used.

With the establishment of the Wildlife Management Institute in 1958, knowledge in the use of fox terriers to locate and kill mink began to spread in Iceland. This had been initiated a few years earlier by a Dane, Mr. C. A. Carlsen, who had used terriers in his home country for badger hunting and brought the dogs with him when he settled to Iceland. The WMU set up kennels where these dogs were bred, trained and distributed free of charge to hunters throughout the country and this work is still continued, albeit on a smaller scale, by the Wildlife Management Institute.

A well-trained dog will totally ignore any other type of wildlife or domestic stock, and indicate upon locating a den whether a mink is in the den at the time, whether a mink has been there a few hours earlier or whether the den has not been used recently. Furthermore, upon discovery of the mink, it will attack and kill the mink without hesitation. Finally, the dog must

not be gun-shy. Training the dog to its full potential may take 2-4 years. For continuity, a hunter should ideally use three dogs of different ages simultaneously because the best way to train a young dog is to have it learn from older dogs (Björnsson 1985).

The only drawback with using fox terriers is that they are not keen on swimming and the mink will generally try to escape into water.

Once a mink has been located in its den, it must be chased out into the open to be either shot or killed by the dogs. If the substrate allows, the dog will often be able to locate the mink accurately within the den. As the dens can be large, it is important to isolate the mink in a portion of it by opening the den with shovels and other tools. When the mink discovers that it can no longer use the whole den it usually opts to leave the den. If the den is in a lava field or in such a rocky substrate that it is impossible to break it open, the hunters normally leave the area after setting traps in places where tracks indicate that the mink normally enters the water. They return a few hours later, either to find the mink dead in a trap or to find that the mink has moved to another den which may be more easily excavated. Gin traps are almost exclusively placed at the water's edge or in shallow water so that mink will drown within seconds when caught in the trap.

In the past, a small amount of petrol would sometimes be poured into the den, care being taken not to pour it exactly at the point where the mink was believed to be, and ignited. The resulting explosion almost invariably resulted in the mink fleeing from the den, generally unscathed. However, this is no longer legal.

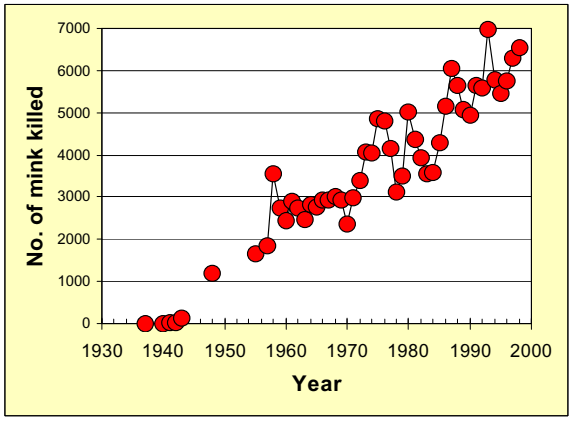

Fig. 1. The number of mink killed annually in Iceland is still increasing.

Research on the American mink in Iceland

During the past two decades there has been no major change in the minkhunting effort in Iceland. In spite of this, the numbers of mink killed annually in Iceland are rising (Fig.1), suggesting that the mink population is still increasing in size. So far, no effort has been made to estimate the population size of the American mink in Iceland. This, however, is clearly an urgent undertaking, and should have a high priority, together with further research on the influence of climate and other environmental factors on the population dynamics of the species (Hersteinsson 1992). Otherwise, we have no way of knowing whether we can limit mink numbers by hunting or whether an increased hunting effort is likely to reduce mink numbers or eradicate the species in the country.

In spite of the aforesaid, it is clear that minkhunting in spring can severely limit the numbers of mink locally. This has been demonstrated repeatedly in and around eider colonies which are harvested for the down (pers. obs.). This is presumably the result of the movement patterns of mink, which appear to be rather sedentary after the mating season ends in early April until early August when pups begin to disperse.

Further research is also clearly needed on the impact of mink predation on bird populations, particularly on waders, passerines and ducks.

Summary and Conclusions

The American mink was introduced to Iceland over 60 years ago and is now to be found all over the island in suitable habitats. In spite of extensive eradication measures, the population appears to be still increasing in size. It is clear that the mink has affected breeding distribution of some bird species in Iceland and evidence suggests that it has been at least partly responsible for the decline in numbers of some species. There is urgent need for research on the population dynamics of the mink in Iceland, its effects on birdlife and the measures taken in the attempt to eradicate the mink. Indeed, that appears to apply to the rest of Europe too.

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2.

Eradication of mammals introduced in the islands /
Eradication des mammifères introduits en milieu insulaire

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Eradications de vertébrés allochtones terrestres
Expériences récentes menées sur le territoire français

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I. Invasions biologiques : rôle de l'Homme

Par invasion biologique, on entend l'accroissement durable de l'aire de répartition d'un taxon (Williamson, 1997). Les invasions biologiques constituent un processus naturel identifié à l'échelle des temps géologiques et réputé participer à l'évolution dans sa globalité (Mac Arthur & Wilson, 1967; Wilson, 1993; Williamson, 1997 *i.a.*). Cependant, pour les seuls vertébrés, de récents travaux montrent que depuis le néolithique et surtout depuis l'avènement de l'élevage (Vigne, 1993), puis de l'agriculture (Auffray *et al.*, 1988 *i.a*), l'Homme interfère avec ce processus naturel, d'une part, directement, en introduisant volontairement ou non des allochtones (Audouin-Rouzeau & Vigne, 1997; Callou, 1995; Steadman, 1995; Vigne, 1993, 1994; Auffray & Britton-Davidian, 1992 *i.a*), d'autre part, indirectement, en modifiant les habitats, autorisant ou favorisant ainsi des événements invasifs (Vigne *et al*., 1996; Vigne, 1998; *i.a*.).

Plus récemment, la prééminence de l'Homme s'est affirmée dans ces processus, dès le XVI^{e} siècle avec l'épisode des grandes découvertes, mais surtout depuis la fin du dernier conflit mondial avec, d'une part, la très forte augmentation du volume des échanges internationaux, des linéaires de communications terrestres (Forman & Deblinger, 1998; Meunier 1999 *i.a*), et de la démographie humaine (U.N., 1994), et, d'autre part, l'évolution des motivations à l'origine des introductions (Gargominy *et al*, 1996 *i.a*), celle de l'usage de l'espace sous la contrainte des changements des pratiques culturales et d'élevages, et celle enfin de l'habitat rural et des processus d'urbanisation et de gestion du périurbain (Dubois, 1998 *i.a*.).

La règle empirique admise par les spécialiste des invasions biologiques suggère que 90 % des introductions sont des échecs et que, parmi celles couronnées de succès, 90 % sont réputés ne pas poser de « problèmes » (Williamson, 1997). Une introduction réussie générant des « problèmes » constitue donc un événement rare. Sa probabilité d'occurrence augmente cependant de façon constante avec celle des diverses activités humaines citées plus haut.

C'est la prise de conscience de cette prééminence de l'action anthropique sur les processus d'invasion, les premières évaluations globales de leurs fortes incidences sur les économies nationales (U.S.C., 1993) et le fonctionnement de la quasi-totalité des écosystèmes du globe (Diamond, 1989 *i.a*.) qui a fait prendre en compte l'étude des processus d'invasion

dans le cadre d'institutions internationales (Convention sur la Diversité Biologique (UNEP/CBD, 1999), CEE, (De Klemm, 1996) *i.a.*) et nationales. Ce sujet relève d'autant plus de l'actualité qu'avec le développement des travaux sur les OGM, se posera immanquablement lors de leur libération, et pour chacun d'entre eux, la question de leur potentialité invasive et de la nature de leurs éventuelles interactions avec les composantes des écosystèmes d'accueil.

Par ailleurs, il semble actuellement impossible de formuler une prédiction réellement fondée des capacités invasives d'une espèce donnée, ou de la susceptibilité aux invasions d'un écosystème donné. Williamson (1997), dans la conclusion de son ouvrage consacré aux invasions, expose de façon convainquante que les modèles actuellement développés ne pourront réellement progresser sans un apport nouveau et substantiel de documentations rigoureuses de cas concrets portant en particulier sur :

- la ou les causes à l'origine de l'invasion,

- les modalités de l'invasion,

- les conséquences de l'invasion sur la composition spécifique et le fonctionnement de l'écosystème d'accueil,

et ceci, dans la perspective d'intégrer l'ensemble de ces résultats dans des modalités de gestion destinées à maîtriser le phénomène.

II. Evolution des motivations des opérations d'éradications

Tout comme les mobiles qui ont présidé aux introductions, la nature des raisons à l'origine d'entreprises d'éradications est variée : santé publique, agriculture et élevage et, plus récemment, préoccupations environnementales.

A notre connaissance, le témoignage le plus ancien d'une éradication programmée et réussie, a eu pour mobile la santé publique et concerne l'éradication par le médecin portugais Bruto da Costa de la population de glossines, vecteurs de la maladie du sommeil, de l'île de Principe (Lapessonnie, 1988). Plus récemment (années 1980), le cas exemplaire de l'éradication du Ragondin (*Myocastor coypus*) de la Grande Bretagne relève de préoccupations essentiellement agronomiques (Gosling & Baker, 1987, 1989; Gosling, 1989).

L'exemple de la Nouvelle-Zélande, riche et documenté, permet l'appréciation à une échelle locale de l'évolution des motivations à l'origine d'opérations d'éradication. Ce pays héberge une riche faune de vertébrés récemment introduits. Le *Department of Conservation* a réalisé l'inventaire des opérations d'éradication tentées à ce jour à l'encontre de mammifères exogènes. Cet inventaire, fondé sur l'analyse bibliographique (Moors, 1985; Veitch & Bell 1990, Mc Fadden 1992a, 1992b), et un ensemble d'informations validées (Ian Mac Fadden, comm. pers.), faisait état, fin 1995, de 161 tentatives d'éradications de populations mammaliennes, toutes menées en milieu insulaire, dont 113 couronnées de succès. Si la motivation agronomique semble avoir été prépondérante pour entreprendre l'élimination des grands mammifères exogènes dans la première moitié du XX siècle, la littérature indique que c'est en 1960 que débute en Nouvelle-Zélande l'ère des éradications entreprises dans un but environnemental avec les travaux de Don Merton (Moors, 1985) sur des populations de

Surmulot (*Rattus norvegicus*). Vingt sept tentatives d'éradication sont recensées pour la période précédant 1960, et 134 pour celle lui succédant (1960 - 1995). Parmi ces dernières figurent les 80 tentatives menées à l'encontre de rongeurs, cibles privilégiées des gestionnaires. Ces données suggèrent qu'en Nouvelle-Zélande, ces 35 dernières années, la quasi totalité des opérations d'éradication ont été entreprises pour des motivations environnementales.

A notre connaissance, la première référence française dans le domaine des éradications à but environnemental concerne l'élimination dans les années 1951-1952 de la population de surmulots de l'île Rouzic (Pascal *et al*., 1996a). Cependant, comme en Nouvelle-Zélande, c'est dans les années soixante que furent entreprises les premières tentatives d'élimination du Chat haret aux îles Kerguelen (Derenne, 1972, 1976; Pascal, 1980), et seulement à la fin des années 1980 que de nouveaux projets se concrétisèrent (Rat noir : Thibault, 1992; Lapin : Chapuis & Barnaud, 1995; Surmulot : Pascal *et al*, 1996a).

Ainsi, les opérations d'éradication à but environnemental, débutent dans les années 50, s'intensifient dans les années 1960, et se généralisent dans les années 80. Elles constituent actuellement la quasi-totalité des opérations d'éradication d'allochtones et se situent toutes, à notre connaissance, en milieu insulaire à la fois parce que les îles se sont révélées particulièrement vulnérables aux introductions (Steadman, 1995; Diamond, 1989), mais aussi parce qu'elles constituent, en raison de leur isolement, et, pour nombre d'entre elles, de leur surface réduite, des sites où il n'apparaissait pas totalement illusoire de réaliser avec succès l'éradication d'une espèce (Chapuis *et al*, 1995). Les Mammifères constituent le taxon cible de ces opérations et les Rongeurs commensaux du genre *Rattus*, introduits dans 82 % des îles du monde (Atkinson, 1985), ont fait l'objet de l'essentiel des interventions.

L'évolution des motivations a engendré une profonde modification de la conception des opérations d'éradication. Par le passé, leur entreprise, sous-tendue par des motivations agronomiques ou de santé publique, n'était conditionnée que par l'instruction d'un dossier technique dévolu pour l'essentiel aux processus devant conduire à l'élimination de l'espèce cible. L'instruction des opérations récentes, générées par des préoccupations environnementales, dépasse l'élaboration de ce dossier technique qui ne prend en considération qu'un nombre réduit d'interactions interspécifiques. Elle développe une démarche délibérément plus holistique, conséquence de la prise en compte du principe de précaution évoqué très tôt dans ce domaine (i.e. : Towns *et al*., 1990), et justifiée, entre autre, par la fréquente mise en évidence, suite à l'élimination d'une espèce allochtone, de répercussions imprévues, et souvent imprévisibles à la lumière des connaissances disponibles au moment de la prise de décision (i.e. Pascal *et al*., 1998). En conséquence, dans l'état actuel des connaissances, une éradication devrait être considérée non seulement comme une opération de gestion, mais aussi comme une expérience à part entière.

- En tant qu'expérience, sa conduite doit donc être rigoureuse afin de fournir des conclusions fondées et généralisables. La démarche comparative, la plus adaptée à ce type d'expérience, impose de disposer de l'état initial du système étudié, décrit par la valeur d'une série de variables jugées *a priori* pertinentes et qui feront l'objet d'un suivi après éradication.

- En tant qu'opération de gestion, elle doit mobiliser les compétences des gestionnaires qui auront, en règle générale, la mission de réaliser une bonne partie des actions relevant de l'éradication et des suivis à long terme, mais aussi, celle, de gérer au quotidien l'information

du public dont l'adhésion au projet est très souvent une condition indispensable à son succès et surtout à sa pérennité.

C'est cette conception qui a guidé la démarche empruntée pour décider, et techniquement réaliser, l'éradication des populations de surmulots de 10 îles de 3 archipels des côtes de Bretagne entre 1994 et 1996 (Pascal *et al*., 1996a,b), et celles de lapins de 3 îles de l'Archipel de Kerguelen (1992-1999) (Chapuis *et al*., 1995 ; Chapuis & Barnaud, 1995). C'est l'exposé de cette démarche qui constitue la suite de ce document.

III. Préalable à une opération d'éradication de mammifères allochtones

1. Agir ou ne pas agir ?

Il a été retenu de s'abstenir d'intervenir (Usher, 1989) si l'allochtone :

- remplit des fonctions écologiques importantes qui ne sont plus assurées par des espèces indigènes, disparues ;

- constitue la proie majeure d'une autre espèce introduite qui en son absence pourrait se tourner vers des indigènes ;

- limite les populations d'autres espèces introduites dont le développement pourrait avoir des effets indésirables sur les communautés dans leur ensemble ;

- permet, par son impact, le maintien de communautés spécifiques à caractère patrimonial.

La conclusion de ce premier niveau d'analyse fut que l'élimination des allochtones ne devrait pas conduire à des perturbations perverses. Il s'est alors agit de répondre à trois questions :

- Quels sont les attendus de l'opération ?
- Quels sont les risques potentiels de l'opération ?
- Quelle est la probabilité de succès de l'opération ?

Et pour cela, 4 rubriques ont été instruites :

* Histoire de l'introduction de ou des espèces allochtones,
* Caractéristiques du milieu d'accueil,
* Modalités de l'intervention,
* Modalités de suivi de l'opération.

2. L'histoire de l'introduction

Les acteurs, souvent obnubilés par les effets d'une espèce introduite particulière, font l'impasse sur l'indispensable inventaire exhaustif du cortège d'allochtones. C'est donc, dans toute la mesure du possible, sur l'ensemble des allochtones qu'il a été tenté d'établir :

- la ou les dates d'introductions de l'espèce, qu'elles soient ou non suivies d'installation,

- l'origine et la composition du ou des groupes fondateurs,

- si la ou les introductions successives de l'espèce concernée ont été volontaires ou non,

- l'évolution historique de la composition spécifique des peuplements et des effectifs des populations des espèces autochtones et les éventuelles corrélations entre cette évolution et les dates d'introduction des allochtones,

afin de répondre aux questions suivantes :

- l'Homme a-t-il été à l'origine de l'introduction ?

- Si l'introduction a été volontaire, ses raisons sont-elles toujours d'actualité et, si oui, jusqu'à quel point ?

- Compte tenu du temps écoulé depuis l'introduction, de la composition (origine simple ou multiple, sex-ratio...) et de l'effectif des fondateurs, peut-on supposer l'émergence d'une originalité génétique, comportementale.... de la population introduite par rapport à la population originelle ?

- Dans quelle mesure la ou les espèces introduites incriminées sont-elles, seules ou en synergies, responsables de la disparition et/ou de la réduction de l'effectif de populations d'espèces autochtones ?

- Des modifications environnementales interférant sur les populations autochtones ont-elles facilité l'installation et le développement des allochtones ?

3. Description du milieu d'accueil, « l'état 0 » :

Disposer d'une description précise du milieu avant intervention (composition spécifique des peuplements, estimation des effectifs des populations, nature des interactions entre espèces...) fut une étape indispensable destinée à apprécier *a priori* comme *a posteriori* ses répercussions sur l'écosystème et de répondre aux questions suivantes :

- Par quels mécanismes les espèces introduites interfèrent-elles avec les autochtones ?

- En cas d'introductions multiples, par quels mécanismes les espèces introduites interfèrent-elles entre elles ?

La mise en perspective de ces connaissances locales par rapport à celles relatives à des échelles régionales ou mondiales a permis de répondre à la question :

- L'éradication projetée a-t-elle une portée locale, régionale ou mondiale ?

4. Les modalités de l'intervention :

Arrêter les modalités de opération d'éradication a nécessité de répondre à trois questions essentielles : où, quand et comment ?

*** Où ?**

Quelle est l'entité géographique sur laquelle doit porter l'opération afin d'en maximiser les chances de succès d'une part, et la pérennité de ce succès d'autre part ?

*** Quand ?**

Quelles périodes du cycle annuel seraient les plus favorables à l'exécution de l'opération d'éradication, ceci en relation avec la biologie de l'espèce cible, mais aussi avec l'impact négatif susceptible d'être occasionné par cette opération aux autres espèces ?

*** Comment ?**

- Quelles stratégies (une seule méthode de lutte ? lutte intégrée ?) et quels moyens de lutte (lutte chimique, lutte physique, lutte biologique ?) seraient les plus efficaces ?

- Quel degré d'innocuité présentent les méthodes et techniques qu'il est envisagé d'employer à l'égard des espèces autochtones ?

- En cas d'usage de toxiques et si leur emploi doit être répété, peut-il être à l'origine d'une sélection d'individus résistants ?

- Dans le cas de l'existence d'une forte dépendance entre plusieurs espèces introduites dans une même localité, doit-on procéder à des éradications simultanées ou de façon échelonnée ? Et, dans ce dernier cas, dans quel ordre ?

- Quelles mesures techniques prendre pour prévenir la réinstallation de l'espèce cible ?

5. Les modalités de suivi de l'opération:

Il s'est agit de répondre ici à quatre types de questions :

- Quelles variables sélectionner pour évaluer les conséquences de l'opération d'éradication, au niveau des espèces, des communautés et, plus largement, des systèmes écologiques ?

- Quelles sont les fréquences d'observation et leur durée nécessaires à la mise en évidence de l'impact généré par l'élimination de l'allochtone ?

- Quelles sont les compétences (scientifiques et opérationnelles) nécessaires à ce suivi ?

- Quelles sont les "garanties" financières autorisant ce suivi jusqu'à son terme ?

IV. Deux exemples récents d'éradication

Eradication des populations de surmulots de dix îles bretonnes :

Le projet d'éradication des populations de surmulots de 10 îles de trois archipels bretons a été élaboré dans la perspective de restaurer la riche avifaune marine de ces sites bénéficiant d'un fort statut de protection. Initié en 1992, le projet a débuté par l'inventaire par capture des faunes mammaliennes insulaires (Pascal *et al.*, 1994) et l'élaboration d'une stratégie générale (Pascal *et al.*, 1996a; 1996b) pour se concrétiser par des opérations d'éradication conduites en 1994 et en 1996. Conçues comme des expériences à part entière, ces opérations cherchent à établir *a posteriori* l'impact de la présence du Surmulot sur les avifaunes marines et terrestres, mais aussi sur les communautés de micromammifères autochtones, d'ecto et d'endoparasites, et sur la présence et le niveau de pathogénicité de bactéries du groupe *Leptospira*.

Où ? Il a été retenu de traiter simultanément des ensembles d'îles d'un même archipel proches géographiquement afin d'en minimiser la probabilité de recolonisation spontanée par proximité.

Quand ? Il a été choisi de procéder à l'opération en septembre - octobre, période du cycle annuel pendant laquelle les populations nicheuses d'oiseaux marins ont quitté les îles et où les conditions météorologiques sont encore suffisamment clémentes pour y accéder.

Comment ? Afin d'augmenter la probabilité de succès, de réduire le temps d'intervention et de minimiser le flux de toxique dans la chaîne trophique, il a été retenu d'utiliser en synergie deux techniques de lutte, le piégeage non vulnérant et la lutte chimique (chlorophacinone sur blé), cette dernière étant différée par rapport à la première.

Efficacité des opérations : Les éradications ont été obtenues en 16 jours. Le piégeage a permis la capture de 85 à 100 % des rongeurs en moins de 10 jours limitant dans les mêmes proportions le flux de toxique dans la chaîne trophique et produisant un échantillon biologique de grand intérêt pour diverses disciplines. L'espèce cible, n'a plus été signalée sur ces îles depuis l'éradication.

Conséquences de l'opération sur les espèces non cibles : L'impact sur les espèces non cibles (87 captures de 5 espèces de passereaux autochtones dont 48 libérés en bon état, et intoxication de lapins allochtones) n'a pas eu de répercutions perceptibles l'année qui a suivi l'éradication.

Premiers résultats du suivi après intervention **:** Quatre ans après éradication, le nombre de couples nicheurs de diverses espèces d'oiseaux marins n'a pas évolué significativement par rapport à celui de populations témoins.

Les effectifs de couples nicheurs de 3 espèces du peuplement d'oiseaux terrestres ont augmenté significativement deux ans après éradication.

Conséquences non prévues initialement :

- Sur l'île Bono (Archipel des Sept-Îles), quatre ans après éradication du Surmulot, l'indice de densité de la forme insulaire autochtone de la musaraigne *Crocidura suaveolens* a été multiplié par 16,4 et sa répartition spatiale, restreinte initialement, couvre actuellement la totalité de la superficie de l'île et deux îlots voisins ont été colonisés spontanément par l'insectivore (Pascal *et al*., 1998).

- Le Pétrel Océanite, le Puffin des Anglais, la Sterne Pierregarin et la Sterne Caugek, absents initialement des îles traitées, sont venus se reproduire sur certaines d'entre elles depuis éradication.

- La population d'Orvet de l'île Bono s'est considérablement accrue sans qu'il soit possible de quantifier le phénomène en raison d'absence de données initiales.

Eradication des populations de lapins de 3 îles de l'Archipel de Kerguelen .

Le projet d'éradication du Lapin de trois îles de l'Archipel de Kerguelen, construit dans une perspective de restauration écologique, a été initié en 1992 suite à l'étude de l'impact de cet herbivore introduit en 1874 dans un milieu dépourvu de mammifères terrestres, et à des travaux en biologie des populations (Boussès, 1991; Boussès *et al*., 1988).

Où ? Le choix des îles à traiter a été fondé sur leur superficie et leur représentation en termes de dégradation afin d'apprécier la résilience des systèmes écologiques. L'isolement naturel de deux des trois îles choisies les mettait à l'abri d'une recolonisation spontanée par le Lapin et la troisième fut équipée d'une barrière artificielle afin d'en prévenir la recolonisation.

Quand ? L'opération d'éradication a été effectuée au cours de l'hiver, période à faible disponibilité alimentaire pour les lapins, marquée par la fréquence des chutes de neige facilitant sa localisation et par l'absence du Skua, candidat potentiel à l'intoxication indirecte.

Comment ? L'absence ou la rareté des vertébrés autochtones omnivores et carnivores sensibles aux anticoagulants a conduit à opter pour la lutte chimique (chlorophacinone) sur support blé préalablement stérilisé afin de prévenir toute introduction d'espèces végétales.

Efficacité des opérations : Réalisées en 1992, 1994 et 1997 sur les îles Verte, Guillou, et Cochons, les opérations d'éradication ont entraîné la disparition de 95 à 99 % des lapins dans le mois suivant la distribution des appâts. Les deux survivants des îles Verte et Guillou ont été éliminés par tir au cours des deux années suivantes. Les tires du printemps 1997 et la lutte chimique de l'hiver 1998 ne sont pas venues à bout de la trentaine de survivants demeurés sur l'île aux Cochons. Une troisième phase d'empoisonnement est prévue pour l'hiver austral 1999.

Conséquences de l'opération sur les espèces non cibles : Pour l'ensemble des trois îles, 14 goélands dominicains, 5 canards d'Eaton et deux becs à fourreau ont été victimes d'un empoisonnement direct, impact jugé négligeable au regard de l'effectif local des populations. L'effectif des populations allochtones de souris des îles Guillou et Cochons a été réduit de près de 95% sans être totale. Prés de la moitié des 15 à 20 chats harets présents sur l'île Guillou ont été victimes d'intoxication indirecte. Les survivants ont été éliminés par le tir.

***Premiers résultats du suivi après intervention* :**

- Stabilisation des fronts d'érosions et augmentation du couvert végétal dès la première année suivant l'élimination du Lapin.

- Recolonisation des îles par deux espèces clés, le Chou de Kerguelen et l'Azorelle, à partir de graines arrivant par flottage ou à partir de rares pieds-mères.

Conséquence non prévue initialement :

- Développement d'une composée allochtone : le Pissenlit.

V. Conclusions

La nature et l'importance des conséquences de l'éradication d'un allochtone sont loin d'être identifiées et quantifiées. En raison de leur coût, le nombre d'opérations d'éradication reste limité. C'est pourquoi nous proposons que ces opérations soient considérées à la fois comme des actes de gestion et des expériences, initiées et conduites avec un minimum de rigueur afin de tenter d'établir le caractère général de leurs résultats. Le cadre des opérations évoquées ici est purement insulaire et environnemental. L'extension de la démarche à des opérations menées avec des motivations relevant de la santé publique, de l'agriculture ou de l'élevage et à des milieux continentaux « isolés » n'est, *a priori,* pas à exclure.

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3.

Control and eradication of non-native terrestrial vertebrates in Cyprus / Limitation et éradication de vertébrés terrestres non indigènes à Chypre

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The island of Cyprus is the third largest island in the Mediterranean with a total area of 9,250 sq. km. About 1,700 sq. km. are forested. The central massif, the Troodos mountains rise to almost 1,951m above sea level while the Pentadactylos range reaches 1,024 m.. Cyprus has a population of about 740,000 and the population density is about 80 persons per sq. km. Per capita income in 1997 was about $15,000.

Cyprus was, some 90 million years ago, part of the bottom of the Tethys sea. Tectonic movements at about that time resulted in the collision of the African with the Eurasian plate, pushing part of the sea bed upwards (Constantinou 1990). About 20 million years ago two parts of Cyprus, two small islands, rose above the sea. These were the Troodos massif and the Pentadactylos range of mountains. They continued rising spasmodically and during the Pleistocene they reached their present height. At about that time the Mesaoria plain was also partly formed.

As a result of the way the island was formed it is obvious that it was never connected to any of the nearby land masses except, apparently, during the period between 6.4 and 5.3 million years ago when the Mediterranean more or less dried up. The exposed sea bed at that time must have been largely a very hostile, salty, terrain with little or no vegetation or fresh water. Because of this, but also on other grounds, it has been inferred that the colonisation of the island by animals was mainly via the sea. Some, no doubt, crossed the exposed and hostile, salty sea bed in the period during which the Mediterranean was more or less dry, but there is still little evidence as to what happened and when.

The fauna and flora of Cyprus evolved in the isolation of the island absorbing elements from all three continents surrounding it. The first large mammals reached the island about one million years ago. They were Elephants and Hippos. They apparently reached the island by swimming across the sea from Asia Minor and the levant coast. The sea level was lower then by about 170 metres, due to the extensive glaciers of the prevailing Ice Age. As a result the distance between the island to the closest mainland shores was around 30 kilometres - a distance which today's' Elephants and Hippos have been recorded to swim on occasion.

In the absence of predators, and no doubt for other reasons also, these species evolved here, as they did in other Mediterranean islands, into endemic pygmy forms (*Phanourius cypriotes* and *Hippopotamus minutus*). Their remains have been discovered in various parts of the island, mainly in caves (Bate 1903). These animals became extinct about 8 to 10 thousand years ago, soon after man's first colonisation the island. His primitive tools were recently discovered in Akrotiri in heaps of pygmy Hippo and Elephant bones, perhaps evidence of his direct involvement in their demise. There is no evidence of the island having had any other large native mammals. It now has a handful of small mammalian species (Spizenberger 1979), including an endemic shrew, 16 species of bat (Boyle et. al. 1990), three frogs, 21 reptiles, including several snakes (including an endemic one) and lizards, one terrapin and no tortoises (Bucknill and Boulenger 1913, boulenger 1914, Schatti 1989,

Demetropoulos and Hadjichristophorou 1981, Demetropoulos 1999). It is still not clear how and when many of these colonised the island.

Many animals, mainly mammals, were introduced into Cyprus by man since his arrival to the island 10,000 years or so ago. These are now often considered as being, or having been, native to the island. The first inhabitants of the island apparently brought with them various animals which were, at the time, at various stages of domestication (or were candidates for this). Deer, wild boar, mouflon and a kind of wild goat. Some must have escaped, or were released, forming wild populations. Competition from them probably affected the older fauna of the island - though there is little evidence of what this was. Foxes and rats and the house mouse were also introduced, the former for no obvious reason, the latter two most probably as stowaways on rafts and boats.

The deer introduced was *Dama mesopotamica*. It disappeared from Cyprus about 400 years ago probably due to hunting and to the reduction of the island's forests. Its remains are often found in archaeological excavations in many parts of the country. A close relative *Dama dama*, the Fallow deer, was introduced from Germany in recent years and has so far been kept in captivity, in a fenced off area, at the Stavrostis-Psokas Forest Station in the Paphos forest. Its increasing numbers and an increasing awareness of the complications of releasing deer to the wild, are now leading to second thoughts as to the wisdom of bringing them to the island in the first place. The wild boar disappeared more recently than the Mesopotamian deer. The last of boars apparently lived in the Akamas peninsula at the beginning of this century.

Apart from the fox the only other large mammal that has survived in the wild until now is the Cyprus Moufflon, *Ovis orientalis ophion*. This has evolved, rather surprisingly for such a short time, into an endemic form. Its population at the beginning of this century was reduced to a few dozen and it was then at the brink of extinction. The threats to it were intensive hunting, the spread of agriculture and the reduction of the forests. The moufflon population, as a result of strict protection, has increased very substantially in the last few decades. Its population is now estimated at about 2,000 animals and it can be found throughout the Paphos Forest. However, it has disappeared from the central and eastern end of the Troodos Mountains, from the Pentadactylos range and the Akamas peninsula in all of which it apparently once flourished.

Cyprus is today not facing serious problems with newly introduced terrestrial vertebrate species i.e., species introduced during this century. There are no introduced reptile or amphibian species that have, so far at least, established breeding populations in the wild. The occasional tortoise (mainly *Testudo* spp) escapees, on past performance, do not seem likely candidates for this role. Some terrapin species are a potential threat and this is briefly discussed later on in this paper. Some problems have also arisen over “reintroduced” boar and deer. The main problem facing the Government now is to prevent further introductions that could lead to new problems.

Controlling Introductions - The Law

The introduction of live animals into Cyprus is directly or indirectly controlled by a number of laws. Some relate mainly to welfare and veterinary aspects and though these provide for some degree of control, importation cannot usually be prohibited on the basis of these laws.

The importation of aquatic species (including aquatic reptiles) on the other hand is controlled by the provisions of the Fisheries Law (CAP 135) and Regulations. The Fisheries

Regulations (Reg..273/90) state that no live aquatic animal can be imported into the Republic without a written permit from the Director of the Fisheries Department. The Director may refuse to grant permits for a number of reasons eg., if there is evidence that the introduction of any species into the island is likely to contravene any Convention or Agreement the country has ratified, or if such an introduction is likely to have adverse effects on the biodiversity or ecology of the island. There have been several cases in which the granting of such permits was refused. The most recent and clearest case was that of the importation of *Chrysemys scripta,* the Florida or Red-eared terrapin (turtle). An end was put to the importation of this species and in fact of all terrapins, in the summer of 1998, in the midst of some controversy (ie., in spite of reactions from importers and pet shop owners). This import ban was decided on when it became evident that several of these animals were released into rivers and dams when they grew too big to be kept in small home aquaria. This practice endangered the indigenous terrapin, *Mauremys caspica*, which was declared as an endangered species in 1981, on the basis also of the Fisheries Regulations. Until then many thousands were imported into the island every month. Some of the animals released into the wild were collected by the Fisheries Department and the Cyprus Wildlife Society and new homes/owners were found for them.

A new Law (Law Prohibiting the Importation into the Republic of Fauna and Flora Species) has now been drafted. As can be gathered from its title it is specifically aimed at the control of the importation of (mainly) fauna species into the country. It includes both aquatic and terrestrial vertebrate and invertebrate species. This law lists the species or genera or groups of species the importation of which is to be banned when the law comes into force. It includes species which are protected under a number of Conventions, while at the same time it also includes species or groups of species which could present problems to the indigenous fauna should they spread to the wild. The justifications for the ban are on environmental grounds and the law is expected to be implemented through the Environment Service.

Freshwater fish

Cyprus has no indigenous freshwater fish, it has one temporary pool fish (*Aphanius fasciatus*) and, of course, eels (*Anguilla anguilla*). About 20 species of freshwater fish were imported by the Fisheries Department mainly in the late 1960s and early 70s. They were used mainly to stock the growing number (and capacity) of reservoirs. Mainly Rainbow trout was and is used for aquaculture in fresh waters. Angling is allowed in the dams on a licensed basis (under the Fisheries Law) and the dams are stocked and managed accordingly. Brown trout was introduced in 1948 by the then colonial government and was stocked in a number of rivers in the mountains. In some it still survives. *Gambusia affinis*, the Mosquito fish, was also introduced at about that time, to help in the fight against malaria. It is still used today to control mosquitos. As a result of the lack of any indigenous freshwater fish and the fact that these fish were mainly used to stock new artificial habitats, the introductions were never questioned as being detrimental to local biodiversity. The same cannot be said in the case of stocking natural water bodies such as springs and rivers with introduced species of fish (mainly Trout and Gambusia). Some of these streams have precious invertebrate communities which are impacted by the introduction of new major predators at the top of the food pyramid. No doubt serious ecological changes have occurred, in some cases at least.

The deer case

As already mentioned a number of Fallow deer, *Dama dama* were introduced to Cyprus in the 1970s by the Forestry Department. These have bred in captivity, in a large fenced off enclosure at the Stavros tis Psokas Forest Station. There are now 43 animals and

they are now becoming a problem for the authorities, which are no longer considering releasing them to the wild, as, presumably, was the original idea. These are now expected to be returned to Europe.

The boars

A small number of boars were imported privately and after they bred in captivity several animals escaped or were released into the wild at about 1995-1996. They have evidently bred in the wild and are reported to be thriving in some areas in the southern slopes of the Troodos mountains. Attempts at eradicating them by hunting have not been very successful as yet.

Foxes and Rats

It is not very clear as to whether these can be considered as introductions in view of the fact that they have been here on the island for a few thousand years (keeping in mind that man came to the island not much earlier – 10,000 years ago)

There have been ongoing government projects for the eradication of both rats and foxes dating back to colonial times, using or providing free poisoned baits or seeds mainly. There have been problems of non-target species (mainly dogs and vultures but also some birds of prey) being killed either directly by eating the baits or by eating poisoned carcasses. As a result and as a result of changing attitudes towards foxes, the use of poisoned bait for foxes in particular is now no longer pursued by Government Departments and though some farmers still use them they do so with much more prudence. These programmes have generally had a moderate success rate as an eradication mechanism. It should also be pointed out that these efforts were not intended at eradication of these species because they were introduced species but because they are considered as pests, in an economic sense. Parallel measures were for example also taken against fruit bats (which are indigenous) in which case free cartridges were granted or a reward was paid for each head brought back.

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4.

Habitat restoration on Deserta Grande, Madeira (Portugal): eradication of non-native mammals / Rétablissement de l'habitat du Deserta Grande, Madère (Portugal) : éradication de mammifères non indigènes

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Madeira archipelago is no exception in what concerns the introduction of animals and plants. On all the islands of the archipelago, except Selvagem Pequena and other small islets, non-native mammals, e.g. goats, rats and rabbits, can be found. Due to the dramatic changes that these animals induce in many terrestrial habitats, the Parque Natural da Madeira, with the technical support of a New Zealand team, carried out an eradication programme for the introduced mammals on the Deserta Grande. The project started in early September 1996 and had the duration of two years. Although mice, and probably cats, were also present on these islands, the target species were the rabbits and the goats. The rabbits were poisoned with baits set out on a 25 m grid. The bait used was a grain based pellet with less than 0,02 % brodifacoum as the active ingredient. Since it was not feasible to catch the goats, they had to be shot. This was only made possible with the aid of an helicopter.

The results were total eradication of these two mammals. The recovery of the vegetation has already been impressive. Many plants that were considered rare before, are, nowadays, quite common, as is the case of the endemic *Sinapidendron sempervivifolium*.

After the removal of these animals it is, now, important: 1. to maintain a strict surveillance to prevent further re-introduction, 2. to have a contingency plan to be followed in such a situation, 3. to be aware for the invasion of non-native plants and to help the soil to stabilise. All these aspects are already being implemented as they are included in the management plan for the Natural Reserve of the Deserta Islands.

5.

Control and eradication of non-native terrestrial vertebrates in the Netherlands / Limitation et éradication de vertébrés terrestres non indigènes aux Pays-Bas

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1. INTRODUCTION

The composition of the fauna in the Netherlands has changed throughout the ages. Some species have become extinct (wolf, beaver) and others have only recently made their home here. Some of the newcomers came under their own steam and have increased their habitat themselves without human intervention (Collared Dove) or reclaimed their habitat (Greylag Goose).

For most species the intervention of humans, whether wittingly or unwittingly, was essential. The best known example is undoubtedly the Black rat, originating in Asia, brought to Europe on ships and spread throughout the continent. The fleas they carried were responsible for the introduction of the bubonic plague. The epidemic this caused resulted in the deaths of a quarter of the European population between 1347 and 1350.

It is a different matter for the group of animals which were intentionally introduced to other areas. These species would probably never have found their own way to the Netherlands, but were put into the wild for a specific purpose. (For example, Rabbit, Common Pheasant, Fallow deer and Mouflon for the hunt, Mute Swan for its down, Raccoon, Muskrat and Coypu for their fur).

Sometimes carelessness was the cause of non-native species being introduced into the Dutch countryside (escape from mink farms, for example).

These species which do not really belong in the Netherlands are known as exotic species.

2. NON-NATIVE SPECIES IN THE NETHERLANDS

The Netherlands now has a large number of non-native terrestrial species originating from all corners of the earth (America, Africa, Asia). They have now formed substantial populations and/or enter the country in large numbers.

2.1. The most important non-native mammals in the Netherlands are:

Rabbit (*Oryctolagus cuniculus*), Muskrat (*Ondatra zibethicus*), Brown rat (*Rattus norvegicus*), Black rat (*Rattus rattus*), Asian chipmunk (*Tamias sibiricus*), *Coypu (Myocastor coypus*), American mink (*Mustela vison*), Raccoon (*Procyon lotor*), Fallow deer (*Cervus dama*) and Mouflon (*Ovis ammon musimon*).

2.2. The most important non-native species of birds are:

Canada Goose (*Branta canadensis*), Egyptian Goose (*Alopochen aeguptiacus*), Ruddy Shelduck (*Tadorna ferruginea*), Bar-headed Goose (*Anser indicus*), Black Swan (*Cygnus atratus*), Mandarin Duck (*Aix galericulata*), Common Pheasant (*Phasianus colchicus*) and Rose-ringed Parakeet (*Psittacula krameri*).

In the Netherlands we divide the non-native species into two categories, viz:

a. Species that are not recognised as native to the Netherlands or Western Europe but once introduced by human intervention somewhere else, have established themselves in our country. (e.g. Muskrat, Coypu, Raccoon).

b. Species that have been introduced or have escaped from captivity and are to be found in the wild but do not belong to our native fauna, (e.g. Fallow deer, Mouflon, American Mink, Asian chipmunk)

Species belonging to the native fauna of our neighbouring countries whose habitat has expanded to include our country are not regarded as non-native species (e.g. Grey seal, Wild cat).

3. POLICY CONCERNING NON-NATIVE TERRESTRIAL VERTEBRATES PRESENT IN THE NETHERLANDS

3.1. Policy of active control

Although an exotic species from the point of view of nature conservation is by definition an "undesirable alien", the question is whether it should be the object of an active control policy. As far as the non-native terrestrial vertebrates are concerned in the Netherlands we practise both an active control policy and a policy of tolerance.

The Dutch Government practises an active control policy against those exotic species in the wild which:

- are detrimental to the ecology (displacement, competition for food, genetic changes, spread of disease; damage to high value communities characteristic to an area);
- have serious negative effects on aspects of public life (public health, public safety, safety of air traffic);
- cause unacceptable damage to crops, cattle, forests, fisheries and water;
- without intervention will reach unacceptable numbers.

The means of control must comply with the following conditions:

- the method of control is selective
- the method of control is ethically acceptable
- the method of control has no unacceptable side-effects.

3.1.1. Examples of the active control policy are the activities carried out to control the Muskrat, Black rat and Brown rat. These species are difficult to control. Active control remains necessary in order to maintain their populations at acceptable levels.

The first Muskrat was captured in the Netherlands in 1941. Water management is of vital importance for the Netherlands, lying as it does for a large part under sea level. This makes Muskrats very unwelcome guests as they dig holes in the banks of our waterways. They also cause damage to agricultural crops. As the Muskrat had no natural predators it could easily increase in numbers and disperse. The amenable climate, large number of potential habitats and availability of sufficient food have also contributed to population growth. The active control of the Muskrat involves tracing and immediate removal. The method of capture and number captured is dependent on the number of Muskrats and the time and place we discover them. Over the years a whole range of measures have become available for capture. They all have their advantages and disadvantages and their specific applications. Means of controlling the muskrat are: traps, fish traps, cage traps, guns, collection tubes, gas, chemical control, genetic control, biological control.

To improve the chances of capture decoys and scents are used.

The large number of Muskrats has had its positive side. A new profession was created: the Muskrat catcher. The monitoring and control of the Muskrat is a provincial responsibility, while the Black rat and the Brown rat are monitored and controlled by the local municipality

3.1.2. Examples of non-native vertebrates which are easy to control are the Egyptian Goose**,** Canada Goose, Fallow deer and Mouflon.

The Egyptian Goose has been breeding in the Netherlands for about 30 years. The first nest of an escaped Egyptian Goose was reported in 1967. Egyptian geese are very intolerant towards other waterbirds (especially the Common Shelduck) that approach their territory, particularly in the breeding season. They often lay as many as 8 to 10 eggs, and the young birds can already reproduce in their second or third year. They have hardly any natural predators. The nuisance and damage caused by the Egyptian Goose to its direct environment is:

- reduction in the numbers of other waterbirds (because of Egyptian Goose's aggressive behaviour to other birds);
- nuisance to grazing cattle through aggressive behaviour;
- fouling of grassland;
- damage to grass harvest.

How can the Egyptian Goose be controlled?

They are relatively easy to catch on and near the nest when they lose their quill feathers (they are not able to fly for a few weeks). There is then a problem of what to do with the captured birds: kill them, eat them or place them in waterbird collections, parks, children's

zoos, etc. A better solution is to remove their wingtips at birth. The Egyptian Goose, Canada Goose, Fallow deer and Mouflon populations are controlled to prevent damage to agriculture. The Ministry of Agriculture Nature Management and Fisheries issues limited shooting licences for this purpose to game management units and individual shooting tenants and land owners.

3.2. Policy of Non-Interference

No action is taken against those exotic species who have made their homes in the wild in the Netherlands and have no adverse affects on Dutch flora and fauna or other interests if they have a limited habitat and are easy to control.

3.3. Bullfrog (*Rana cathesbeana*) Problem

The Bullfrog is a noisy croaking frog, about 20 cm in length which came over from America. It lives in lakes, ponds, streams, ditches and small rivers with abundant vegetation. A large number of eggs are laid in the water and free-swimming larvae develop within a few days. This stage usually lasts for a year, but in cooler climates can last as long as 2 to 3 years. After metamorphosis the frog grows quickly to maturity in 2 to 3 years.

Towards the end of the 80s trade in the bullfrog became a matter of controversy. Traders praised the bullfrog for its size, volume and diet. They called it the amphibian pit-bull terrier. Nature conservationists on the other hand saw the bullfrog as a most unwelcome guest because of its eating habits and the threat it posed to domestic frogs. At least 50,000 bullfrog larvae were imported in the 80s, many of them as a by-product of consignments of goldfish brought in to meet the growing demand of garden pond enthusiasts. In 1988 and 1989 there was an enormous growth in the profits to be made from the trade in bullfrog larvae.

In the summer of 1990 there was a great deal of media interest in the bullfrog. The press was unanimous in its disdain for this lazy, unappetising animal, a greedy and slimy monster, giving rise to the most bizarre tales. The Government, nature conservation organisations, pet traders organisation and garden centres repeatedly lobbied to end the import and trade of this despised species.

Getting rid of the bullfrog

- Before catching unwanted bullfrogs a place had to be found for them in zoos or shelters. As a result of the wild stories in the press in 1990 zoos and shelters were bursting at the seams with unwanted bullfrogs within a few months.

- In extreme circumstances euthanasia can be carried out by injecting the bullfrog with Euthesase (1 ml/kg body weight) or T61 (1 ml/kg body weight). This treatment should of course only be undertaken by an expert (veterinary surgeon).

- If these substances are not available the animal can be killed by exposing it to very low temperatures. By this method the animal is put in a container of water which is then placed in the refrigerator for several hours until it reaches a body temperature of 4°-8° C. It is then transferred in the container to the freezer. The animal is dead

within 24 hours. It cannot feel pain at temperatures of 0° C and below. The public is not happy with this method of killing bullfrogs. Control and extermination of the larvae however poses considerable problems. American research has shown that amphibians are extremely sensitive to TMF (3-Trifluoromethyl-4-nitrophenol). The number of Sea Lampreys in the Great Lakes have successfully been controlled by the administration of TMF. The use of this chemical pesticide on bullfrog larvae still needs to undergo field tests in the Netherlands.

4. POLICY IMPLEMENTATION

4.1. Regulation concerning non-native species

The great increase in the Bullfrog population in the Netherlands in the summer of 1990 accelerated the introduction of legislation concerning non-native species.

- In 1993, partly as a result of our international obligations, a new provision was adopted under the Nature Conservation Act which determined that the Minister for Agriculture, Nature Management and Fisheries, in the interests of plants and animals in the wild under his stewardship, could forbid the purchase or sale, stocking, releasing of animals, eggs, pupae or larvae from non-native wild animals.

- Releasing of (native) game was already forbidden under the Game Act. The American mink (*Mustela vison*), Raccoon (*Procyon lotor*), Coypu (*Myocastor coypus*) and Raccoon dog (*Nyctereutes procyonoides*) had all been designated non-native fauna on 11 April 1978. The Muskrat (*Ondatra zibethicus*) was included in the ruling of 14 May 1981.

- A new regulation which identifies exotic species and came into force in 1995 also adds the Egyptian Goose (*Alopohen aegyptiacus*) and the Ruddy Duck (*Oxyura jamaicensis*) to the list of non-native fauna.

This regulation, under article 54 of the Game Act, allows for control of these species on someone else's property and for the use of game licence holders for this purpose. The control may only take place on the order of the Ministry of Agriculture, Nature Management and Fisheries on the grounds of and with due consideration of the conditions and limitations laid down in the order.

The Ruddy Duck (*Oxyura jamaicensis*) is a native of America. It is now also found in the wild in several European countries, including the United Kingdom, Spain and the Netherlands. The Ruddy Duck hybridises easily with the threatened European White-headed Duck (*Oxyura leucocephala*). To preserve the population of the White-headed Duck the Rudy Duck should not increase in numbers. Active control is therefore essential.

- The new Flora and Fauna Act includes a total ban on the release of animals or their eggs that do not naturally occur in the Netherlands in the wild, and a ban on planting or sowing certain plants (article 14). The Minister can also rule that the numbers of specified animals identified under an Order in Council must be limited on specified land or in specified areas.

The Flora and Fauna Act replaces the Bird Protection Act, the Game Act, the Act of Threatened Exotic Species and part of the Nature Conservation Act.

- It should also be noted that international trade, import, holding and releasing of threatened non-native animal species is regulated under the Washington Convention (CITES), which the Netherlands signed in 1984. The Netherlands implements the agreement in the Act of Threatened Exotic Species. As a member of the European Union the EG-CITES regulation also applies in the Netherlands which provides for the implementation of the agreement within the EU.

Monitoring of compliance with the Acts is carried out by the regular police forces and by specialists from the Ministry's General Inspection Service.

We have to realise that by introducing a ban on releasing or reintroducing animals into the wild our task is not complete. If the holder of an exotic species of pet wants to dispose of the animal there is nothing to stop him opening the door to the cage or aviary without being caught. And even if it is ascertained that the animal came from him, it will still be difficult to prove that the animal did not escape by accident. Neither the police nor the Department of Public Prosecution would give high priority to this type of incident. The ban is in any event mainly a declaration of principle from the Government. Such a ban also serves as a legal framework for any other introductions into the wild by nature conservation agencies, research institutes and zoos. This means that they will have to apply for a licence or exemption if they wish to release animals into the wild. This can then be granted at the discretion of the Government.

4.2. Information and education

To make these laws work the Government will of course have to devise other measures than purely punitive ones. Information and education must play an important role in this.

It is important that the public are made aware of the negative effects that result from the escape of an exotic species. Such animals usually have a slim chance of survival in our climate. But if they do survive and manage to breed, they can have extremely detrimental effects on other animals and plant species, agriculture and property. The Ministry has published an information folder on the risks associated with exotic species.

In time some of these problems solve themselves, but this does not mean we should not act. We should be on our guard to ensure that our original West Palearctic fauna does not become too mixed with alien species and that the natural ecological-geographical composition of our fauna remains recognisable. Prevention is better than cure.

6.

The effect of non-native American minks on breeding coast birds in the archipelagos in the Baltic Sea / Les effets du vison d'Amérique non indigène sur la reproduction des oiseaux côtiers dans les archipels de la mer Baltique

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Introduction

Mink was imported to Sweden and neighbouring countries in the late 1920s to be bred on fur farms (Gerell 1967, Bevanger & Ree 1994). Feral populations were first recorded during the 1940s. By the mid 1960s the species could be found throughout the whole of Sweden except the northern mountainous region and the outer archipelagos in the Baltic Sea.

Present distribution and trends

The American mink has colonised almost the whole Finnish and Swedish archipelagos, mainly during the 1950s-1990s. At present, only a few small island groups and solitary islands situated in the outermost part of the outer archipelago zone are free from minks (Fig 1). Minks have appeared occasionally also on these islands but have not yet established themselves. In many areas mink density is high, but in areas colonised early there was a peak in the mid 1990s followed by a decrease.

Importance of the Baltic Sea archipelagos as breeding habitats for coastal birds

The Baltic Sea archipelagos are internationally important breeding areas for coastal birds. The number of species is high, including marine as well as fresh water species forming a unique bird community. The numerous and relatively undisturbed islands and the vast areas of shallow water give favourable natural conditions for breeding diving ducks, gulls, terns, waders and auks. The only important native mammalian predator, the Red Fox *Vulpes vulpes,* was intensively controlled by the inhabitants during a long period, which created a situation with low predation pressure.

For several species, the Baltic archipelagos constitute a very important breeding area from a European perspective.

Effects of mink predation on breeding coast bird populations

The invasion of mink in the archipelagos implies an addition of a generalist predator with a high swimming capability and a high capacity to move around on the ice during winter.

The conclusions of the effect of the mink on prey species in the Baltic archipelagos are based on comparative studies of breeding success and population trends of prey species in

areas with and without mink during the period 1970-1999, and to a lesser degree on experiences from recently started experimental studies.

Minks appearing on bird islands for the first time may kill a substantial number of adult birds. However, later on the predation exerted by the mink mainly seems to hit eggs and young. In several studies, substantially higher breeding output has been recorded among birds nesting in mink-free areas than in areas with an unaffected mink population (Andersson 1992, Craik 1995, 1997, Nummi 1996 and ongoing experimental studies).

The predation of the mink leads to a substantial change in the distribution of breeding birds. Concurrent with the mink appearance, many species move to mink-free islands, usually situated in the periphery of an island group, or to the most isolated islands in the neighbourhood. Bird species capable of living in colonies and transporting food over long distances to their young abandon their small or middle-sized colonies and form dense colonies, mainly on the outermost island groups. This is the case for the Herring Gull *Larus argentatus* and Razorbill *Alca torda* among others (Tab 1). Other bird species with limited adaptability to the new situation are decreasing slowly in mink areas but do not show any increase in mink-free areas. The Velvet Scoter *Melanitta fusca*, Red-breasted Merganser *Mergus serrator* and the Black Guillemot *Cepphus grylle* belong to that group.

In the Stockholm archipelago, several bird species have decreased markedly, especially in areas where mink has been present for a long period. This can be expected, since most prey species are long-lived with a deterred sexual maturity, a low reproductive output and a pronounced site fidelity. The process takes at least 10-15 years before a decrease of a local population is apparent. If this conclusion holds true, we can expect a massive decrease in areas colonised by mink more recently.

There are several cases of local extermination and some species are on the brink of disappearing as breeding birds. Hole-nesting and late breeding species seem to be the most vulnerable. Some archipelagos have lost several coastal bird species during the last 25-year period (Tab. 2). However, the forecast is that no species will completely disappear from the Finnish-Swedish archipelago area.

Extermination experiments

In three areas in the Baltic archipelagos, research is being carried out experimentally to test if it is possible to exterminate the mink and to study the responses on the breeding birds. Each experiment includes two areas where minks are caught and hunted intensively and two control areas where the mink is allowed to prosper. The studies are supported by the European Union´s Structural Funds, governmental research funds, and non-governmental organisations.

Minks are killed in traps or searched for by especially trained dogs and shot. Use of a leaf-blower to force the mink to leave its hiding-place increases the efficiency (Nummelin & Högmander 1998).

Breeding success as well as long-term population changes are studied through regular censuses.

The projects started in 1998 and an evaluation will be carried out after the 2001 season.

Management plans

According to the Convention on Biological Diversity which Sweden signed in 1992, the parties should "prevent the introduction of, control or eradicate those alien species which threat ecosystems, habitats or species". This gives us a policy platform. In Sweden as well as in Finland, more thorough knowledge to elucidate the effects of the mink on native species has been requested before a management policy is formulated.

Experiences from earlier campaigns to control the mink population inevitably show that it is practically impossible to exterminate the mink from larger areas and that the species has a high capacity to re-colonise areas where they have been taken away. In the outer part of the archipelago it might be possible to reduce the mink population substantially. However, this is a very labour-intensive activity and must continue forever. The ongoing experiments hopefully will give us the knowledge we need to come to a reasonable decision.

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Tab. 1. Population changes of razorbill and black guillemot in relation to mink occurrence in four transects in the central and outer archipelago of Stockholm and Södermanland 1973-1998. Grey tone denotes areas with minks.

Nr	Archipelago zone	Type of archipelago	Mink	Razorbill	Black guillemot
1 a	central	scattered islands	occasional	++	+
1 b	outer	scattered islands	absent	++	++
1 c	outer	scattered islands	absent	++	+
2 a	central	scattered islands	numerous		---
2 b	outer	dense archipelago	numerous	---	---
3 a	outer	dense archipelago	numerous		---
3 b	outer	dense and isolated archipelago	absent	+++	++
3 c	outer	scattered islands	relatively numerous		--
3 d	outer	scattered islands	occasional	++	+
3 e	outer	isolated island	absent	+++	?
4 a	central	dense archipelago	numerous		---
4 b	outer	scattered islands	numerous		---
4 c	outer	scattered islands	absent	+++	+

+++ = increase 3xx, ++ = 1-2xx, + = < 1x etc

Tab. 2. Population trends for breeding coast bird species during the period 1970-1996 in areas with and without mink, respectively. Figures denote number of species. Preliminary figures.

Mink occurrence	Trend (number of species)						
	extinct	decreasing	stable	increasing	new		
With mink	4	6	7	0	3	3	0
Without mink	1	0	0	3	5	8	2

7.

Management measures against alien vertebrates / Mesures de gestion contre les vertébrés exotiques

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It has been said that in some circumstances eradication is not a priority. The ratio benefit/cost should be evaluated (Hone, 1994). Eradication must be encouraged because of the profits that could emanate, not because of former harms (Cleaveland & Thirgood, 1999), and aliens ought to be pursued because of their damage, not their origin (Hone, 1994). In fact, a careless decision can have worse consequences than doing nothing. Biological research on pathogens and immunocontraception might be very useful but attention must be paid to the possible consequences of their use. Some difficult circumstances are proposed as follows.

Several introduced species are involved

The relationship among introduced species can make very difficult to decide whether a control campaign should be initiated or not (Nogales & Medina, 1996) and in which conditions should it be developed (Rounsevell & Brothers, 1984; Coulter, Cruz & Cruz, 1985; Johnstone, 1985; Zino et al., 1995a-b; Cooke, 1998). Many times, control over introduced preys is enough to control its predator population (Bell & Bell, 1997; Alterio et al., 1997; Brown et al., 1998; Robertson et al., 1998).

Some recent research in population modelling (Courchamp et al., 1999a, b, c) are helping to understand the behaviour of interaction among different population of introduced animals. Some of the effects were known from real situations, but little effort has been made to model the processes. The *mesopredator release effect* is caused when in a three level system (superpredator-mesopredator-preys) the first is suppressed, allowing the mesopredator to increase and cause a worst effect on the prey populations. In other terms when, e.g. in a system cat - rat- birds the cats are eradicated, the rats increase in such a way that the bird populations suffer a bigger predatory pressure. The other case is the *hyperpredation process*, which occurs when an alien herbivore (for example, the rabbit) is introduced in a system alien predator - native prey (e.g. cat - birds). The alien herbivore is better adapted to high predation pressure allows the predator to achieve higher population levels, and to produce a worse effect on the native prey, even the extinction.

Biological control

Rabbit calicivirus is being used in Australia for the control of feral rabbits. The results are quite promising. The release was planned to be done in at least 280 points throughout Australia. The introduction occurs in October 1995 and since then reductions up to 90 % have been registered. Shrub and tree regeneration has started, in some cases for the first time in 20th century (Cooke, 1998).

Brushtail possum (*Trichosurus vulpecula*) is an herbivorous Australian marsupial which has become a pest in New Zealand. This species has been controlled by traditional means but now there is a research line on biological control. Possums in Australia and New

Zealand have been investigated for pathogens useful in biological control. This search has led to the detection of the "wobbly possum disease", in captive possums in New Zealand. This fatal virus may be used as a biological control (Clout & Sarre, 1995).

Feline Panleucopenia Virus (FPV) has been used to control feral cats, as in Marion Island. Other viral disease seem to be more efficient than FPV: Feline Immunodeficiency Virus (FIV) and Feline Leukaemia Virus (FLV). The reasons for these diseases being more efficient are: FIV and FLV infect and are spread for some years before killing their host, allowing more transmissions than FPV; FPV kills chiefly juveniles, many of which would dead equally in natural processes, but FIV mainly infects dominant animals; FIV and FLV are behaviourally transmitted, the first by biting and the second by licking, maternal grooming and food sharing, so being more effective than FPV which is environmental transmitted and therefore inefficient at low densities (Courchamp & Sugihara, 1999). However, FPV can continue spreading after the death of the animal (Cleaveland & Thirgood, 1999), so it has some other advantages. FLV could totally exterminate an island population of cats if the level of resistance was low due to founder effect. Although total eradication was only possible with the help of culling, the use of these diseases could be desirable to maintain a permanent control in situations when total control is impossible (continuous introduction of cats) or undesirable (presence of rats).

The use of these techniques should be carefully studied for each case. Some diseases could be transmitted to domestic animals or non target species or populations. The situation of wild rabbit populations in Spain and the impact on some endangered communities is clearly illustrative of the damage that can be caused if those techniques are used in a wrong way or place. In very isolated populations the use of aggressive pathogens may be safe enough. In less isolated populations their use must be carefully controlled.

Immunocontraception

Neutering and sterilisation have been frequently proposed to limit populations of alien pests. As effort is similar to killing and results were worse, this is only advisable when constraints are strong against killing, e.g. for sociological reasons. Among birds, eggs could be pricked, shacked or immersed in an oily substance in order to kill embryo. Mammals could be sterilised with chemicals or surgically after been caught. The problems in any case were the high cost of the operation, the necessity of frequent repetitions and the time needed to achieve a reduction.

Instead of the expensive surgical sterilisation, the vaccination with zona pellucida antigens started as a way to limit the expansion of alien mammals, as feral horses. The theory consist in deliver antigens derived from the egg's zona pellucida and sperm into a feral mammal population, in such a way that the immune system will recognise them as foreign and attack them with antibodies. As the biochemical communication between sperm and egg is broken, fertilisation is avoided. Immunocontraception should be highly selective. It should be possible to develop a specific immunocontraceptive vaccine that would not affect any other species. The antigen-recognition process is so precise that it has the potential to discriminate between closely related species, but the right antigen must be found.

Furthermore, if this biological information could be transmitted by a vector, the animals of a whole alien population would be at risk of becoming sterile. Such a vector could be a parasite or a disease and it would make the campaign faster and cheaper.

The safety of this technique lies in several levels of specificity. Not only have the involved proteins to be specific, but also the vector disease. A useful way to prevent infection among species is to use sexual transmitted illness. If invertebrate vectors are needed, they have to be as specific as possible, and they cannot be able to travel out of the target area, neither by their own means nor as stowaways in other vertebrates. Measures must be taken to avoid trade or transport of any infected animal.

Specificity of the immunocontraceptive must very high in order to prevent that nearly species could be affected. Some close species For example, myxoma virus causes a non lethal disease to *Sylvilagus* rabbits, but the use of the virus to transmit immunocontraception could cause sterility in the American native species if the antigen was not specific enough. The same could happen with any canid in rapport with the immunocontraception of foxes. The use of these techniques in Australia is relatively safe because its geographic isolation, reinforced by strict quarantine measures. The combination of isolation and quarantine has successfully protected Australia from exotic viruses for two centuries and could protect the neighbour islands from the expansion of a recombinant myxoma.

In New Zealand an investigation line is on the possibility of controlling possums by transmitting immunocontraception through sexually transmitted diseases as *Herpes* or *Chlamydia*. Ideally the behaviour of sterilised animals remains untouched, so that they continue to compete for resources and spread the disease through their social contact. If infected females continued to be capable of oestrous cycles without pregnancy, they might have an increased number of sexual contacts, consequently increasing the chance of spreading the immunocontraceptive (Clout & Sarre, 1995).

In Britain, immunocontraception is under investigation to fight grey squirrel (Lurz et al., 1998).

In the same way as pathogens, immunocontraception must be carefully used because it could be easily transmitted to wild or domestic species. When close species are involved, cautions ought to be the greatest.

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8.

Neozoa and non-native terrestrial vertebrates management in Switzerland : an overview of current policies and methods / Gestion des neozoa et des espèces terrestres exotiques en Suisse: un bilan des problèmes et politiques actuelles

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Etat de la situation en Suisse

La Suisse compte aujourd'hui plus d'une vingtaine d'espèces terrestres exotiques (y compris les tortues) vivant à l'état sauvage. Ce chiffre ne tient pas compte des espèces dont la présence est liée à une expansion naturelle de leur aire de distribution, comme la tourterelle turque (*Streptopelia decaocto*), ni d'espèces introduites par l'homme, mais dont la présence se limite à quelques observations ponctuelles, sans réelle formation de populations. Ces espèces nouvelles de la faune sont regroupées sous l'appellation de neozoa pour autant qu'elles se reproduisent depuis plus de trois générations après leur installation (Bezzel, comm. pers.), ce qui est le cas de plusieurs des espèces exotiques actuellement présentes en Suisse (Tab. 1).

Certaines de ces espèces n'ont pas été directement introduites en Suisse, mais proviennent de l'expansion de populations formées dans des pays limitrophes ou proches de la Suisse. Dans tous les cas, ces introductions sont dues à l'action de l'homme.

Nous résumons ici le cadre légal actuel couvrant le statut de ces espèces, les problèmes rencontrés, les méthodes de limitation des effectifs employés, ainsi que les principes de gestion qu'il serait souhaitable d'envisager à l'avenir.

Cadre légal

Le statut des espèces exotiques vivant l'état sauvage en Suisse est couvert par deux lois fédérales, la loi sur la chasse et la protection des mammifères et oiseaux sauvages (LChP, du 20 juin 1986) et la loi sur la protection de la nature et du paysage (LPN, du 1er juillet 1966). Ces textes sont complétés par des ordonnances fédérales, ainsi que par les lois et règlements cantonaux, qui ont été décrits dans le cadre de précédents rapports du Conseil de l'Europe. Le principe général de ces textes est une interdiction d'introduire des espèces non indigènes sans une autorisation des autorités fédérales. Ce principe est complété, pour les mammifères et les oiseaux, par une liste des espèces dont le lâcher est interdit en raison des dégâts qu'elles peuvent provoquer. Pour ces dernières, la législation prévoit le principe de l'élimination des populations, sous la forme d'une compétence donnée aux cantons d'empêcher leur propagation et leur multiplication. Par contre, pour les espèces exotiques vivant à l'état sauvage et ne figurant pas sur cette liste (notamment les reptiles et les amphibiens), l'introduction et la limitation des effectifs ne sont pas actuellement réglementées par la législation fédérale.

Cas problématiques et impacts

Actuellement, aucune espèce exotique ne pose de graves problèmes économiques en Suisse. Plusieurs problèmes écologiques préoccupants ont été constatés, ils restent cependant insuffisamment décrits. Sur le plan des mammifères, les principaux problèmes économiques et écologiques constatés à ce jour sont le fait du rat musqué (*Ondatra zibethicus*), du mouflon (*Ovis musimon*) et du cerf sika (*Cervus nippon*). Pour *Oryctolagus cuniculus* et *Myocastor coypus*, les conditions écologiques de la Suisse sont vraisemblablement trop défavorables pour permettre une expansion des populations (Hausser 1995). Cette observation est également valable pour *Tamias sibiricus*, dont les populations restent cantonnées dans des parcs situés en milieu urbain (à Genève principalement). Quant à *Procyon lotor*, son statut reste mal connu et il n'existe aucune indication d'un développement particulier de ses effectifs.

Le milieu ornithologique suisse, bien que fortement imprégné par le principe de la protection des espèces d'oiseaux, pour lequel il s'est engagé depuis des décennies, admet aujourd'hui que la question de la régulation de certaines espèces se pose (Biber et Antoniazza 1998). Cette prise de conscience de l'importance de la surveillance des effectifs des oiseaux exotiques a conduit à les inclure dans les activités de monitoring (Kestenholz, 1997, Schmid *et al.* 1998). Parmi les espèces exotiques posant problème et pour lesquelles une régulation est souhaitée, l'Erismature rousse (*Oxyura jamaicensis*) et la nécessité de l'éliminer du continent européen pour éviter qu'elle n'élimine l'Erismature à tête blanche (*Oxyura leucocephala*), est un cas fréquemment cité (voir Tucker & Heath 1994).

Enfin, pour les spécialistes des batraciens, l'espèce la plus problématique est la grenouille rieuse (*Rana ridibunda*), qui a colonisé une partie importante des zones de basse altitude et dont la présence dans de nombreux étangs occasionne un impact écologique par le fait qu'elle élimine des espèces indigènes et pose des problèmes liés à l'hybridation avec d'autres grenouilles vertes du genre *Rana*. La présence de cette espèce est également une source de dérangement pour le public, des plaintes liées à ses coassements étant régulièrement enregistrées. A ces cas, s'ajoute celui de la tortue de Floride (*Pseudemys scripta*), espèce d'agrément relâchée dans la nature et dont la présence pose plusieurs types de problèmes écologiques (OFEFP 1995).

Régulation des effectifs

Le tableau 1 indique les espèces faisant l'objet de prélèvements par la chasse ou de mesures de régulation. Toutes ces interventions restent localisées et aucune politique nationale d'éradication n'est pratiquée actuellement. Le rat musqué est sans doute l'espèce qui a suscité le plus de préoccupations dans la période des années 1980, période pendant laquelle une politique d'éradication a été menée (Wendelspiess 1990). Elle n'est cependant plus aujourd'hui considérée comme une priorité de gestion de la faune. Toutefois, les prélèvements se poursuivent dans le cadre des activités ordinaires des gardes-faune. Les régulations d'effectifs des différentes espèces pratiquées à ce jour font appel aux tirs, piégeages et méthodes passives de dissuasion de l'installation d'animaux, ainsi que, pour *Rana ridibunda*, à la pêche électrique et à l'assèchement des biotopes. Pour cette dernière espèce, l'efficacité de ces mesures peut être considérée comme faible. L’emploi de toxiques se limite aux rodenticides et n’est normalement pas envisagé pour la limitation d’espèces exotiques.

L'absence actuelle de politiques nationales d'éradiction s'explique principalement par l'absence de problèmes économiques majeurs et par le fait que les impacts écologiques (déclin massif d'une espèce indigène sous l'effet de la concurrence avec une espèce introduite) restent insuffisamment compris. Un autre élément d'explication est la forte sensibilité de la Suisse à la problématique de la protection des animaux, qui rend le principe même d'une politique d'éradication assez délicate à défendre face au grand public.

Perspectives de gestion future

Les conclusions suivantes sont tirées de la situation helvétique actuelle :

- Du point de vue légal, il manque une base précisant quelles espèces de batraciens et reptiles (*Rana ridibunda* ou *Pseudemys scripta elegans* par exemple) ne doivent pas être introduites sans autorisation fédérale.

- Plusieurs espèces introduites semblent ne pas se développer rapidement ou semblent limitées dans leur développement par l'inadéquation des conditions écologiques de la Suisse. A cet égard, il est nécessaire d'instaurer un dispositif de monitoring des effectifs de plusieurs espèces figurant sur le tableau 1. Par ailleurs, l'établissement de cartes de distribution potentielle (voir Hausser 1995) s'avère être un excellent moyen de prévision et d'aide à la prévention.

- D'une manière générale, les méthodes d'éradication se heurtent à des problèmes de faisabilité et d'efficience, ainsi que d'acceptabilité par la population. En conséquence, l'efficience de ces mesures devrait toujours être analysée (voir Caughley & Sinclair 1994), l'information du public améliorée et le développement de mesures préventives placée en priorité des actions à entreprendre.

- La prévention des introductions nécessite une définition précise des espèces indésirables à l'échelle européenne, l'exemple de la Suisse montrant que dans de nombreux cas, les neozoa sont issues de l'expansion d'espèces introduites, à l'origine, dans d'autres pays européens.

Remerciements

Les personnes suivantes ont contribué à cette communication: Dr Simon Capt (Centre Suisse de Cartographie de la Faune, Neuchâtel), Dr Matthias Kestenholz (Station ornithologique suisse de Sempach), Dr Silvia Zumbach et Dr Jean-Claude Monney (KARCH, Berne), Dr Marianne Wendelspiess. Que ces personnes soit très sincèrement remerciées ici de leur collaboration.

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Tableau 1: Vertébrés terrestres exotiques de la faune helvétique (état 1999, sans les observations exceptionnelles). La rubrique "contrôle des effectifs" regroupe les espèces pour lesquelles des prélèvements par la chasse sont légalement possibles et pratiqués (Ch), ainsi que les espèces pour lesquelles les autorités responsables de la gestion de la faune effectuent des contrôles (R). Catégories de problèmes constatés: $ = économiques, Oe = écologiques, - = aucun problème important constaté actuellement.

	Introduit en Suisse	**Introduit dans des pays limitrophes**	**Problèmes**	**Contrôles des effectifs**
Mammifères				
Oryctolagus cuniculus	X		-	Ch
Tamias sibiricus	X		-	
Ondatra zibethicus		X	$,Oe	Ch, R
Myocastor coypus		X	-	Ch, R
Procyon lotor		X	-	Ch, R
Cervus nippon		X	$, Oe	Ch, R
Ovis musimon		X	Oe	Ch, R
Oiseaux				
Branta canadensis		X	-	
Branta leucopsis		X	-	
Alpochen aegyptiacus		X	-	
Tadorna cana	X	X	-	
Tadorna ferruginea	X	X	-	
Aix sponsa	X	X	Oe ?	Ch, R
Aix galericulata	X	X	Oe ?	Ch, R
Oxyura jamaicensis		X	Oe	
Phasianus colchicus	X		-	Ch
Psittacula krameri	X		-	
Myopsitta monachus		X	-	
Cygnus olor	X	X	-	
Reptiles				
Vipera ammodytes	X		Oe	
Pseudemys scripta elegans	X		Oe	R
Amphibiens				
Rana ridibunda	x		Oe	R

9.

The use of different kind of baits in death-traps for American mink and the effect on non-target victims in Denmark / L'utilisation des différents types d'appâts pour pièges pour le vison d'Amérique et l'effet sur les victimes non cibles au Danemark

Mr Anton LINNET
(Game-consultant, The National Forest and Nature Agency, Denmark)

Fauna pollution

There is a serious increase in the amount of fauna pollution of the environment in Denmark at the moment. According to the annual statistics concerning the killing of wild animals published by the Danish Environmental Investigation Agency, the number of mink destroyed (that is, shot or trapped) is increasing by 25 percent a year. In the 1997/98 season, for example, 8,000 mink were destroyed. The mink is a wild animal from North America. It was introduced into Scandinavia in the 1920's with a view to the production of fur, and today animals that have escaped from mink farms are a serious problem throughout Europe. There are about 2,600 mink farms in Denmark, and it is estimated that at least 2 animals per farm escape every year. The former Soviet Union has also contributed to the spread of mink. Between 1930 and 1960 at least 16,000 mink were let out into the wild in Latvia and Lithuania to be caught for their pelts.

Mink are an unwelcome addition to Danish fauna, but they have already established themselves in such large colonies that we shall probably have to learn to live with them. There have been many observations of female mink with young, so it is now certain that mink have established themselves as a new species of wild animal, capable of reproducing in the wild. The way mink have established themselves in Sweden shows how quickly they can increase when the population becomes viable. The number of mink destroyed (that is, shot or trapped) increased in Sweden from about 15,000 in 1980 to about 42,000 in 1989.

The problem in Denmark

In the light of the increasing number of people contacting The National Forest and Nature Agency to complain about mink, there is no doubt that the problem is rapidly becoming acute and has to be taken seriously. In 1996, therefore, The National Forest and Nature Agency started to experiment with spring traps on the island of Bornholm. Spring traps kill animals, and are therefore banned in Denmark under existing legislation. On the other hand, the experiment on Bornholm was fairly safe, in that other types of mustelidae, such as stone martens, pine martens, polecats, stoats and weasels, are not found on the island. The last four of these species are protected in Denmark.

In 1998, a similar experiment was started in Thy, which is in the northwest corner of Denmark. All species of mustelidae are found in this part of the country, so we would be able to see if the spring traps for mink could be used without unacceptably large bycatches of other mustelidae.

It was important to investigate this, because present legislation only allows the use of traps that catch animals alive, and requires such traps to be inspected morning and evening. In the case of a stone marten up in the attic, or a polecat in the dovecote, traps can easily be inspected morning and evening by anyone. In the case of mink, however, traps are set up out in the countryside near waterways and marshes, and usually it is not possible to inspect them morning and evening. As a result, either traps are not set, and mink nuisance spreads - or traps are set without this regular inspection, and that is cruelty to animals. Traps that kill animals can be inspected at weekends, for example, or when there is time.

The experiment has been designed to run until 31 March 2000. The trapping season is from 1 September to 31 March 1997/98, 1998/99 and 1999/2000, so that animals will not be caught in the breeding season. For various reasons, trapping did not start until about 20 February 1998.

100 traps have been acquired for the experiment: 50 of the Gävleborg type, and 50 of the Ihjel type (***see Fig. 5***), which are produced and type approved in Sweden. The traps are passage traps made of wood with a 7 cm opening at both ends. The traps are fitted with a tread arrangement, which with the help of a heavy spring releases a striking mechanism which kills the animal immediately.

Expected outcomes

My department hopes to examine some of the problems connected with the use of traps, especially the following:

1. Whether the traps present problems in terms of animal ethics, and whether there are any differences between the traps.

2. The size of the bycatch in relation to various kinds of bait.

3. The mink's choice of biotope (general lines).

As I have mentioned earlier, the aim of this experiment is to investigate whether mink can be caught in these kind of traps without an unacceptably high bycatch of other mustelidae that inhabit the same biotope. We have looked at the chances of catching otters in these traps (*the otter is a threatened species and protected in Denmark*) and have concluded that otters are too big to enter a trap with an entrance 7 cm in diameter. Even otter cubs, which normally do not leave the otter hide until they are about three months old, would be too big to enter the traps. On the other hand, we have been more cautious about predicting whether we could avoid unintentional bycatches of polecats. Polecats also inhabit the areas where we catch mink, and have more or less the same size and weight as the latter. Weasels, stoats and stone martens may also be found in such areas, but we have reason to think that they will not be caught, or at least only in very small numbers.

Trapping strategy

The traps have been set up at regular intervals in the Thy area, and all of them near lakes or along waterways. Each trap has an index number which refers to a log book with a standard entry containing information about the ownership of the area, a description of the

biotope, a photograph of the trap as set and the position of the trap on a 4 cm map. There is a separate record to log catches for each trap. The idea is to set up the same trap at the same place throughout the course of the experiment, and the traps will be inspected about once a week.

To all the traps is attached a plastic tag with the information stamped on it that the trap has been set by The National Forest and Nature Agency in connection with an experiment concerned with the catching of wild mink.

Bait

Based on the question, *what other animals will enter a trap that only smells of mink*, we have decide to use mink urine as a bait throughout the whole of one trapping season, spring and autumn. The urine will be collected at a mink farm, filtered and put into a spray bottle. In this way, handling becomes reasonably hygienic, and the urine can easily be sprayed into the trap exactly where we want it. We think it is very important that there should be no urine outside or on the trap. We can only be sure that the mink will enter the trap by spraying the urine directly below the striking mechanism in the centre of the trap. *We presume* that mink are attracted by scent just like a dog, cat, or otter, and will mark off their territory by urinating directly on top of another mink's scent. If there is urine outside or on the trap, a mink will presumably simply *squirt its urine* here and then move on.

For reasons of comparison we will then for a whole season use various kinds of other bait. For example, this could be the innards of wild animals and birds, fish, tinned cat food or mink feed. It may well be that bycatches will increase when these types of bait are used. ***See Fig. 3***. In particular, we expect problems with rats that will try to empty the traps.

Preliminary results

The traps were set from 20 February to 31 March 1998, and again from 1 September 1998 to 31 March 1999. The catch was 113 mink, 22 polecats, 14 stoats and 6 weasels. ***See Fig. 1***.

Of the 113 mink, only 22 were male. ***See Fig. 4***. In addition, 1 stone marten was caught, 1 squirrel, 17 rats, 16 water voles, 3 mice and 2 water rails.

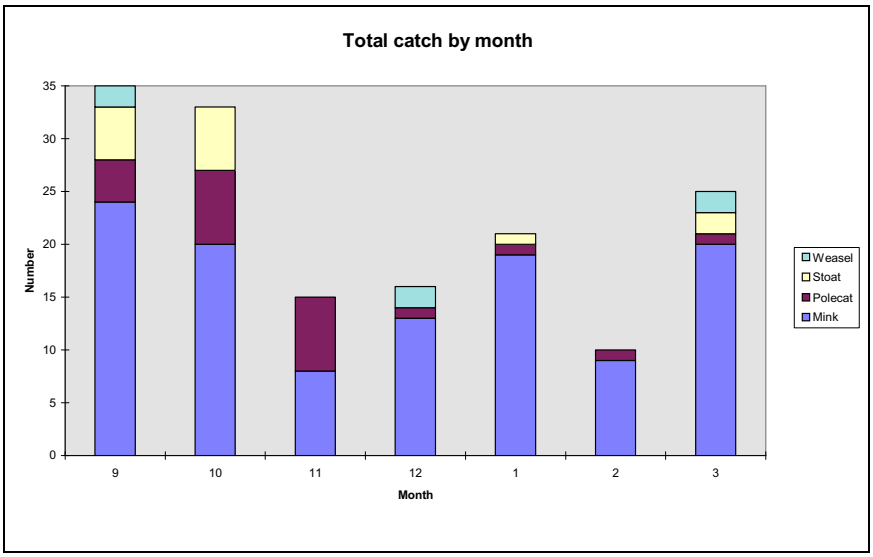

Figure 1: ***Total catches of mink, polecats, stoats and weasels by month. Months 2 and 3, therefore, record catches from both 1998 and 1999.***

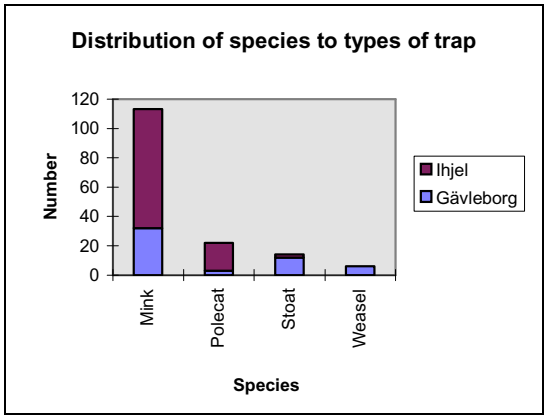

Figure 2: ***Total catch distributed according to the 2 types of trap used. Bycatches of polecats occurred mainly in the Ihjel Trap, bycatches of stoats and weasels mainly in the Gävleborg Trap.***

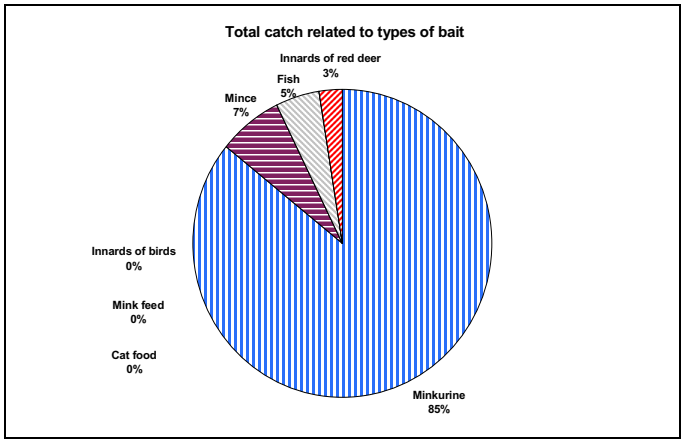

Figure 3: ***Total catch distributed according to bait. Mink urine was used for about 5 months, and other types of bait at intervals of 14 days for 3 months. The innards of wild birds, mink feed and cat food produced no catches.***

The preliminary catches made in this way do not indicate any major problems as regards animal ethics. Two animals, however, would appear not to have been killed immediately, as indicated by tooth marks on the edge of the trap and by the way in which the animal was caught in the trap. All the other animals would appear to have been killed instantly.

All the animals trapped were labelled with the date caught and the index number of the trap and then sent to the State Veterinary Serum Laboratory for further investigation. The

animals were investigated for the infectious diseases much feared by mink farmers: *Plasmasytosis, Salmonella and Campylobacter.*

No final results of these investigations are available as yet. So far, only 29 animals caught in the experiment have been investigated, and none of the above diseases has been found, though mink caught on Bornholm have been found with antibodies against Plasmasystosis.

If the results of these investigations reveal the presence of the Plasmasystosis virus in wild or escaped mink, this will be an major reason to tighten legislation concerning mink farms, so that animals do not escape to the extent we see it today. Mink farmers themselves will be interested in greater control, since if animals can escape from farms, the risk of virus infected animals getting in is very real.

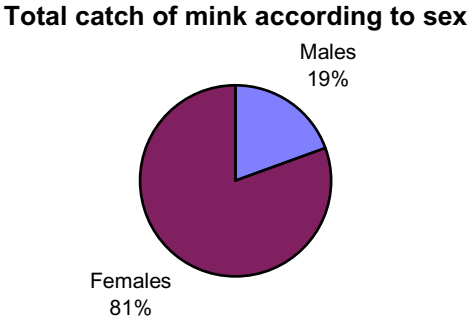

Figure 4: ***Distribution of the mink caught according to sex. Catches were evenly distributed over the months.***

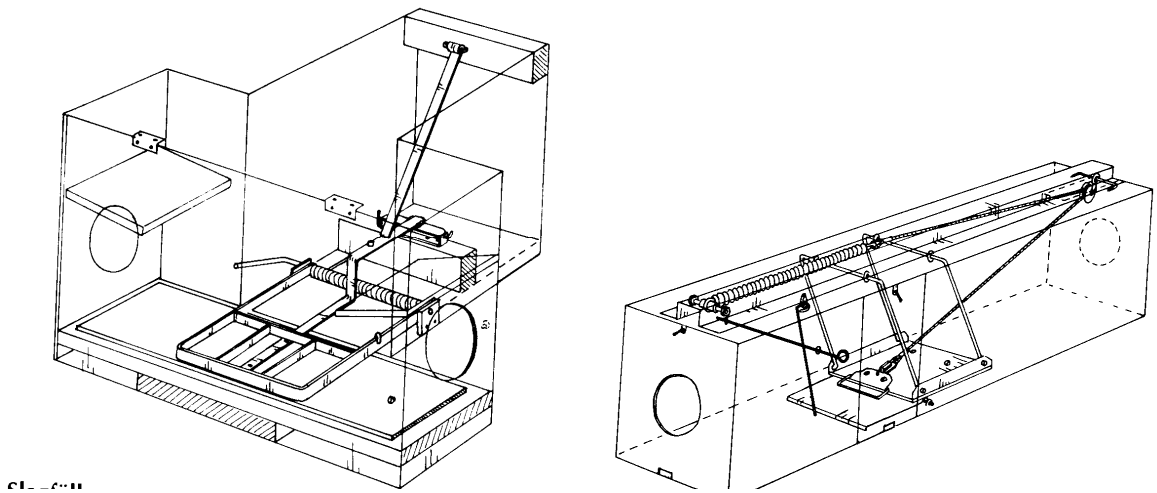

Figure 5: ***Types of trap used. The Gävleborg Trap on the left and the Ihjel Trap on the right.***

10.

Non-native terrestrial vertebrates in Latvia / Vertébrés terrestres non indigènes en Lettonie

Mr Vilnis BERNARDS (Environmental Protection Department, Latvia)

Biogeography and human population of Latvia

The nature of Latvia is determined by its geographical location in the Western part of the East-European plain and on the eastern coast of Baltic Sea. Latvia belongs to a temperate zone, mixed forest subzone (boreonemoral province)

surface area	**64 589 km^2**
forest	44,6%
inland waters	3,7% (12 436 rivers, 2256 lakes, 796 bodies of water)
agricultural lands	38,8%
human population	**2,66 million**
population density	31,8 individuals per 1km^2
urban population	69%
rural population	31%

Animal species

VERTEBRATES

Mammals	69
Birds	320
Reptiles	7
Amphibians	13
Fishes	95
Lampreys	3

The most famous and well known non native terrestrial vertebrate species are racoon dog (*Nyctereutes procyonoides* Gray), American mink (*Mustela vision* Briss.) and muskrat (*Ondatra zibethica L.*).

1. Racoon dog

For the first time, the racoon dog was recorded in Latvia in 1943 as an invader from neighbouring countries. It was first released in Belarus, already in 1936. In 1948, less than 100 specimens were simultaneously released in two areas of Eastern Latvia. The rapid population increase was recorded and since 1952, hunting of racoon dog has been allowed. Shortly afterwards, racoon dog was recognised as a pest, in regard to the native fauna. According to hunters and foresters, the racoon dog is presently a common prey of wolves and roaming dogs. The influence of these carnivores on the racoon dog population could be increased during years with mild winters, since racoon dog is active all the winter.

Unfortunately, its influence on native mammal and bird species in Latvia remains unknown. Distribution- all forest districts of Latvia. Racoon dog population is stabile.

Hunting

Racoon dog hunting season –whole year

Hunting methods:

- Shooting
- Trapping (basically- cage traps, leg-hold traps)
- Hunting with hunting dogs (basically-winter time hunting with dogs in caves, autumn time hunting with dogs in waterbodies, rivers area)
- all other methods are prohibited

Forest guards according to division in forestry districts (total 261 unit) yearly carry out racoon dog census. Results should be submitted till 1 March. Forest Inventory Institute of State Forest Service makes the final summarising of data.

2. American mink

For the first time the American mink was recorded in Latvia in 1944. The American mink was introduced in neighbouring countries in the 1950 s. The species appeared at first as escaped (sometimes may be have been released) from fur farms and later as invasion from neighbouring countries.

The detailed course of colonisation in Latvia is not documented. Since 1975 the American mink is included in the game species list. Since 1979, foresters for official game statistics have estimated its population size.

The present decline of mink in harvest statistics does not relate to a population decrease, but is due to a fur market decline. The American mink distribution- common in all districts.

Hunting

American mink hunting season- from 1 October to 15 March

Hunting methods:

- Shooting
- Trapping (basically- cage traps, leg-hold traps)
- Hunting with hunting dogs

- all other methods are prohibited

3. Muskrat

For the first time the muskrat was recorded in Latvia in 1961 as invader from neighbouring countries. Muskrat was introduced in Belarus (from 1953 to 1961) and Lithuania (1954-1955). Muskrat is included in the list of game species since 1979. Muskrat is a wide spread species throughout Latvia.

Decreased hunting pressure due to the significant general reduction of fur prices is the main reason for population size increase. During last 5 years only less than 100 specimen were trapped. Mainly predators regulate population size: red fox, otter, American mink, polecat, stoat, roaming dogs, Marsh harrier.

Hunting

Hunting season- from 1 October to 15 March

Hunting methods:

- Shooting
- Trapping (leg-hold traps)
- Hunting with hunting dogs
- all other methods are prohibited

Summary:

For the control of non-native terrestrial vertebrates (racoon dog, American mink, muskrat) only 3 hunting methods are used-shooting, trapping and hunting with dogs. All others methods are prohibited. The racoon dog hunting season – full year. American mink and muskrat hunting season- from 1 October till 15 March.

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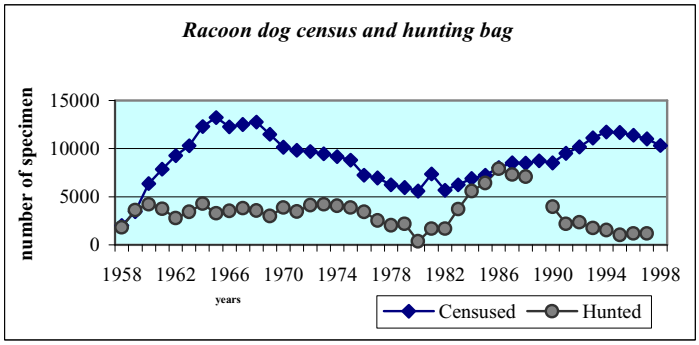
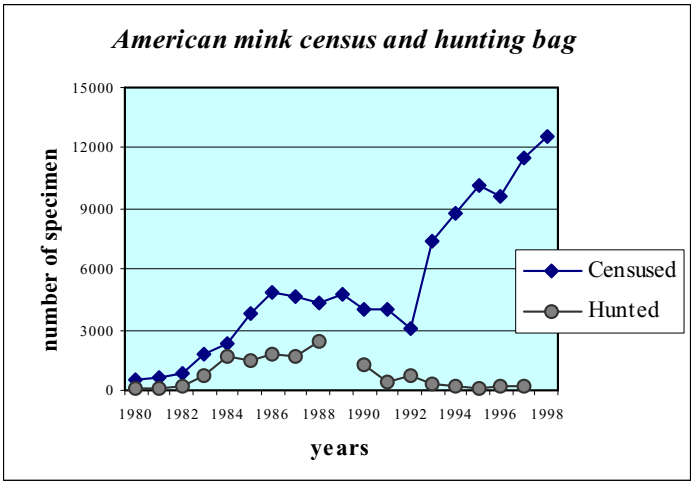
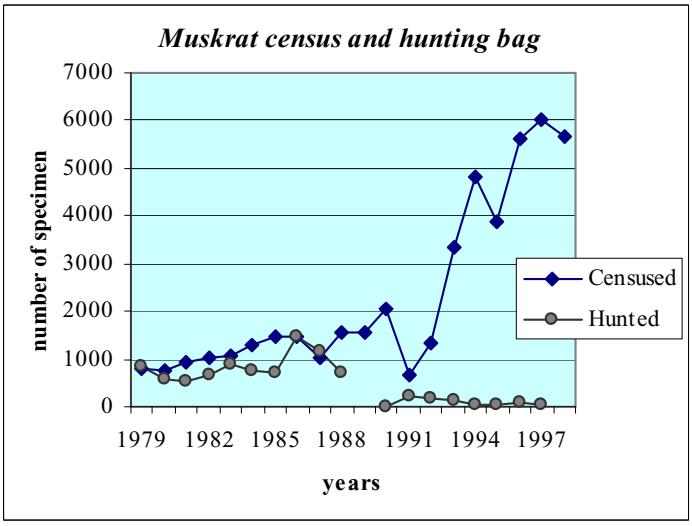
State Forest Service game animals census data


Racoon dog census and hunting bag
number of specimen
15000
10000
5000
0
1958 1962 1966 1970 1974 1978 1982 1986 1990 1994 1998
years
Censused
Hunted


American mink census and hunting bag
number of specimen
15000
12000
9000
6000
3000
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998
years
Censused
Hunted


Muskrat census and hunting bag
number of specimen
7000
6000
5000
4000
3000
2000
1000
0
1979 1982 1985 1988 1991 1994 1997
years
Censused
Hunted

11.

Eradication of *Myocastor coypus* in United Kingdom / Eradication de *Myocastor coypus* au Royaume-Uni

Mr Simon BAKER (Farming and Rural Conservation Agency,
Ministry of Agrilculture, United Kingdom)

History of the UK population

Coypus are native to South America and have been widely farmed for their fur. There have been numerous escapes from captivity and in some countries animals have been deliberately released to try and establish feral populations that could be cropped (Lever, 1985). They were originally introduced into Britain in 1929 for fur farming. The farms were not, however, profitable and by 1945 the farming of coypus had ceased in Britain. Farms were often little more than poorly fenced off ponds and streams and, as a consequence, escapes were reported from more than 50% of them (Laurie, 1946).

From the original escapes coypus became established in two centres; one, based on the sewage works near Slough, disappeared without any known control in 1956. A second group probably originated from three farms near Norwich, close to the rivers Yare and Wensum, in East Anglia (Laurie, 1946).

Early population changes

Quantitative estimates of population size using population reconstruction techniques are only available after 1962 (Gosling *et al*., 1981). Before this, the information is anecdotal, but the population probably started in the mid-1930s and grew progressively with two major checks in the severe winters of 1946/7 and 1962/3 (Norris, 1967). Centrally organised control started in 1962 and continued at various levels until the start of the eradication campaign in 1981. Numbers of coypus probably reached a peak in the late 1950s with a total of between 50,000 and 100,000 animals.

Damage

Coypus are generalist herbivores and feed on a wide range of native plants and crops. They generally select the parts of plants which contain the highest nutrient concentrations and, where these include basal meristems, the plant is often destroyed. As a result of such feeding, large areas of reed swamp were eliminated in the Norfolk Broads during the 1950s (Boorman & Fuller, 1981). Coypus also favour particular species, including the flowering rush and cowbane, which became extremely rare when coypu were abundant. They also damage a wide variety of crops including cereals, brassicas, sugar beet and other root crops.

The most important damage in purely economic terms was caused by burrowing. Coypus dug extensive burrow systems into the banks of ditches and rivers which disrupted drainage systems and posed the risk of flooding in low-lying East Anglia. As damage by Coypus began to increase alarmingly in the late 1950s, there was a widely based call for an official control campaign.

The first control campaign 1962-1965

The damage caused by coypus led to two initiatives in 1962. The first was to establish the Coypu Research Laboratory in Norwich, and the second to launch a trapping campaign which was to run until 1965 (Norris, 1967). Complete eradication was believed to be impossible, and the aim of the campaign was to reduce coypu numbers and confine the remainder to the Norfolk Broads in eastern England. By necessity this campaign was organised in advance of any results from the Laboratory. The area containing most coypus was divided into nine sectors which were trapped successively by a team of 12 specially employed trappers starting at the outside of the control area and working inwards towards the area where the density of coypus was highest. There was also a large amount of trapping ahead of the campaign carried out by the employees of rabbit clearance societies and by some landowners. Outside the main control area, government pest control staff attempted to clear what were regarded as outlying colonies in co-operation with landowners.

It is possible now to see a number of flaws in the strategy; notably that the main trapper force spent much of its time in clearing relatively low density areas rather than attempting to maximise capture rates. Also, although the effect of immigration into cleared areas was considered it was not given sufficient weight.

Events were also complicated by the winter of 1962/3, the coldest winter in Britain for over 200 years. This winter killed over 90% of the population in three months. By the end of the campaign in 1965, over 40,000 coypus had been trapped, and the main objective had been achieved.

In the absence of a demographic analysis, it was not clear to what extent trapping was responsible and in retrospect perhaps the main achievement of the trappers was to keep the numbers down to the low levels caused by the cold winter. In ignorance of the quantitative relationship between trapping effort and the population's response, the trapping force was not sufficiently large to prevent an eruption in numbers when a run of mild winters occurred in the early 1970s.

The coypu eradication campaign 1981-1989.

In 1977 the government set up a committee, The Coypu Strategy Group, to advise on future policy relating to the control of coypus (Anon, 1978). In contrast to the earlier campaign, information was available to The Group from the results of a long-term investigation of coypu population ecology, and this was used to plan the 1981 campaign. Over 30,000 coypus were dissected to get information about reproductive biology, age structures and the other information needed to reconstruct past populations and to try to understand why coypu numbers varied.

Results indicated that trapping explains more of the variation in adult populations than winter severity, although the two combined variables accounted for 82% of the variation in the change of coypu numbers. Not all this information was available in the late 1970s, but enough was known to provide an analytical background for simulation models of the population. Simulations were used to assess the effect of employing different numbers of trappers on the population under various climatic circumstances.

A range of these simulations (Gosling *et. al.*, 1983) were available to the Coypu Strategy Group and the option recommended was an attempt to eradicate coypus with a force of 24 trappers. Before the recommendations were accepted by the Government, one more important feature had been demonstrated; that it was possible to eradicate coypus by cage trapping. An exercise was carried out on 30km of the river Yare, to the west of Norwich which included Surlingham Broad. It was possible to demonstrate that coypus could be eradicated by cage trapping on a realistic scale (Gosling *et. al.*, 1988).

When the eradication campaign started in 1981, the organisation and funding of the Coypu Control Organisation was also changed. Taking into account the reasonable expectation of improvements in trapping techniques and other equipment, it was decided to attempt eradication within ten years. Laboratory staff gave technical guidance to the control organization throughout the campaign. An example is the scheme used to deploy trapping effort. Deployment was adjusted every three months using recent capture/trapping effort ratios in the strategic regions . This ratio was weighted to different extents so that effort could be concentrated on high density areas early in the campaign and deployed more widely later on. However, some control was carried out throughout the population, and in contrast to the sweep approach adopted in the first campaign against coypus.

The technique used was cage trapping. Traps were inspected every day and any trapped coypus shot. This technique had the advantage that any non-target animals could be released unharmed. Because of this it was possible to get the co-operation of all landowners, including those with conservation and game interests; this is essential where the objective is whole population removal.

Various improvements were introduced by the Laboratory, including the use of traps on baited rafts. Field trials showed that these were at least 50% more effective than traps set on land and non-target captures were also significantly reduced. Following this work, over 600 rafts were deployed. The Laboratory also monitored the progress of the campaign both by field checks and by reconstructing the population. Starting from around 6,000 adults in 1981, coypus had probably been eradicated by the end of 1989. The campaign was helped by an above average number of cold winters, but it is important to appreciate that cold weather itself would never eradicate all the coypus from Britain; as shown by the response to the exceptionally cold winter of 1962/3.

Even when the main technical problems in the operation have been solved, why should the trappers attempt to succeed in an eradication exercise when doing so would also eradicate their jobs? The scheme devised was to restrict funding to a maximum of ten years, and promise the trappers a bonus of up to three times their annual salaries if they succeeded in eradicating the coypu population. The bonus declined progressively after six years to encourage an early end to the campaign. It is impossible to judge the precise effect of this scheme, but we believe it was an essential element. In the end the trappers gained an almost maximum bonus!

It was also necessary to have an independent check on whether or not coypus had been eradicated as the scheme has the danger of ‘encouraging’ trappers not to report kills which would potentially reduce their bonus. Laboratory staff carried out an independent check throughout East Anglia for coypus for the last four years of the campaign. The technique

used was to put out rafts baited with carrots and check these for signs of coypus, such as droppings and teeth marks.

Once the Eradication Campaign had officially finished, it was believed that it was likely that a few coypus remained. To help find any remaining animals, three field staff were retained to search for them. In December 1989 this team confirmed the presence of what was to be the last coypu found in the wild in Britain. The systematic field effort ceased in March 1992.

Conclusion

The successful coypu eradication campaign would not have been undertaken without detailed technical assessments of the effort, costs and likely chances of success. These could only have been achieved by a long term study of population ecology, targeted to a particular control application. The research also allowed operational experience to be gained and it is significant that the arguments for such practical details as the incentive bonus scheme came from biologists. Population trends and the results of field checks were passed back to the control organisation and helped to direct the campaign and to stimulate the efforts of the trappers. This sort of interaction between applied biology and a centrally organized control operation has potential for wide application in any extensive pest control operation and may be essential for the successful removal of a well established introduced mammal. A summary of the eradication campaign and aspects of its planning and monitoring are given by Gosling & Baker (1987), Gosling (1989), Gosling & Baker (1989)

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12.

**Strategy to control the Muscat rat (*Ondatra zibethicus*)
in the Walloon Region of Belgium /
Stratégie de lutte contre le rat musqué (*Ondatra zibethicus*)
dans la région wallonne en Belgique**

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D'origine nord-américaine (Alaska, Canada et la majorité des Etats-Unis d'Amérique), le rat musqué (*Ondatra zibethicus* L., alias Ondatra Fiber) est un mammifère inféodé au milieu aquatique (Photo 1), qui s'est développé accidentellement sur le continent européen au début du siècle.

D'un poids d'environ 1 kg dans nos contrées (les plus gros avoisinent les 2 kg), il vit dans des galeries souterraines qu'il creuse dans les berges ou, en sol marécageux, dans des huttes.

Sa durée de vie est de trois à quatre ans en Europe et un couple peut donner annuellement de 2 à 3 portées de six jeunes qui sont mâtures sexuellement après un hiver. La taille adulte du rat musqué lui permet d'échapper à tous les prédateurs indigènes en milieu aquatique. Sa faculté d'apnée (6 minutes en nage) et la configuration des entrées de son terrier rend secondaire la régulation par des mordants tels que le renard (*Vulpes vulpes)* et le putois (*Martes putorius*).

Historiquement, le premier lâchage a eu lieu en 1905 à Dobrisch (près de Prague), puis en Finlande vers 1922 ainsi qu'en plusieurs endroits des Iles britanniques entre 1927 et 1929. Le rongeur a été introduit en Belgique à Begijnendijck (marais clôturé), Huissignies (Hainaut) et Manderfeld (Liège) vers 1928.

A l'exception de la Grande-Bretagne qui a réussi à l'éradiquer peu de temps après son introduction (1932-1937), les implantations initiales se sont considérablement étendues pour atteindre toute l'Europe occidentale et centrale ainsi que la Sibérie et la Chine.

Les limites méridionales semblent se stabiliser dans les bassins du Danube, du Pô et du Rhône.

Dégâts

Le rat musqué creuse ses terriers dans les rives meubles des cours d'eau et des étangs. Le rongeur évacue constamment les déblais, ce qui élargit considérablement les galeries, affaiblit les berges, crée des trous qui vont jusqu'à provoquer la vidange de plans d'eau entiers par phénomène de siphon et accélérer le remblaiement des ruisseaux et rivières (2 à 3 m^3 par famille et par an).

Dans les étangs et les marais, il se nourrit de diverses plantes aquatiques, ce qui provoque leur disparition rapide et modifie ainsi les écosystèmes des zones humides. La surface dénudée peut atteindre près de 500 m² en deux ans.

Dans les régions agricoles, il s'attaque successivement à de nombreuses cultures installées le long des cours d'eau, en fonction du calendrier des récoltes : prairies de ray-grass, céréales, lin, carottes, trèfles, cultures maraîchères, avec une nette préférence pour les betteraves et le maïs. Il peut ainsi raser complètement des zones de plus de 10 mètres de large en bordure des rives.

En cas de forte concentration, le rat musqué s'attaque aux racines, écorces et rejets d'arbres, de préférence des saules, peupliers et aulnes, voire de jeunes résineux.

Base légale de la lutte en Belgique

L*e responsable (le propriétaire, le locataire, l'occupant, la personne de droit public ou de droit privé) est tenu de procéder à la lutte contre le rat musqué dès qu'il en constate la présence ou que celle-ci lui est signalée par un agent de l'autorité.* Il est obligé de collaborer suivant les instructions du service lorsqu'une campagne officielle de lutte contre les rats musqués est organisée (Arrêté royal du 19/11/1987 relatif à la lutte contre les organismes nuisibles aux végétaux et aux produits végétaux - voir également la base légale au niveau de l'Union européenne).

Stratégie

La Région wallonne a divisé son territoire en 21 secteurs (limites de bassins hydrographiques) correspondant chacun à une surface utile de 400 km² (**Photo 2).**

Par surface utile, il faut entendre une aire de laquelle ont été déduites les zones non propices, essentiellement boisées ou très urbanisées. C'est ainsi que le nord-ouest de la Wallonie (Hainaut) avec ses terrains de culture limoneux et à haute densité en fossés de drainage est plus favorable à l'installation de l'ondatra que le sud du pays (Ardennes) aux forêts profondes et au sol schisto-gréseux.

Chaque secteur est confié à un piégeur professionnel recruté par un examen d'Etat. Ce personnel dépend directement d'un ingénieur du Ministère de la Région wallonne, qui a toute compétence pour organiser la lutte contre le rat musqué sur l'ensemble du territoire (domaines publics et privés)

Moyens mécaniques

Dans l'attente de normes ISO et la mise en place d'organismes de certification des engins de destruction ou de capture, la Station de Zoologie appliquée du Ministère fédéral de l'agriculture belge a étudié la spécificité pour le rat musqué des systèmes de piégeage utilisés en Région wallonne et de leur respect du règlement CEE 3254/91 interdisant l'utilisation du piège à mâchoire.

Tous les pièges à mâchoires du service de piégeage ont été dotés d'un dispositif empêchant l'engin de se refermer sur un membre de l'animal. De plus, afin d'éviter la capture d'espèces non cibles (spécialement les poules d'eau : *Gallinula chloropus*) le piégeage sur les lieux de passage, tant sur la terre ferme que dans l'eau, sont interdits.

Types

- Pièges à appâts (« livre de messe », *Köderfalle*) par 6 sur des flotteurs protégés d'un treillis et de tôle (spécificité à 99%) (Photo 3)

- pièges (en X : *Conibear* ou à fil *(Haargreiffe)*) dans les terriers sous eau (spécificité à 95 %)

- nasses coniques ou carrées (spécificité à 90%).

Moyens chimiques

Le traitement se fait au moyen d'un morceau de carotte dans lequel est injecté 1 ml d'anticoagulant (chlorophacinone sous forme huileuse contenant 0,25% de matière active). Une étude de la spécificité de l'appât carotte pour le rat musqué en milieu naturel (identification photographique des consommateurs - photo 4) a établi des recommandations de pose garantissant une sauvegarde des espèces non cibles.

Conclusions

Des études belges ont démontré que pour stabiliser une population de rat musqué, 80 % des animaux doivent être détruits avant la mise bas de leur première portée (mars-avril) et 90 % avant la naissance de la 2ème portée (mai-juin), 94% avant la sortie de la 3ème portée (juillet-août).

Le seul emploi de pièges n'est pas suffisant et autorise même une extension de l'infestation. Il est nécessaire de traiter au moins deux fois par an tous les lieux d'installation du rongeur au moyen d'appâts empoisonnés et d'en éliminer un maximum par des pièges mécaniques lors des deux « migrations » (réorganisation familiale) qui ont lieu au printemps et en septembre.

Afin de garantir la spécificité et la coordination de la lutte, il est primordial de disposer de professionnels du piégeage et d'un seul niveau de décision. La Région wallonne ne valorise pas les peaux et l'intervention de ses agents est gratuite.

Enfin, Il est à signaler que quelques populations de ragondins (*Myocastor coypus)* sont présentes en Région wallonne depuis avant 1960, sans toutefois se développer.Celui-ci est considéré comme animal d'élevage, statut qui complique toute initiative d'organisation d'une lutte systématique. De plus, la réintroduction non contrôlée du castor (*Castor sp)* en Wallonie amène à repenser l'utilisation des appâts toxiques dans la lutte contre le rat musqué.

13.

The status of the Ruddy duck (*Oxyura jamaicensis*) in the Western Palearctic and an action plan for eradication, 1999-2002 /
Le statut de l'érismature à tête rousse (*Oxyura jamaicensis*) dans le Paléarctique occidental et plan d'action pour son éradication, 1999-2002

Dr Baz HUGHES (The Wildfowl & Wetlands Trust, United Kingdom)

The status of the Nrth American ruddy duck *Oxyura jamaicensis* in the western palearctic: towards an action plan for eradication

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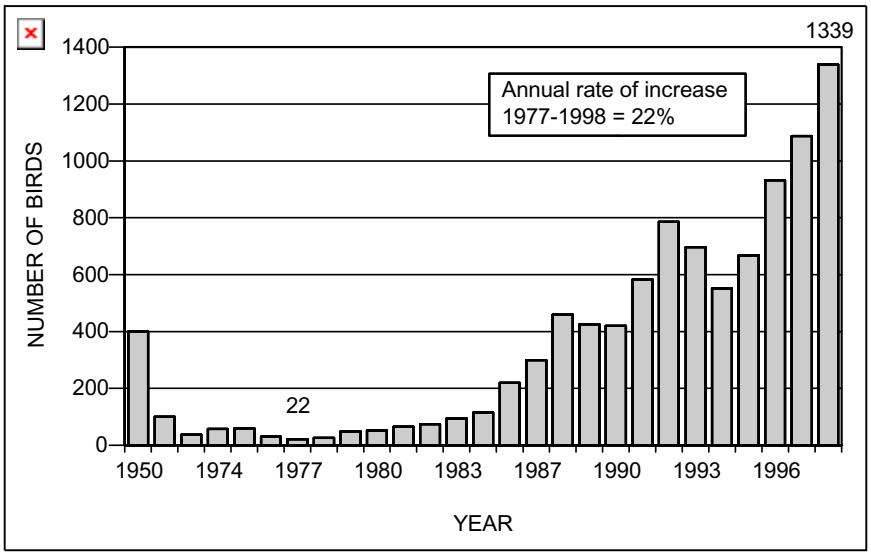
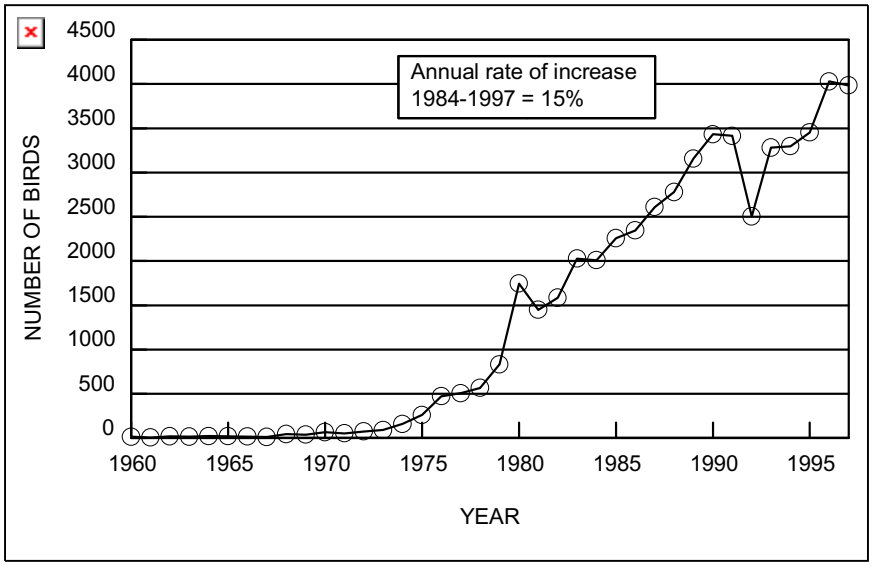
A requirement to prevent the introduction of, or to control established, non-native species is expressed in EU legislation (the Birds and Habitats Directives), and in a number of international conventions, including the Bern Convention, the Bonn Convention and the Convention on Biological Diversity. The White-headed Duck *Oxyura leucocephala* is a globally endangered species recorded as □Vulnerable□ on the World List of Threatened Birds. Conservation efforts in Spain have increased the number of White-headed Ducks there from only 22 birds in 1977 to over 1,300 birds in November 1998, an annual rate of increase of 22 % (Figure 1). Conservation initiatives for the White-headed Duck are currently underway elsewhere in Europe, including a LIFE-funded project to reintroduce White-headed Ducks to Corsica and a programme of habitat protection, restoration and reintroduction in Italy.

Figure 1. Peak annual counts of White-headed Ducks in Spain, 1950-1998 (Torres *unpubl. data*).



The North American Ruddy Duck *Oxyura jamaicensis* was introduced into the UK from North America in the 1940's. After escaping from captivity, Ruddy Ducks first bred in the wild in 1960 and increased to about 4,000 birds in 1998 (Figure 2). Without control, North American Ruddy Ducks are expected to colonise continental Europe and threaten the White-headed Duck with extinction through hybridisation and competition. Precedents exist from elsewhere to demonstrate the potential level of threat. For example, in New Zealand, the introduced Mallard *Anas platyrhynchos* has caused rapid absorption of the native Grey Duck *Anas superciliosa superciliosa* through hybridisation. Only an estimated 15-20 % of the total Mallard/Grey Duck population in New Zealand now consists of pure Grey Duck genotypes, compared to an estimated 95 % in 1960.

Figure 2. Numbers of Ruddy Ducks wintering in the UK, 1960 -1997, assuming a 90% count coverage (Wetland Bird Survey data).



Between 1965 and 1996, there were over 900 records of some 1,500 North American Ruddy Ducks in 19 Western Palearctic countries. Records are concentrated along the North Sea coasts of The Netherlands, Belgium, and Germany, in France and in southern Spain

(Figure 3, Table 1). Ruddy Ducks now occur annually during the breeding season in eight countries (excluding the UK) and annual breeding attempts probably take place in six: Belgium, France, Germany, Ireland, The Netherlands, and Morocco (not Spain as most birds are shot).

Figure 3. Distribution of Ruddy Ducks recorded in mainland Europe, 1965-1996 (597 records of 938 birds at 289 different sites). NB. Sites without latitude and longitude data excluded; no data for Iceland and Ireland.

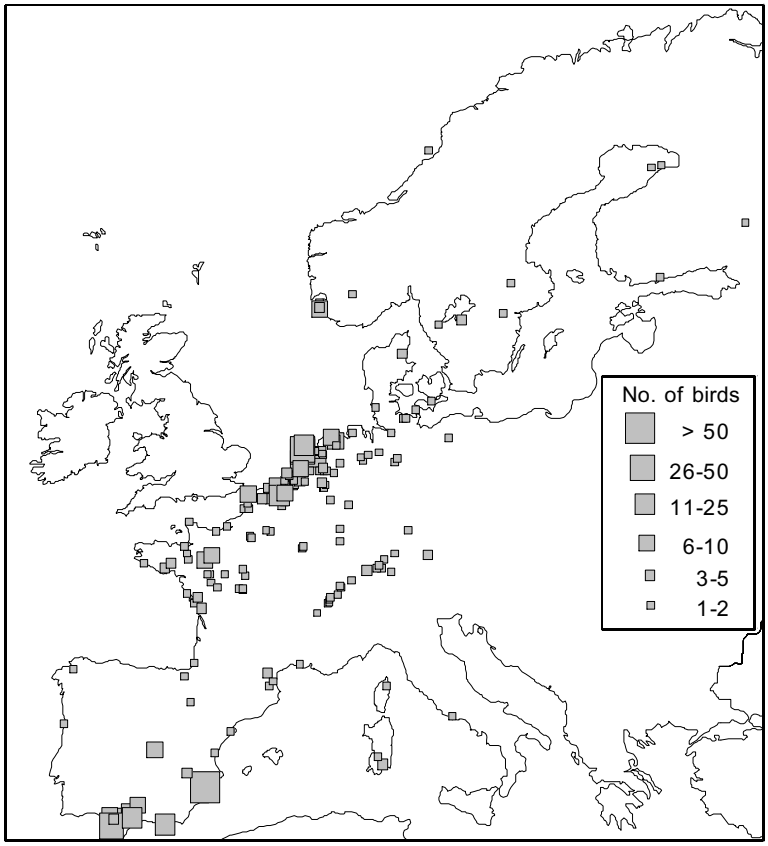


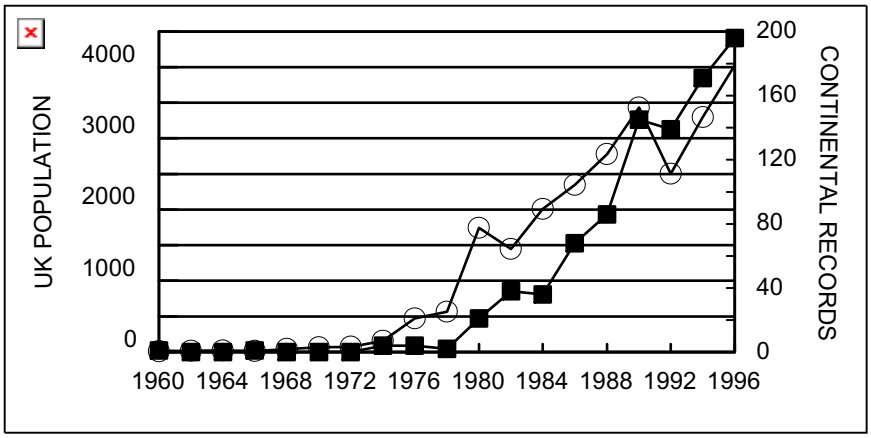
Table 1. Occurrence of the Ruddy Duck in Western Palearctic countries, 1965-1996 (excluding the UK). Figures in parentheses are numbers of years with Ruddy Duck records assuming presence in years with missing data.

Country	Year of First Record	No. of Years with Records		Total No. of Birds	Total No. of Records
		1965-1996	1992-1996		
Netherlands	1973	16	5	325	220
France	1974	20	5	281	153
Belgium	1979	18	5	155	126
Spain[1]	1982	12 (13)	4 (5)	175	102
Ireland[2]	1973	17 (19)	2 (4)	234	80
Germany	1982	14	5	58	57
Iceland	1976	12	4	83	30
Norway	1984	9	2	42	29
Sweden	1965	13	5	32	26
Morocco	1986	6	5	130	25
Switzerland	1981	13	4	25	21
Denmark[3]	1985	7 (8)	2 (3)	10	10
Italy[3]	1987	6 (7)	4 (5)	9	9
Finland[3]	1989	4 (5)	1 (2)	4	4
Portugal	1989	4	3	7	5
Austria	1991	1	0	2	2
Hungary	1994	1	1	1	1
Israel[4]	1983	1	0	1	1
Turkey	1988	1	0	1	1

[1] No data for 1995; [2] No data for 1994 or 1996; [3] No data for 1996; [4] Possible escape from captivity.

Large flocks of wintering birds have recently appeared in Spain and France. In January 1997, about 30 Ruddy Ducks were recorded in northern Spain following freezing conditions across northern Europe, and some 30-40 birds have wintered annually at Lac de Grand-Lieu in northern France since 1995/96. The number of Ruddy Duck records in the Western Palearctic is still increasing, at a mean annual rate of 21 % between 1976 and 1996. The greatest increase has been in The Netherlands where the number of records increased at 34 % per year between 1984 and 1996. The increase in continental records has been highly correlated with the increase in the UK Ruddy Duck population (Figure 4), even to the extent that the number of continental records has declined in years following declines in the UK Ruddy Duck population. It is unlikely that mass escapes from captivity could explain the recent appearance of large flocks of Ruddy Ducks in France and Spain. Therefore, most Ruddy Ducks occurring in mainland Europe probably originate from the introduced UK population, although additional birds undoubtedly escape from collections. DNA fingerprinting has ruled out the possibility that birds are natural transatlantic vagrants.

Figure 4. Numbers of Ruddy Ducks in the UK, 1960-1996, in relation to the biannual total of records in Western Palearctic countries. Open circles - UK population; closed squares - number of continental records.



Since 1993, when the first international meeting was held to discuss the Ruddy Duck issue in the Western Palearctic, there has been action in many countries. An appraisal of the level of implementation of country-by-country recommendations for Ruddy Duck control from the Council of Europe White-headed Duck Action Plan (Table 2) reveals: 1) Monitoring of Ruddy Ducks in the wild is adequate in most countries; 2) The legal provision for Ruddy Duck control exists in all countries; 3) Many countries have, or are considering, a national Ruddy Duck strategy; 4) There is a commitment to eradication in three countries (France, Portugal, Spain) while the UK has conducted research into suitable control measures for Ruddy Ducks and has moved to a regional trial to assess the feasibility of nationwide eradication. This regional trial may reduce the UK population by up to 1,000 birds. Spain, France and Portugal attempt to control all Ruddy Ducks and hybrids, with a total of 135 birds shot to date (68 Ruddy Ducks and 51 hybrids in Spain, 13 Ruddy Ducks in France, and one Ruddy Duck and two hybrids in Portugal). There is no ongoing control in six countries in which annual breeding attempts are thought to occur (Belgium, Germany, Iceland, Ireland, Morocco, and The Netherlands); 5) Few countries have acted to address the potential threat posed by Ruddy Ducks escaping from captivity (although it was already illegal to keep Ruddy Ducks in Iceland and Norway and there are no birds in collections in Sweden). Few countries have mechanisms in place to monitor the numbers of birds kept in captivity and in four countries (Ireland, Italy, The Netherlands and Portugal) it is not illegal to release Ruddy Ducks into the wild. Ruddy Ducks can be traded freely in most countries; 6) Few countries have public relations strategies regarding Ruddy Ducks, although these are in place in countries with ongoing control.

A strategic approach needs to be adopted if North American Ruddy Ducks are to be eradicated from the Western Palearctic. An international eradication strategy needs to be produced (based on this document), which is endorsed and implemented by all Western Palearctic states. Individual countries need to produce national eradication strategies, in consultation with relevant interest groups. Both wild and captive birds should be eradicated, the former taking priority as these are thought to be the major source of birds reaching White-headed Duck populations. The immediate priorities (1999-2002) for the control of wild Ruddy Ducks should be to assess the feasibility of eradication from the UK and to ensure that birds do not become established in other countries. With regard to captive populations, all countries should introduce and/or enforce legislation preventing the release and escape of Ruddy Ducks into the wild, introduce schemes to monitor the numbers of birds kept in

captivity. The ultimate goal should be to prohibit the keeping of Ruddy Ducks in captive collections. Further research is needed to predict the timescale for eradication of Ruddy Ducks from the Western Palearctic and the timescale for extinction of the White-headed Duck if eradication does not take place. DNA studies are required to identify the provenance of Ruddy Ducks occurring in mainland Europe. Training requirements include a technical manual of control methods for Ruddy Ducks, a training programme for control teams, and a mechanism to develop control expertise via regular contact between control teams. This process may be best initiated through the organisation of an international meeting to discuss Ruddy Duck eradication and the conservation of the White-headed Duck. There remains an urgent need to increase public awareness of the dangers of alien species. The importance of this factor should not be underestimated - it may have a major influence on the success, or otherwise, of any eradication strategy. These recommendations should be reviewed in 2002, once the results of the UK□s Ruddy Duck regional control trials are available. The Ruddy Duck issue has demonstrated a reluctance to act on the Precautionary Principle with regard to controlling non-native species. A proactive, rather than reactive, approach to the Ruddy Duck problem would have saved much time, energy and money.

Table 2. Ruddy Duck control measures in Western Palearctic countries. Only countries with five records included. Key: □ - measures in place, □ - measures not in place but issue being considered, P - measures pending, □ - measures not in place, ? - unknown, n/a - not applicable. Note that there are no Ruddy Ducks in captivity in Iceland, Norway, Sweden and possibly Morocco. Shaded squares highlight actions which require further effort.

COUNTRY	BIRDS IN THE WILD						BIRDS IN CAPTIVITY						PUBLIC RELATIONS STRATEGY
	Adequate Bird Monitoring	Legal Provision for Control	National Control Strategy	Commitment to Eradication	Dissemination of Control Information	Provision of DNA Samples	Code of Practice	Adequate Monitoring of Numbers	Bird Register	Release Ban	Trade Ban	Ban on Keeping	
LARGE POPULATIONS													
United Kingdom	T	T	T	[	T	T	T	T	P	T	P	Ξ	T
SMALL POPULATIONS													
Annual breeding attempts													
Belgium	T	T	Ξ	Ξ	n/a	n/a	?	Ξ	Ξ	T	Ξ	Ξ	Ξ
France	T	T	T	T	T	Ξ	T	Ξ	Ξ	T	Ξ	Ξ	T
Germany	Ξ	T	Ξ	Ξ	n/a	n/a	?	Ξ	Ξ	T	Ξ	Ξ	Ξ
Iceland	T	T	T	Ξ	n/a	n/a	n/a	n/a	n/a	n/a	n/a	T	Ξ
Ireland	T	T	Ξ	Ξ	n/a	n/a	Ξ	Ξ	Ξ	Ξ	Ξ	Ξ	Ξ
Morocco	Ξ	?	Ξ	Ξ	n/a	Ξ	?	?	?	?	?	Ξ	Ξ
Netherlands	T	T	T	Ξ	n/a	n/a	T	?	?	Ξ	?	Ξ	Ξ
Spain	T	T	T	T	T	T	T	Ξ	Ξ	T	Ξ	Ξ	T
Records throughout the year													
Portugal	T	T	T	T	n/a	Ξ	Ξ	Ξ	Ξ	Ξ	Ξ	Ξ	Ξ
Records mainly during summer													
Denmark	Ξ	T	[	Ξ	n/a	n/a	Ξ	Ξ	Ξ	T	Ξ	Ξ	Ξ
Norway	T	T	[	Ξ	n/a	n/a	n/a	n/a	n/a	n/a	n/a	T	Ξ
Sweden	T	T	[	Ξ	n/a	n/a	n/a	n/a	n/a	T	n/a	Ξ	Ξ
Records mainly during winter													
Switzerland	T	T	[	Ξ	n/a	n/a	Ξ	Ξ	Ξ	T	Ξ	Ξ	Ξ
Italy	Ξ	T	T	Ξ	n/a	n/a	T	Ξ	Ξ	Ξ	Ξ	Ξ	Ξ

14.

Conservation of *Sciurus vulgaris* and eradication of *Sciurus carolinensis* in Italy / Protection de *Sciurus vulgaris* et éradication de *Sciurus carolinensis* en Italie

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Dr G. AMORI (Chairman of the IUCN/SSC Rodent Specialist Group)

Introduction

The Red squirrel (*Sciurus vulgaris* Linnaeus, 1758) is considered threatened in Europe (Amori & Zims 1994), for the competition with the American Grey squirrel (*Sciurus carolinensis* Gmelin, 1788), and for the fragmentation of woodland habitats (Celada et al. *1994*). Any action aimed to protect the Red squirrel will have limited effects, unless an eradication of the Grey squirrel is planned (Bertolino et al. *in press*); in this respect, Italy plays a key role, as the country presents the only populations of Grey squirrels living in continental Europe.

This alien species was introduced in 1948 to Piedmont (north west Italy), in Genova in 1966, and in the Ticino valley in 1994. All data gathered in the United Kingdom (Gurnell & Pepper 1993, Kenward 1983, Skelcher 1997) and in Italy (Wauters et al. 1997) confirm that in areas colonised by the Grey squirrel, the authochtounous Red squirrel gets rapidly extinct. In Piedmont, the Grey squirrel has been confined until 1970 to the Stupinigi Park, in the suburbs of Turin, where the Red squirrel was also present. The last observation of a Red squirrel in the Park was recorded in the winter 1979-80. In 1990 the Grey squirrel's range had largely increased, and in the same area the Red squirrel had disappeared from Stupinigi and from most of the woodland fragments of the northern, western and central parts of the Grey squirrel's range; Red squirrels had reduced of 54% their range in the area, and were still present only along some rivers in the outermost southern and eastern parts of the Grey squirrel's range. Between 1991 and 1997, the extinction rate of the Red squirrel was very rapid, with a decrease of 55% of the species' range in the area; in 1997 the Red squirrel was still present only in two locations: Racconigi Park (where a dramatic decrease was observed) and the small Borgo Cornalese park, where the Grey squirrel arrived only in 1996 (Wauters et al. 1997).

Grey squirrel eradication campaign in Italy

In recent years, the risk of extinction of Red squirrels deriving from the Grey squirrel's presence in Italy was underlined by several national and international organisations (IUCN, UK Forestry Commission, WWF, People's Trust for Endangered Trust, etc.). Also in respect to the international obligations of Italy (Bern Convention, Rio Convention), the National Institute for Wildlife (Istituto Nazionale per la Fauna Selvatica, INFS) presented a recommendation at the 3rd National Conference of Game Biologists (Bologna, February 1995) to promote the eradication of the Grey squirrel from Italy. In the same year, the INFS informed all competent authorities (Ministers and local administrations) of the risks related to the Grey squirrel presence in Piedmont, and on the need and urgency to plan an eradication of the species.

More recently, a sanitary risk related to the presence of the Grey squirrel was underlined by British experts; the species is in fact suspected to be a source of *parapoxvirus*, that is a potential threat not only to wildlife, but also to livestock and humans (Sainsbury et al. 1997).

In 1996, an eradication campaign was proposed by INFS in co-operation with the University of Turin; the programme was aimed to 1) monitor the species' range, 2) evaluate the feasibility of an eradication, 3) define humane control methods, 4) assess the presence of the *parapoxvirus*, and 5) finally produce an eradication plan.

Public opinion

The programme was discussed with the main NGOs, with animal rights groups, and with all local political parties. Comments of the NGOs were considered, and in this respect it was decided to test the possibility of using live traps, anaesthetising squirrels by using alothane (that reduces stress in rodents), and euthanisia by an over-dosage of the same drug.

The first phase of the eradication programme, that was officially presented to all the parties in April 1997, was an experimental eradication, aimed to test methods, to allow a prediction of the effort needed for the total eradication, and to collect samples for sanitary analyses.

Experimental eradication

The trial eradication was carried out in the Racconigi park, a 150 ha fenced park closed to the public; in the park, a total population of about 350 Grey squirrels was previously estimated through a mark-recapture study (Bertolino & Wauters in prep.). 150 multiple live catch traps were used; traps were baited with corn, covered with black plastic sheets, and checked every morning.

Animals were introduced in a sealed box, treated with alothane, and monitored by a veterinarian to detect stress indicators and time needed for unconsciousness. After euthanasia, a blood sample was collected and authoptic analyses were carried out in order to test for *parapoxvirus* and other pathologies.

Removal data were analysed by regression analysis to evaluate the effort needed in the following phases to remove the population of Grey squirrels from Piedmont.

In June 1997, the project was taken to court by animal rights groups, determining an interruption of the campaign.

Results

The adopted procedure resulted reducing the animals' stress; squirrels reached unconsciousness in less than a minute, and could be euthanised on the field, with very limited manipulation. The tested control method was very effective; 188 animals (>50 % of the estimated population) were trapped in about 10 days of activity. The early stop of the programme did not allow estimation of the effort needed to remove the total population (fig. 1).

Risks of future expansion

Recent results of a distribution monitoring, carried out by hair-tubes transects (Bertolino in prep.), indicate that the species has not arrived to the Alps yet, but has much expanded its range in respect to previous data (Wauters et al. 1997), arriving to the edge of the alpine region (fig. 2).

A predictive model developed by Lurz et al. (1999) indicates a possible exponential increase of the number on Grey squirrels and of the populations of the species in the next ten years. The risk of a future expansion to the entire Alps, including France and Switzerland in the medium term, is confirmed by the homogeneous and continuous broad leaf woodlands covering most of the Alps (fig. 3). The model developed by Lurz et al (1999) predicts that the colonisation of the Alps will occur within year 2007.

Conclusions

The risk of a Grey squirrel expansion to the alpine region represents one of the major threat to biodiversity at a European scale. Thus, the control and eradication of the species is a priority and should be planned from the Italian authorities; we highlight the importance that in the future France and Switzerland develop action plans to control the species if the expansion will continue.

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Fig. 1 results of the trial eradication in the Racconigi Park ($R^2 = 0.16$)

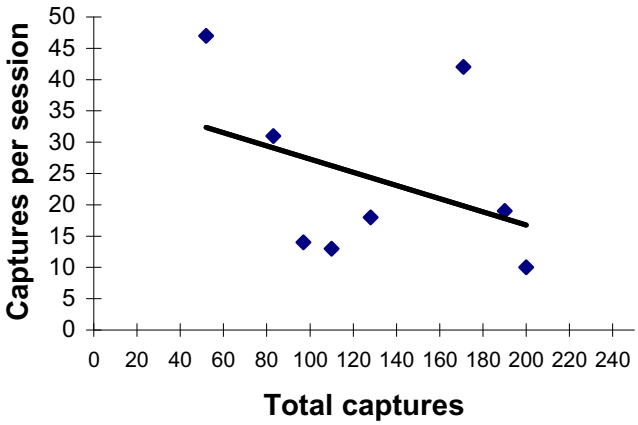


Fig. 2 distribution of the grey squirrel in 1979, in 1996 (Wauters et al 1997), and in 1998 (Bertolino in prep.).

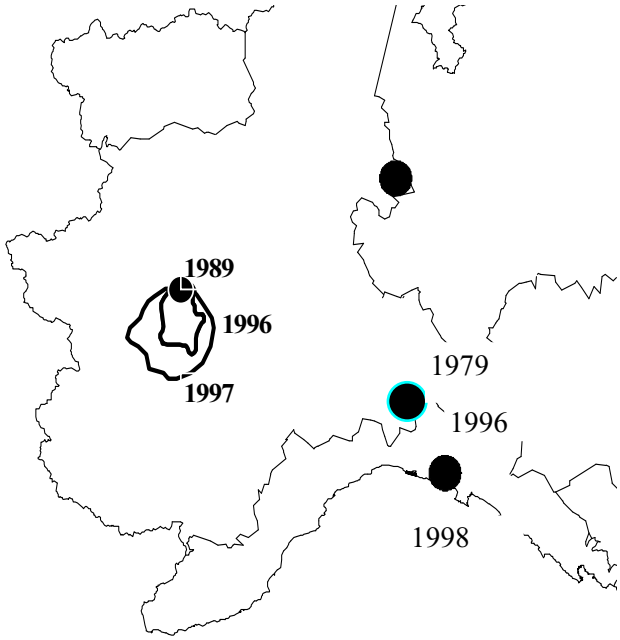
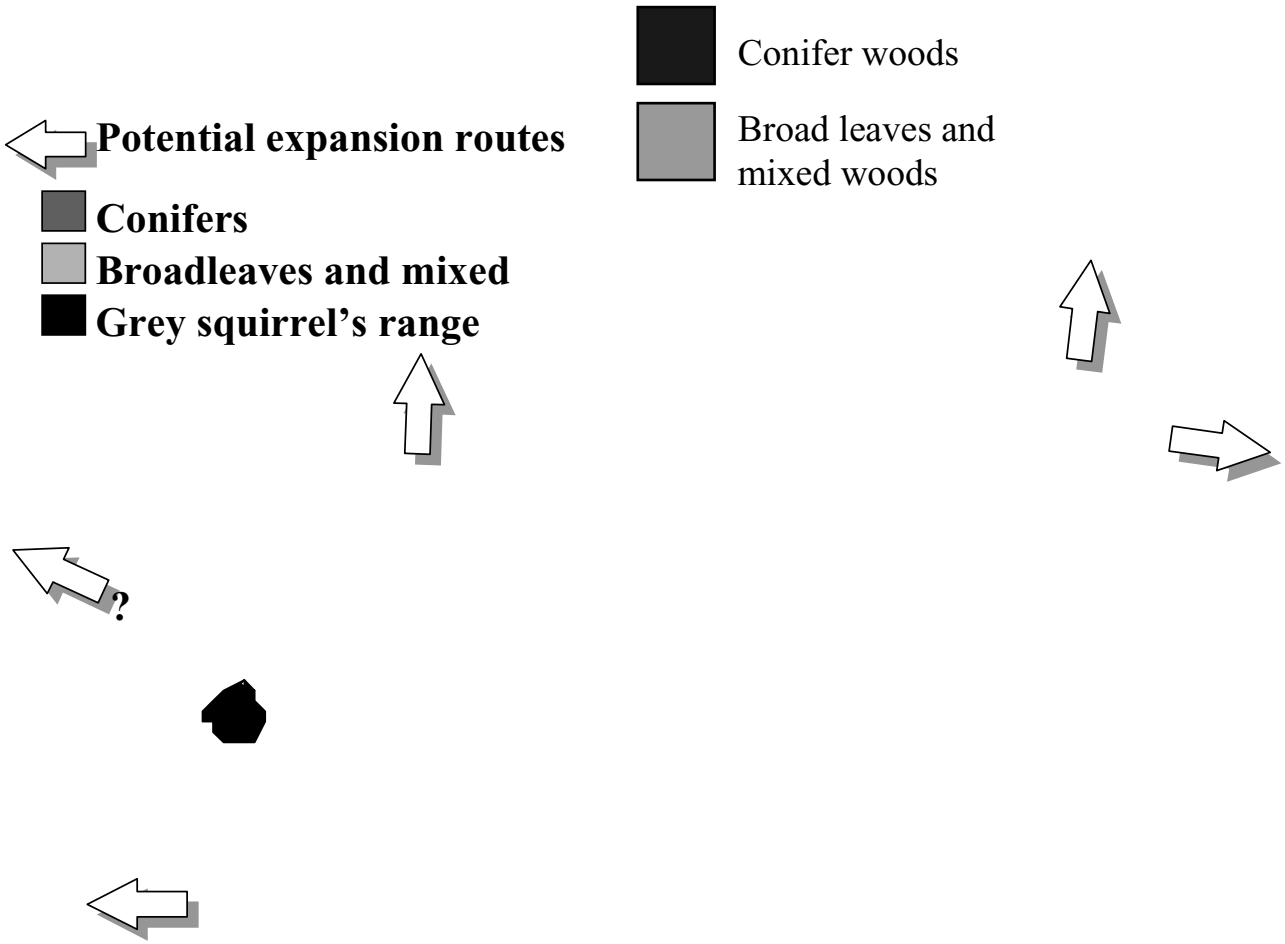


Fig. 3 Map of woodlands in the Alpine region.



15.

Non-native terrestrial vertebrates : Greek cases / Vertébrés terrestres non indigènes : cas grecs

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The issue of the introduction and re-introduction of non-native fauna and flora species is of substantial significance for the wildlife conservation and an increasing problem for the future.

This problem, apart of its national dimension, has a transfrontier one, closely related to the existing international legal instruments and the national legislation.

General provisions for the introduction of the non-native species are contained in the International Law, a synopsis of which follows.

I. LEGAL FRAMEWORK

I.1. Bern Convention

Besides the provisions for the conservation of the European wildlife and natural habitats Article 11, paragraph 2.*b*, specifically is related to the strict control over the introduction of the non-native species. Furthermore, other provisions relate directly or indirectly to the subject, i.e. Article 6, paragraph *e* (internal trade in animals listed in Appendix II of the Convention), Article 7, paragraph 3, sub-paragraph *c* (regulation of transport of wild animals) and Article 9, paragraph 1 (derogation permitted for purposes of repopulation and reintroduction) should be taken into consideration.

The Standing Committee of the Bern Convention has also adopted relevant Recommendations, general or species oriented, i.e.:

- Recommendation No. 37 (1997) on the implementation of organisms belonging to non-native species into the environment, sets general principles and guidelines for controlling introductions of non-native species;

- Recommendation No. 31 (1991) on the protection of the European Mink *(Mustela lutreola),* calls the Contracting Parties for taking measures to reduce the numbers of American mink in areas known to be occupied by the European mink;

- Recommendation No. 61 (1997) on the Conservation of the White-headed Duck *(Oxyura leucocephala),* which recognizes the critical importance of the expansion in Europe of Ruddy-duck, *Oxyura jamaicensis*, on the future of the native endangered *Oxyura leucocephala* and that the eradication of *Oxyura jamaikensis*, is just an instrument in the conservation of the white-headed duck.

I.2. Convention on Biological Diversity

Basic commitments for each Contracting Party are derived directly from Article B.*h,* according to which "*each Contracting Party, shall, as far as possible and as appropriate, prevent the introduction of, control or eradicate those alien species*" and indirectly from Article 14, according to which "*each Contracting Party, as far as possible and as appropriate shall take measures for impact assessment and minimizing adverse impacts at national and transboundary level*".

I. 3. Bonn Convention

On the basis of Article III.4, paragraph C, in respect to the Endangered Migratory Species of Annex I, the Contracting Parties, which are Range States of one of these species, to the extent feasible and appropriate must endeavor to prevent, reduce or control factors that are endangering or are likely to further endanger the species including strictly controlling the introduction of, or controlling or eliminating, already introduced exotic species.

As for the conclusion of Agreements, relating to the species listed in Annex II Article V, paragraph 4, of the Convention provides for "*where appropriate and feasible, each Agreement should provide for strict control of the introduction of, or control of already introduced exotic species, detrimental of the migratory species*".

Only in the Agreement on African / Eurasian Migratory Waterfowl, in Article III.1.*g* the Parties, shall "*prohibit the deliberate introduction of non-native waterbird species into the environment and take all appropriate measures to prevent the unintentional release of such species if this introduction or release would prejudice the conservation status of wild flora and fauna; when non-native waterbird species have already been introduced the Parties shall take all appropriate measures to prevent these species, from becoming a potential threat to indigenous species*".

I. 4. Barcelona Convention (Diversity in the Mediterranean)

The Geneva Protocol of 1982 on Specially Protected Areas in the Mediterranean Article 7.*e* prohibits the introduction of exotic species, only in protected areas. However the newly elaborated Protocol, not yet in force «*On the Protocol on Specially Protected Areas and Biological Diversity in the Mediterranean*» state that according to Article 6, paragraph *d*, the Contracting Parties, shall take the protection measures required for regulation of the introduction of any species not indigenous in the Specially Protected Area in question, whereas according to Article 13 the Parties shall take all appropriate measures to regulate the intentional or accidental introduction of non-indigenous to the wild and to prohibit those that may have harmful impacts on the ecosystems, habitats or species in the area, to which this Protocol applies. (i.e. the Mediterranean Sea, the seabed and subsoil, the terrestrial coastal areas design be each of the Parties including wetlands).

This Article provides for the eradication of already introduced species after scientific assessment, it appears that such species cause or are likely to cause damage to ecosystems, habitats or species in the area in which the Protocol applies.

I. 5. CITES Convention

This Convention sets the rules for the international trade in endangered species of wild fauna and flora, amongst which non-native ones are included.

I.6. "Bird Directive" 79/409/EEC

Besides to the provisions for the conservation of the wild birds and their habitats Article 11 states that "*Member States shall see that any introduction of species of birds which do not occur naturally in the wild state in the European territory of the Member States does not prejudice the local flora and fauna. In this connection they shall consult the Commission".*

I.7. "Habitats Directive" 92/43/EEC

Article 22 states that Member States ensure the deliberate introduction into the wild of any species, which is not native to their territory is regulated, so as no to prejudice natural habitats, within their natural range or the wild fauna and flora and if they consider it necessary, prohibit such introduction. The results of assessment undertaken shall be forwarded to the Committee for information.

NATIONAL LEGISLATION

I.8. Law 1650/1986

On the protection of the Environment by Article 20 sets the obligation for the protection and conservation of the native fauna and flora species.

I.9. Legislative Decree 86/1969

Forest Code by Article 25A, paragraph 2, as modified by Law 177/1975, Article 4, provide for the operation of the Game Breeding Stations, the Game Refuges and the Controlled Hunting Areas.

Only in the Controlled Hunting Areas selective hunting is permitted as a management means of the indigenous or imported game species.

1.10. Ministerial Decision No. I 1B/2000/19

«Sanitary Regulation on the Condition for the Establishment and Operation Bird / Animal Farming Installations».

This Decision refers to :

a. Bird - Animal Farming Installations

Apart of the Building Permit and the Operation Permit**,** which follow, the Environmental Permit is the first step.

The Environmental Permit, issued by the Competent Regional and Prefectural Authorities, is mainly focusing on the conditions for the disposal of the liquid and solid treated wastes and for the protection of public health.

b Game Breeding Stations

With regard to the introduced, non-indigenous fauna species the Competent Sanitary Committee, decides upon the location of the Breeding station for those species, which will be used for controlled hunting, as well as upon the wastes treatment, from the point of view of public health.

c. Pet's Keeping Selling

There are provisions only of sanitary character.

II. GENERAL PICTURE

Referring to the non-native, terrestrial vertebrate species in Greece, their occurrence in the wild is very limited and it is the result of *deliberate* or *accidental* (actual or potential) releases.

The animal - bird farms and the game breeding stations are considered as potential source of accidental releases.

The impact on natural ecosystems of these releases and the acclimatization of non-native species are not thoroughly examined. In this sense monitoring procedure, wherever might be appropriate is not in place.

The whole situation does not justify the application of control and/or eradication schemes for non-native terrestrial vertebrate species.

Examining the subject of releases, on the basis of information provided by the Ministry of Agriculture, the following are presented.

II.1. Deliberate Releases

a. Mammals

In the middle of 70`s, the *Ovis mousimon* (mufflon) has been released, by the Forestry Services, in Controlled Hunting Areas and Selective hunting is applied for the species management. This species has been also released in game sanctuaries.

By the same time *Myocastor coypus* has been released in two lakes in Northern Greece, and it has then expanded.

b. Birds

By the middle of 60`s, the Forestry Service of the Ministry of Agriculture has, firstly, raised in Game Breeding Station and afterwards were released in Controlled Hunting Areas and in Game Refuges the following species : *Callipepla californica* (California qnail), *Colinus virgianus* (bobwhite), *Syrmathicus reevesii* (Reeve`s Phaesant), *Chrysolophus pictus* (Golden Pheasant), *Chrysolophus amherstial* (Lady's Amherst`s) and *Alectoris rufa* (Red - Legged Patridge).

None of them, with the exception of *Alectoris rufa*, has succeeded in the wild. The Red-Legged Patridge has been released in 1985 in the Game Refuges of Northern Sporades and has been fully acclimatized in the Alonissos island (belonging to the Northern Sporades island complex) and a population of about 500 individuals is recorded.

Successful introduction, by the 60`s of *Phasianus colchicus* hybrid, is also recorded, in Controlled Hunting Areas in many areas of the country.

II.2. Accidental Releases

Releases of this category are distinguished in the actual and to potential ones. Considering the latter, not positive case is recorded.

The sources of origin for accidental releases are :

a. Fur Bearing Animals / Fur Farms

In such farms a good number of non-indigenous species have been raised, namely the : *Mustela vison, Nutria nutria, Vulpes vulpes* (variety "argante"), *Lynx rufus, Chincilla chincilla* and *Myocastor coypus*.

With the exception of *Myocastor coypus*, the other cases are considered as potential accidental releases sources.

For the *Myocastor coypus*, actual accidental releases have taken place in Northern Greece where it did not survive, due to cold climatic conditions in the Perspes and Agra lakes, whereas on the contrary, in the case of the Axios delta river (Ramsar site) the coypus survived and has expanded to the southern and western areas of the river delta.

b. Animals Farms

The *Struthio camellus* is raised in animal farms and seventeen such farms are registered, up to now.

III. IMPORTS FOR PET TRADE

Imports for pet trade is a field of activity, contributing, to some extent, to the introduction in the wild of non-native terrestrial vertebrates.

The procedures of the CITES Convention as well as national legislation, wherever appropriate, are applicable for such imports. The Ministry of Agriculture is the Competent National Authority.

Reptiles [Snakes, Terrapins] and Birds [Soft-billed birds, Parrots and Parakeet] are, mainly the introduced groups of animals.

It is now known that the *Psitacula Krameri* (Parakeet) has been established in the wild, at least, in two areas near Athens.

IV. POLICY PLANING

Taking into consideration the actual situation of the aforementioned activities and their future relevant trends are estimated.

For the Fur Farms, there is a negative trend and most of them have been closed down. The Game Species (i.e. Breeding Stations and release in Controlled Hunding Areas), are under Control.

For the Bird Farms there is a positive trend whereas the Pet-Trade activities are slowly increasing.

In relation to the above the Policy Planning focuses in the following sectors

1. Game Farms - Fur Farms – Animal Farms

- The Ministry of Agriculture is expected to complete by the year 2000 of the National Inventory *of the existing Game Breeding Stations (game farms), Fur-Farms and Animal Farms,* with regard to : capacity, location, technical infrastructure, general environmental conditions, legal and administrative arrangements;

- Elaboration of a list of permitted game species, as well as, of the fur bearing and other farm animal species;

- Elaboration of guidelines for the technical infrastructure, in the context also of the animal welfare aspects;

- Elaboration of guidelines for comprehensive environmental assessment, in terms of their potential impact over the native fauna and flora species, as well as, the habitats;

- Elaboration of guideline for emergency action plan, in cases of accidental releases.

2. Pet Trade

- The Ministry of Agriculture is expected by the year 2000 to complete by the National Inventory *of the importers and the retail shops for all kinds of imported animals.*

- Elaboration of a scheme of good keeping practice.

3. Assessment of cases for which control action is or might be needed

16.

Control of non-native terrestrial vertebrates in Finland / Mesures de contrôle des vertébrés exotiques en Finlande

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Of 13 wildlife species introduced to Finland, 11 have established populations in the wild (Table 1, Nummi 1996). This gives a success rate of 85 % - a high figure compared to the "tens" rule (Williamson & Fitter 1996).

Effects of vertebrate introductions in Finland

Introduced species have mainly caused problems in Finland via competition, predation and herbivory; also hybridization has caused some concern (Kauhala 1996, Nummi 1996).

The mink probably has affected native species more than the raccoon dog (Kauhala 1996). This is because it has also colonized the outer bird islands of the Baltic Sea, where such a predator has not existed earlier; the indigenous European mink of Finland apparently did not inhabit large waters (Westman 1968). Black guillemot *Cepphus grylle* and razorbill *Alca torda*, which feed their young in crevice nests for several weeks, are more vulnerable than for example eiders. Hario et al. (1986) noted a clear decline in the numbers of breeding black guillemot in Finnish archipelago as a result of heavy nest predation in several successive years; in some years a considerable number of hens also were killed.

There are two species pairs in which the American counterpart seems to outcompete the Eurasian species: European and American mink, and European and Canadian beaver. In Finland the American mink apparently has hindered the recovery of the European mink - the decline of which, however, started already before the increase of the American species (Maran & Henttonen 1995).

Of herbivores, the most is known about the effects of muskrat. Muskrat alters wetland vegetation succession profoundly (Danell 1977), and it has changed species dominance relations in small lakes in Finland: *Phragmites* and *Typha* have increased at the expense of *Equisetum* and *Schoenoplectus* (Toivonen & Meriläinen 1980).

Not much is known about the effects of other non-indigenous herbivores. Quantitatively, the effects ofthe introduced Canadian beaver may differ from the ecological impact of the European species, because the alien species appears to build more (Danilov 1995, Ruusila 1997). One would also suspect the grazing by the mute swan to have some effect. In dense mute swan areas the production of young has decreased in a density dependent manner (Nummi & Saari 1999), As they are known to be able to reduce the amount of aquatic vegetation (Cobb & Harlin 1980), the mute swans may have locally affected the vegetation to the extent that also other species could be influenced. Apart from causing agricultural damage, the Canada goose "herbivory" is well-known for the nuisance in parks and beaches of USA (Conover & Chasko 1985); Nordic countries are already familiar with the phenomenon also.

One special problem in Finland is to prevent the hybridization of semi-domesticated reindeer (*Rangifer tarandus tarandus*) and wild forest reindeer (*R. t. fennicus*). The distribution areas of the two subspecies meet in northeastern Finland.

Control measures

So far, there is no general policy to control alien species in Finland. Raccoon dog and mink are controlled as a part of game management. In a natural reserve in the southern archipelago, minks have been catched as a measure for bird protection (Nummelin & Högmander 1998). The use of a portable air blower (normally used for collection of leaves) together with a dog has proved to be an effective hunting method. As a result of mink eradication, species like mallard, velvet scoter, tufted duck and mew gull have clearly increased, wheareas e.g. common eider, greylag goose and mergansers were not affected (Nummelin & Högmander 1998).

In context of a rabies epidemic in Finland during 1988-89, raccoon dogs and foxes were orally immunized with Tübingen vaccine baits. The main target of the vaccination program was the raccoon dog in which the most disease cases were detected (Westerling 1991).

A special problem in Finland is the continuous spread of the Canadian beaver. In the east, it crossed the Russian border in the early 1960s (Danilov 1995). In the west, it has reached the area of the European beaver, and, during the last ten years it has also proceeded over one hundred kilometers northwest towards the realms of the European beaver in Sweden (Ermala et al. 1989, Ermala 1996). Canadian beaver apparently have outcompeted the European species in areas where they were both introduced (Ermala et al. 1989). It has been suggested that local populations of Canadian beaver should be exterminated before they start to grow, and large populations should be prevented from invading areas inhabited by the European species (Nolet & Rosell 1998). So far, this has not proved to be very successful; so, probably it would be wise to try to exterminate the European population of Canadian beaver altogether.

Domestic reindeer has been prevented to enter in forest reindeer area with the aid of a fence. Additionally, snowmobiles have been used: domestic reindeers are slower runners than forest reindeers, so they are quite easily catched from a mixed herd of the two subspecies (Keränen 1998, pers. comm.).

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17.

Activities of the World Conservation Union (IUCN) /
Activités de l'Union mondiale pour la nature (UICN)

Dr Piero GENOVESI (member of the IUCN/SSC Invasive Species Specialist Group)

IUCN Guide Lines and Activities for the Prevention of Biodiversity Loss due to Biological Invasions

Biological invasions are considered the second major threat for biodiversity, and such threat is increasing dramatically, also for the rapid development of transport means; thus, in recent years, the World Conservation Union made invasives one of its primary *foci* for global action.

When dealing with biological invasions, actions are often limited by several problems: in fact, despite over a century of organised work on pest prevention and control, the world community today still lacks many of the essential technical tools to overcome this threat; furthermore, many of the tools that do exist are not fully accessible to all nations. Therefore, communication among countries and experts is a priority; in this respect, IUCN carries out several activities, including the technical work of SSC, the policy work of Biodiversity Programme and the Environmental Law centre, and field activities.

The Invasive Species Specialist Group, based in New Zealand, has the specific aim to reduce threats to natural ecosystems and the native species they contain by increasing awareness of invasions, and of ways to prevent, control, or eradicate them; keywords for ISSG action are thus: awareness, prevention, control. The group has presently over 80 members (scientific and policy experts), publishes *Aliens*, a bi-annual newsletter aimed to put researchers in contact and to report news on invasive species, and co-ordinates a listserver with over 473 subscribers.

The Global Invasive Species Programme (GISP), co-ordinated by SCOPE (Scientific Committee on Problems of the Environment) and in which the World Conservation Union is a major partner, is a specific project aimed to develop guide lines and tools to support actions toward invasives. Some of the principles identified by the GISP work are: 1. the need of an early warning of incipient invasions, that can only be achieved if people are aware of both the potential extent of damage, and the likelihood that it will occur; 2. management will only be effective, firstly if an early warning system evolve and people use it, and secondly if contingency plans for rapid response are designed and set in motion. GISP is also developing toolkits for conservation action: the International Invasive Species Database, and the World's 100 Worst Invasive Species. The production of lists of invasive species can help governments to more efficiently prevent further introductions and to promote actions in the early stages of invasions.

IUCN is preparing updated Guidelines for the Prevention of Biodiversity Loss due to Biological Invasion; the final draft, produced in February 1999 and mailed to IUCN members for review in March 1999, is available on the net. The Guide Lines underline the importance of targeting communities and public with appropriate information and the need of adequate

communication strategies. A general principle defined by the Guide Lines, is that prevention is the cheapest and most preferred option; for this reason, we need to act rapidly to prevent introduction. Furthermore, a precautionary principle should be followed: “invasive species are guilty unless proven innocent”. Another approach proposed by the Guide Lines and aimed to prevent accidental introduction, is “the polluter pays” principle, that links responsibility to the damage. Europe has a particular sensitivity to animal welfare, and control methods should consider this aspect; nevertheless, it is important to affirm the principle that eradication methods should be consistent with the aim of permanently eliminating the invasive species. Another peculiarity of the European region, is the presence of a large number of pets, and, subsequently, of feral animals; it is important to stress that a significant benefit can be achieved by eradicating feral species especially from islands, and this should be considered an important management tool. Finally the Guide lines underline as the success of control is the response in the species, habitat or ecosystem that the control aims to benefit; we thus need to accurately monitor not only the alien species, but also the whole ecosystem.

In conclusion, for more effective actions to prevent and control the threats posed by biological invasions in Europe, future efforts should be concentrated in implementing common legislation, and European Action Plans. Useful tools are the development of European list of Invasives, and means of information exchange among states and experts, to promote prevention of new introductions and an early warning for newly established invasives.

18.

Human dimension in wildlife management – gaining public acceptance / Dimension humaine de la gestion de la vie sauvage – gagner l'approbation du public

Dr. Alistair J. BATH
(Department of Geography, Memorial University of Newfoundland, Canada)

Introduction

Attempting to implement management plans to control and eradicate non-native terrestrial vertebrate species can often be opposed by various publics. This opposition can occur for a variety of reasons and is often strong enough to stop the control and eradication program. As public interest in, and opposition to the issue increases, wildlife managers are frequently heard saying: "the public doesn't understand the issue, and the public just needs to be educated, then they will see that what we as managers are proposing is what should be done." Unfortunately, bringing the public on side requires more than just another generic education and information program. For such awareness programs to be effective they must be targeted specifically to those beliefs which are most directly linked to attitude. While there may be biological facts about the species that are interesting from a biological viewpoint, if such information is not significant in influencing attitudes, it may not be worthwhile to include it in the educational program. Different interest groups or publics may hold different beliefs, and may have different beliefs which are most influencing their attitudes toward acceptance or rejection of the wildlife program, thus each group may require a slightly different educational program to be truly effective in changing attitudes.

This being said about the importance of targeted educational programs, the reason for the conflict and opposition may have nothing to do with a lack of knowledge and understanding of the issue, but may be due to many other reasons. In these situations the best designed educational program will still not be effective in changing attitudes and gaining the necessary support for the wildlife management program because the conflict is not about knowledge but may be about values, costs and benefits, behavioural issues or some combination of all three (These types of conflicts will be explained later in the paper). Similar to the biological research and understanding required to address the control and eradication of a species, understanding the human dimension of the wildlife resource management equation and gaining public acceptance of controversial wildlife programs requires social science research. Through an understanding of the various publics, the identification of the nature of the conflict, and the appropriate use of methods to involve people in reaching decisions, managers can implement management plans successfully.

To aid wildlife managers striving to implement control and eradication programs, this paper will outline the nature of human dimensions (HD) in wildlife resource management, discuss the types of conflict, and discuss public involvement as a means to reach better decisions. Many wildlife issues and species, including the eradication and control of non-native terrestrial vertebrate species, often elicit strong public emotions; management becomes as much a socio-political issue as a biological one.

What is the human dimension?

Each resource management issue including wildlife issues such as the control and eradication of non-native terrestrial vertebrate species, has two broad components: a human and a biophysical. Within the human component there are several perspectives that can be examined including economic, legal, institutional, political and social issues. Together these perspectives make up the human dimension in resource management. Mitchell (1989) integrates these perspectives into a framework and suggests that they can be examined over a temporal and spatial scale. Most of the issues then in resource management are more human in nature than biophysical.

While wildlife managers have realized for many years that the public support is needed to implement wildlife programs, wildlife managers have struggled with how to understand their resource constituency and how to influence people's attitudes and behaviour. Aldo Leopold, considered the founder of wildlife management in North America, remarked in the early 1940s that the problem of game management is not how we should handle the deer but how we should handle the people (Flader 1974). Wildlife management definitions clearly emphasize the importance of understanding people. One such definition discusses how wildlife management consists of three parts: understanding the population aspects of the species, understanding the habitat, and understanding people. It explicitly states that "everything done in wildlife management is done for the people"(Anderson et al. 1987). And although this emphasis has been in wildlife management definitions for more than ten years, wildlife managers tend to remain trained very well in biological issues and habitat issues, but struggle when they find that most of their job is dealing with people.

Because most biologists are not trained in this study of people, HD research has been completed by geographers, sociologists, foresters, and economists and hence results are often scattered through a variety of journals. The importance of a scientific understanding of people in wildlife management issues is being increasingly recognized by wildlife agencies; more recently wildlife agencies are hiring human dimension specialists on staff.

Human dimensions in wildlife resource (HDWR) management has been defined as that research which "focuses on the public's knowledge levels, expectations, attitudes and activities concerning fish and wildlife resources and associated habitats. There is a close tie between human dimensions and conservation education research" (Adams 1988). Research on human dimensions in wildlife has taken several directions, each addressing various aspects of the definition above. Early research focussed upon public relations and wildlife issues (Cain 1960, Gilbert 1966). During the 1970s, a proliferation of articles dealt mostly with the characteristics of hunters and fishermen (Applegate 1973, Eisele 1973 Shaw and Gilbert 1974). While in the late 1970s there were more articles concerning hunting and fishing, there were also broader articles dealing with wildlife-related recreation and urban wildlife. More articles appeared in the late 1970s discussing non-consumptive wildlife issues (Lime 1976, Wilkes 1977, Langenau 1979). In the 1980s while there continued to be work published on deer hunters, broader articles on attitudes toward wildlife emerged (Kellert 1980) and on economic values of wildlife (Berryman 1987, Decker and Goff 1987). HDWR research in the 1990s has focussed on funding non-game programs (Heberlein 1991) and future directions for HDWR (Giglotti and Decker 1992). In addition, several articles on attitudes toward predators, particularly wolves, emerged in the 1990s (Bath 1991, Bath 1996, Bath 1998, Vitterso et al. 1999).

Applying human dimensions research specifically to eradication and control of non-native species has been limited. Bath (1998) completed a study of beliefs, perceptions of risk, tolerance of risk, and public willingness to change behaviour concerning the non-native species moose (*Alces alces*) in Newfoundland, Canada. In the province consisting of approximately 425,000 people with basically one major road across the province (1000km from east to west), there are approximately 800 moose-vehicle collisions per year. Working with biologists who had found no pattern in the accidents in terms of condition of the moose, habitat, age and sex, data was collected about people's driving behaviour, experience, perception and tolerance of risk. Integrating the human component provided a more complete picture of the moose-vehicle issue and should help in reducing the number of collisions.

The moose-vehicle collision example helps illustrate another key issue, the perception of whether the issue is a problem and whether the damage is tolerable. Orueta and Ramos (1998) suggest that one of the management options when facing alien species is limiting the population to levels where damage is tolerable. Damage is a subjective term; what is damage to one individual or group may not be seen as damage by another. The amount of damage tolerated is also subjective and determined by human values, willingness to make trade-offs, costs and benefits, and past experience with both the species and the management agency in charge of the species. Decker and Purdy (1988) developed the concept of wildlife acceptance capacity (WAC) to address human tolerance for a species. Similar to a biological carrying capacity, the various publics have an upper limit of acceptance for a species; they have applied the concept to black bear and deer management issues in the eastern United States.

Addressing conflicts and involving people

Human dimensions research can be used to identify the types of conflict which exist within an issue and the best way to proceed. HD research is however, only one mechanism of many which can be used to involve the publics and to gain a better understanding of the publics. In this final section of the paper the types of conflicts and the nature of public involvement in resource management decision-making are outlined.

There are basically four types of conflicts which can occur when trying to implement a management plan, program or action. There may be a cognitive conflict between the key interest groups and the management agency. Basically this means that there are differences in factual knowledge which lead groups to different conclusions. For example, one group believes there are only 50 animals left of a particular species and comes to a conclusion to protect them all, while another group believes there are 5,000 animals and that they should not be protected. A targeted education program could eliminate this type of conflict.

The second type of conflict which may exist is a values conflict. Two groups agree that there are 50 animals left, but one group believes that these animals are not important (not valued), especially if the animals are protected, as this may threaten the development of a good transportation network through their existing habitat.

The third conflict may be about costs and benefits. Two groups agree on the facts, and the importance of protecting the species but disagree over where it will be protected. One group recognizes that if it is protected in their immediate area they will gain significant eco-

tourism dollars whereas the other group will not so they end up disagreeing. The disagreement occurs over the costs and benefits.

The final conflict is a behavioural conflict. Two groups may agree on facts, values and costs and benefits but one group chooses to disagree because they do not trust the management agency or the individual behind the program. Perhaps one group was misled in the past and this is now an opportunity to get back at the agency resulting in the conflict. It is possible that several conflicts occur at the same time. Human dimensions research can aid managers in identifying the nature of the conflict and work towards resolving the issue.

While wildlife managers often see involving people as a legal requirement or as an unfortunate stumbling block to implementing a program, a well-designed public involvement process can build credibility and cooperation between the agency and the various publics. Public involvement can take many forms and is really about redistributing power from decision-makers to the various publics. Involving people early in the planning process is essential as many conflicts occur when decisions have already been made and the public is allowed to participate only at the end.

If wildlife resource managers are to manage public resources truly for the benefit of the entire public, they must learn more about the people, their wants, concerns, expectations, attitudes and behaviour. For successful implementation of wildlife programs HDWR research and public involvement programs should be pro-active, rather than crisis management driven, longitudinal in design to allow for monitoring of attitudes and knowledge as the wildlife population numbers change, rather than one-shot studies, representative of the entire constituency, not just the vocal lobby groups, and truly integrated into the daily decisions of wildlife managers.

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COUNCIL OF EUROPE CONSEIL DE L'EUROPE

APPENDIX 1

Strasbourg, 17 May 1999 T-PVS/Eradication (99) 1

CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE AND NATURAL HABITATS

WORKSHOP ON THE CONTROL AND ERADICATION OF NON-NATIVE TERRESTRIAL VERTEBRATES

Malta, 3 – 5 June 1999

PROGRAMME

Wednesday 2 June 1999

Arrival of participants at Gudja airport in Malta

Registration

Night in the Victoria Hotel – George Borg Olivier Street, Sliema

Thursday 3 June 1999

8.30– 9.00	Registration
9.00– 9.30	Opening of the meeting and welcome by the Minister or an official from the Ministry of the Environment of Malta Speech of thanks by the Council of Europe
9.30–13.00	Scientific session
13.00–15.00	Lunch
15.00–18.00	Scientific session

Night in the Victoria Hotel – George Borg Olivier Street, Sliema

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COUNCIL OF EUROPE CONSEIL DE L'EUROPE

ANNEXE 1

Strasbourg, le 17 mai 1999 T-PVS/Eradication (99) 1

CONVENTION RELATIVE A LA CONSERVATION DE LA VIE SAUVAGE
ET DU MILIEU NATUREL DE L'EUROPE

ATELIER SUR LA LIMITATION ET L'ERADICATION DES VERTEBRES TERRESTRES NON INDIGENES

Malte, 3–5 juin 1999

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PROGRAMME

Mercredi 2 juin 1999

Arrivée des participants à l'aéroport de Gudja à Malte

Inscription

Nuit à l'Hôtel Victoria – George Borg Olivier Street, Sliema

Jeudi 3 juin 1999

8h30- 9h00 Inscription

9h00- 9h30 Ouverture de la réunion et allocution de bienvenue par le ministre ou une personnalité officielle du ministère de l'Environnement de Malte
Discours de remerciements par le Conseil de l'Europe

9h30-13h00 Session scientifique

13h00-15h00 Déjeuner

15h00-18h00 Session scientifique

Nuit à l'Hôtel Victoria – George Borg Olivier Street, Sliema

Friday 4 June 1999

9.30–13.00	Scientific session
13.00–15.00	Lunch
15.00–18.00	Scientific session
20.00	Closing reception kindly offered by the Maltese authority
	Night in the Victoria Hotel – George Borg Olivier Street, Sliema

Saturday 5 June 1999

9.00	Departure by bus for a day excursion

Sunday 6 June 1999

Departure of participants

Vendredi 4 juin 1999

9h30-13h00 Session scientifique

13h00-15h00 Déjeuner

15h00-18h00 Session scientifique

20h00 Réception de clôture offerte par les autorités maltaises

Nuit à l'Hôtel Victoria – George Borg Olivier Street, Sliema

Samedi 5 juin 1999

9h00 Départ en bus pour une journée d'excursion

Dimanche 6 juin 1999

Départ des participants

PROGRAMME OF SCIENTIFIC SESSIONS

Thursday 3 June 1999

9.00- 9.30	Welcome speech by the Maltese authority Presentation of the Workshop by the Secretariat of the Council of Europe
9.30- 9.50	Methods to eradicate the American mink (*Mustela vison*) in Iceland Prof. Pall HERSTEINSSON (University of Iceland)
9.50-10.10	Eradication of mammals introduced in the islands Mr Michel PASCAL (National Institute for the Agronomic Research, France)
10.10-10.30	Control and eradication of non-native terrestrial vertebrates in Cyprus Ms Myroula HADJICHRISTOPHOROU (Ministry of Agriculture)
10.30-10.50	Habitat restoration on Deserta Grande, Madeira (Portugal): eradication of non-native mammals Mr Paulo Jorge S.G. OLIVEIRA (Natural Park of Madeira)
10.50-11.15	*Coffee break*
11.15-11.35	Control and eradication of non-native terrestrial vertebrates in the Netherlands Mr Jan-Willem SNEEP (Ministry of Agriculture)
11.35-12.00	The effect of non-native American mink on breeding coast birds in the archipelagos in the Baltic Sea Mr Åke ANDERSSON (Swedish Association for Hunting and Wildlife Management, Sweden)
12.00-13.00	Discussion
13.00-15.00	*Lunch*
15.00-15.20	Management measures against alien vertebrates Mr Jorge FERNÁNDEZ ORUETA (Gestión y Estudio de Espacios Naturales)
15.20-15.40	Neozoa and non-native terrestrial vertebrates management in Switzerland: an overview of current policies and methods Mr Cornelis NEET (Conservation de la Faune-Service cantonal de la Conservation de la nature et de la Faune, Suisse)
15.40-16.00	The use of different kind of baits in death-traps for American mink and the effect on non-target victims in Denmark Mr Anton LINNET (Game-consultant in the Ministry of Environment)
16.00-16.30	*Coffee break*

PROGRAMME DES SESSIONS SCIENTIFIQUES

Jeudi 3 juin 1999

9h00- 9h30 Allocution de bienvenue par les autorités maltaises
Présentation de l'Atelier par le Secrétariat du Conseil de l'Europe

9h30- 9h50 Méthodes d'éradication du vison d'Amérique (*Mustela vison*) en Islande
Prof. Pall HERSTEINSSON (Université d'Islande)

9h50-10h10 Eradication des mammifères introduits en milieu insulaire
M. Michel PASCAL (Institut national de recherche agronomique, France)

10h10-10h30 Quelques exemples de limitation et d'éradication de vertébrés terrestres non indigènes à Chypre
Mle Myroula HADJICHRISTOPHOROU (ministère de l'Agriculture)

10h30-10h50 Rétablissement de l'habitat du Deserta Grande, Madère (Portugal) : éradication de mammifères non indigènes
M. Paulo Jorge S.G. OLIVEIRA (Parc naturel de Madère)

10h50-11h15 *Pause café*

11h15-11h35 Contrôle et éradication de vertébrés terrestres non indigènes aux Pays-Bas
M. Jan-Willem SNEEP (ministère de l'Agriculture)

11h35-12h00 Les effets du vison d'Amérique non indigène sur la reproduction des oiseaux côtiers dans les archipels de la mer Baltique
Mr Åke ANDERSSON (Association suédoise pour la gestion de la chasse et de la vie sauvage)

12h00-13h00 Discussion

13h00-15h00 *Déjeuner*

15h00-15h20 Mesures de gestion contre les vertébrés exotiques
M. Jorge FERNÁNDEZ ORUETA (Gestión y Estudio de Espacios Naturales)

15h20-15h40 Gestion des vertébrés terrestres non indigènes néozoïques en Suisse : vue d'ensemble des politiques et méthodes en cours
M. Cornelis NEET (Conservation de la Faune, Service cantonal de la Conservation de la nature et de la faune, Suisse)

15h40-16h00 L'utilisation des différents types d'appâts pour pièges pour le vison d'Amérique et l'effet sur les victimes non cibles au Danermark
M. Anton LINNET (Consultant pour le gibier, ministère de l'Environnement)

16h00-16h30 *Pause café*

17.00-17.0 Non-native terrestrial vertebrates in Latvia
Mr Vilnis BERNARDS (Environmental Protection Department)

17.00-17.0 Eradication of *Myocastor coypus* in United Kingdom
Mr Simon BAKER (Farming and Rural Conservation Agency – Ministry of Agriculture)

17.00-17.0 Discussion

Friday 4 June 1999

9.00- 9.20 Strategy to control the Muscat rat (*Ondatra zibethicus*) in the Walloon Region of Belgium
Mr Francis LAMBOT (Ministry of the Walloon Region)

9.20- 9.40 The Status of the Ruddy Duck (*Oxyura jamaicensis)* in the Western Palearctic and an action plan for eradication, 1999-2002
Dr Baz HUGHES (The Wildfowl & Wetlands Trust, United Kingdom)

17.00-17.0 Conservation of *Sciurus vulgaris* and eradication of *Sciurus carolinensis* in Italy
Dr Piero GENOVESI (National Institute for Wildlife – Italy)

10.00-10.20 Non-native terrestrial vertebrates: Greek cases
Mrs Demetra SPALA (Ministry of the Environment of Greece)

17.00-17.0 Control of non-native terrestrial vertebrates in Finland
Dr Petri NUMMI (Department of Applied Zoology, University of Helsinki)

17.00-17.0 *Coffee break*

17.00-17.0 Activities of the World Conservation Union (IUCN)
Dr Piero GENOVESI (member of the Invasive Species Specialist Group)

17.00-17.0 Human dimension in wildlife management – gaining public acceptance
Dr Alistair J. BATH (University of Newfoundland, Canada)

17.00-17.0 Discussion

17.00-17.0 *Lunch*

17.00-17.0 Bern Convention action needed :

- drafting a Recommendation for the Standing Committee of the Bern Convention ;
- preparing a list of non-native terrestrial vertebrates the eradication of which is considered a priority, to be included in the Recommendation.

17.00-18.00 Conclusion of the Workshop

16h30-16h50 Vertébrés terrestres non indigènes en Lettonie
M. Vilnis BERNARDS (Département de la Protection de l'Environnement)

16h50-17h10 Eradication de *Myocastor coypus* au Royaume-Uni
Mr Simon BAKER (Farming and Rural Conservation Agency – ministère de l'Agriculture)

17h10-18h00 Discussion

Vendredi 4 juin 1999

9h00- 9h20 Stratégie de lutte contre le rat musqué (*Ondatra zibethicus*) dans la région wallonne en Belgique
M. Francis LAMBOT (ministère de la Région wallonne)

9h20- 9h40 Le statut de l'érismature à tête rousse (*Oxyura jamaicensis*) dans le Paléarctique occidental et plan d'action pour son éradication, 1999-2002
Dr Baz HUGHES (The Wildfowl & Wetlands Trust, Royaume-Uni)

9h40-10h00 Protection de *Sciurus vulgaris* et éradication de *Sciurus carolinensis* en Italie
Dr Piero GENOVESI (membre du Groupe d'experts sur les espèces invasives)

10h00-10h20 Vertébrés terrestres non indigènes : cas grecs
M^{me} Demetra SPALA (ministère de l'Environnement de Grèce)

10h20-10h40 Mesures de contrôle des vertébrés exotiques en Finlande
Dr Petri NUMMI (Department of Applied Zoology, Université d'Helsinki)

10h45-11h15 *Pause café*

11h15-11h35 Activités de l'Union mondiale pour la nature (UICN)
Dr Piero GENOVESI (membre du Groupe de spécialistes sur les espèces invasives)

11h35-12h00 Dimension humaine de la gestion de la vie sauvage – gagner l'approbation du public
Dr Alistair J. BATH (Université de Newfoundland, Canada)

12h00-13h00 Discussion

13h00-15h00 *Déjeuner*

15h00-17h00 Actions de la Convention de Berne nécessaires :

- élaborer une Recommandation pour le Comité permanent de la Convention de Berne ;
- préparer une liste de vertébrés terrestres non indigènes dont l'éradication est considérée comme une priorité, liste qui doit être incluse dans la Recommandation.

17h00-18h00 Conclusion de l'Atelier

APPENDIX 2 / ANNEXE 2

LIST OF PARTICIPANTS / LISTE DES PARTICIPANTS

I. COUNTRIES / PAYS

BELGIUM / BELGIQUE
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APPENDIX 3

Convention on the Conservation of European Wildlife
and Natural Habitats

Standing Committee

Draft Recommendation No. … (adopted on …December 1999) on the eradication of non-native terrestrial vertebrates.

The Standing Committee of the Convention on the Conservation of European Wildlife and Natural Habitats, in accordance with Article 14 of the Convention,

Having regard to the aim of the Convention to conserve wild fauna and its natural habitats;

Recalling that under Article 11, paragraph 2.*b* of the Convention, each Contracting Party undertakes to strictly control the introduction of non-native species;

Recalling that under Article 8.*h* of the Convention on Biological Diversity, each Party undertakes to prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or indigenous species;

Recalling that the Bonn Convention provides that, with regard to the endangered migratory species listed in its Annex 1, to the extent feasible and appropriate, the Parties must endeavour to prevent, reduce or control "*factors that are endangering or are likely to further endanger the species, including strictly controlling the introduction of, or controlling or eliminating, already introduced exotic species*";

Recalling Article 11 of the EU Directive (79/409/EEC) on the Conservation of Wild Birds, which states that "*Member States shall see that any introduction of species of bird which do not occur naturally in the wild state in the European territory of the Member States does not prejudice the local flora and fauna*";

Recalling that Article 22.*b* of the EU Directive (92/43/EEC) on the Conservation of Natural Habitats and of Wild Fauna and Flora requires the Member States to "*ensure that the deliberate introduction into the wild of any species which is not native to their territory is regulated so as not to prejudice natural habitats within their natural range or the wild native fauna and flora and, if they consider it necessary prohibit such introduction*";

Bearing in mind Recommendation No. R 14 (1984) of the Committee of Ministers of the Council of Europe to Member states concerning the introduction of non-native species;

Recalling Recommendation No. 57 (adopted on 5 December 1997) of the Standing Committee, on the introduction of organisms belonging to non-native species into the environment;

ANNEXE 3

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

Comité permanent

Projet de recommandation n° … (adoptée le … décembre 1999) relative à l'élimination de vertébrés terrestres non indigènes

Le Comité permanent de la Convention relative à la conservation de la vie sauvage et du milieu naturel de l'Europe, agissant en vertu de l'article 14 de la convention,

Considérant que la convention vise à conserver la faune sauvage et le milieu naturel de l'Europe ;

Rappelant qu'aux termes de l'article 11, paragraphe 2.*b*, de la convention, chaque Partie contractante s'engage à contrôler strictement l'introduction des espèces non indigènes ;

Rappelant que, selon l'article 8.*h* de la Convention sur la diversité biologique, chaque Partie s'engage à empêcher que soient introduites des espèces étrangères qui menacent des écosystèmes, des habitats ou des espèces, à les combattre et à les éliminer ;

Rappelant que la Convention de Bonn prévoit, pour les espèces migratrices menacées énumérées dans son Annexe I, que les Parties contractantes s'efforcent, lorsque cela est possible et approprié, de prévenir, de réduire ou de contrôler « *les facteurs qui menacent ou risquent de menacer davantage ces espèces, notamment en contrôlant strictement l'introduction d'espèces exotiques ou en surveillant, limitant ou éliminant celles qui ont déjà été introduites* » ;

Rappelant que l'article 11 de la Directive européene (79/409/CEE) relative à la conservation des oiseaux sauvages prévoit que « *les États membres doivent veiller à ce que l'introduction éventuelle d'espèces d'oiseaux ne vivant pas naturellement à l'état sauvage sur le territoire européen des États membres ne porte aucun préjudice à la flore et à la faune locales* » ;

Rappelant que l'article 22.*b* de la Directive européenne (92/43/CEE) sur la conservation des habitats naturels ainsi que de la faune et de la flore sauvages demande aux États membres de « *veiller à ce que l'introduction intentionnelle dans la nature d'une espèce non indigène à leur territoire soit réglementée de manière à ne porter aucun préjudice aux habitats naturels dans leur aire de répartition naturelle ni à la faune et à la flore sauvages indigènes et, s'ils le jugent nécessaire, d'interdire une telle introduction.* » ;

Considérant la Recommandation n° R 14 (1984) du Comité des Ministres du Conseil de l'Europe aux Etats membres relative à l'introduction d'espèces non indigènes ;

Rappelant la Recommandation n° 57 (adoptée le 5 décembre 1997) du Comité permanent. relative à l'introduction dans l'environnement d'organismes faisant partie d'espèces non indigènes ;

Taking into account that, in Recommendation No. 57, species native to a given territory means a species that has been observed in the form of a naturally occurring and self-sustaining population in historical times; "species" in the sense of this Recommendation refers both to species and to lower taxonomic categories, subspecies, varieties, etc. (thus, for instance, the release of a different non-native subspecies into a given territory should also be considered as an introduction);

Taking into account that, in Recommendation No. 57, "introduction" means deliberate or accidental release, into the environment of a given territory, of an organism belonging to a non-native taxa (species or lower taxa that has not been observed as a naturally occurring and self-sustaining population in this territory in historical times);

Recalling that Recommendation No. 57, recommends that Contracting Parties prohibit the deliberate introduction within their frontiers or in a part of their territory of organisms belonging to non-native species for the purpose of establishing populations of these species in the wild, except in particular circumstances where they have been granted prior authorisation by a regulatory authority, and only after an impact assessment and consultation with appropriate experts has taken place;

Recalling that the methods of eradication should be as selective, ethical and human as possible, consistent with the aim of permanently eliminating the invasive species;

Considering that feral animals (domestic cats, dogs, goats, etc.) and commensal non-native species (*Rattus* spp., *Mus* spp., etc.) can be some of the most aggressive and damaging alien species to the natural environment, especially on islands, and that in some circumstances the removal of feral and commensal non-native species is a management option;

Considering that the introduction of organisms belonging to non-native species may initiate a process (competition with native species, predation, transmission of pathogenic agents or parasites, hybridisation with native species, etc.) which can cause serious harm to biological diversity, ecological processes or economic activities and public life;

Considering that the species introduced into the territory of a State can easily spread to neighbouring States or entire regions and that the damage which may be caused to the environment of other States gives rise to the liability of that State;

Considering that, at the present state of knowledge, the impact of the eradication of invasive species on native flora and fauna, as well as on the functioning of local ecosystems is likely to be uncertain;

Considering that to be successful in eradicating non-native species a national action plan often requires acceptance by the local community,

Considérant que, selon la Recommandation n° 57, il y a lieu d'entendre par espèce indigène à un territoire donné, une espèce qui y a été observée sous la forme d'une population présente à l'état naturel et viable dans les temps historiques ; « espèce », au sens de la présente recommandation, concerne à la fois les espèces et les catégories taxonomiques de rang inférieur, les sous-espèces, les variétés, etc. (ainsi, les lâchers d'une sous-espèce non indigène dans un territoire donné doivent, par exemple, être considérés comme une introduction) ;

Considérant que, selon la Recommandation n° 57, il y a lieu d'entendre par « introduction », la libération ou la dissémination intentionnelle ou accidentelle dans l'environnement d'un territoire donné, d'un organisme appartenant à un taxon non indigène (espèce qui n'a pas été observée sous la forme d'une population présente à l'état naturel et viable dans les temps historiques dans ce territoire) ;

Rappelant que la Recommandation n° 57 recommande aux Parties contractantes d'interdire l'introduction intentionnelle dans l'environnement à l'intérieur de leurs frontières ou d'une partie de leurs territoires, d'organismes appartenant à des espèces non indigènes, dans le but d'y établir des populations de ces espèces, sauf dans des circonstances particulières où une telle introduction a reçu une autorisation préalable émanant d'une autorité investie du pouvoir réglementaire, ce qui ne sera fait qu'à la suite d'une évaluation de l'impact et après consultation des experts appropriés ;

Rappelant que les méthodes d'élimination doivent être aussi sélectives, éthiques et humaines que possible et avoir pour seul but d'éliminer définitivement les espèces envahissantes ;

Considérant que les animaux errants (chats, chiens, chèvres, etc.) et les espèces commensales non indigènes (familles de *Rattus*, *Mus*, etc.) peuvent être les espèces les plus agressives et nuisibles, surtout dans les îles, et que leur élimination peut dans certains cas être une solution pour la gestion de l'environnement ;

Considérant que l'introduction d'un organisme appartenant à une espèce non indigène peut être la cause de processus (concurrence avec des espèces indigènes, prédation, transmission d'agents pathogènes ou de parasites) pouvant porter des atteintes graves à la diversité biologique, aux processus écologiques ou à des activités économiques et à la vie publique ;

Considérant que les espèces introduites sur le territoire d'un Etat peuvent aisément se propager à des Etats voisins ou à des régions entières et que les dommages qui peuvent ainsi être causés à l'environnement d'autres Etats entraîne la responsabilité de cet Etat ;

Considérant qu'en l'état actuel de nos connaissances, les incidences de l'élimination des espèces envahissantes sur la faune et la flore indigènes ainsi que sur le fonctionnement des écosystèmes locaux ne sont pas connues avec certitude ;

Considérant que pour réussir à éliminer les espèces non indigènes, un plan d'action national suppose souvent l'approbation de la population locale,

Recommends that Contracting Parties:

1. Monitor populations of non-native terrestrial vertebrate species within their territory and assess the potential threat to biological diversity. Those species listed in the Appendix to the recommendation are examples which have proved to be such a threat;

2. Assess the feasibility of eradicating those populations representing a threat to biological diversity;

3. Formulate, implement and regularly review national action plans to eradicate populations for which eradication is deemed feasible in Item 2. Monitor the effect of the eradication on native fauna and flora;

4. Set up mechanisms for inter-State co-operation, notification and consultation in order to co-ordinate precautionary and control measures for invasive species;

5. Seek the involvement and co-operation of all interested parties, including non-governmental organisations, local and regional authorities, as well as the scientific communities;

6. Upon understanding the key beliefs which are most directly linked to attitude, gain public acceptance, if appropriate, through launching of public awareness and education campaign informing the general public of the threat represented by non-native species for the indigenous wildlife and its natural habitats;

7. Communicate to the Secretariat, so that it may in turn inform the other Contracting Parties, of any relevant result achieved as well as any information available on the outcome of the measures adopted.

Recommande aux Parties contractantes :

1. de contrôler les populations de vertébrés terrestres non indigènes sur leur territoire et d'évaluer la menace qu'elles représentent pour la diversité biologique. La liste annexée à la présente recommandation énumère quelques-unes des espèces dont l'influence potentiellement nuisible est établie ;

2. d'évaluer la possibilité d'éliminer des populations qui représentent une menace pour la diversité biologique ;

3. de formuler, de mettre en œuvre et de réviser régulièrement des plans d'action nationaux afin d'éliminer les populations pour lesquelles cette mesure a été jugée réalisable aux termes du point 2 et de contrôler les effets de cette élimination sur la faune et la flore indigènes ;

4. de mettre au point des mécanismes de coopération, de notification et de consultation interétatiques pour coordonner les mesures de lutte et de précaution à prendre face aux espèces envahissantes ;

5. de rechercher la participation et la coopération de toutes les parties intéressées, notamment des organisations non gouvernementales, des collectivités locales et de la communauté scientifique ;

6. de convaincre l'opinion publique du bien-fondé des mesures envisagées, en veillant à ne pas heurter les consciences sur des problèmes dont la perception relève directement des valeurs culturelles et en lançant au besoin des campagnes de sensibilisation et d'information sur la menace que les espèces non indigènes représentent pour la faune et la flore sauvages et leurs habitats naturels ;

7. de communiquer au Secrétariat tout résultat atteint dans ce domaine et toute information disponible sur le résultat des mesures prises de manière à ce qu'il puisse à son tour en informer les autres Parties contractantes.

Appendix to the Recommendation No….

EXAMPLES OF INVASIVE SPECIES
WHICH HAVE PROVED TO BE A THREAT TO THE BIOLOGICAL DIVERSITY

_____

Mustela vison (American mink)

Ondatra zibethicus (Muskrat)

Myocastor coypus (Coypu)

Sciurus carolinensis (Grey squirrel)

Oxyura jamaicensis (Ruddy duck)

Cervus nippon (Sika deer)

Procyon lotor (Raccoon)

Nyctereutes procyonoides (Raccoon dog)

Castor canadensis (Canadian beaver)

Appendix to the Recommendation No….

EXEMPLES DESPèECES ENVAHISSANTES
AYANT PROUVÉ ÊTRE UNE MENACE POUR LA DIVERSITÉ BIOLOGIQUE

Mustela vison (vison d'Amérique)

Ondatra zibethicus (rat musqué)

Myocastor coypus (ragondin)

Sciurus carolinensis (écureuil gris)

Oxyura jamaicensis (érismature à tête rousse)

Cervus nippon (cerf Sika)

Procyon lotor (raton laveur)

Nyctereutes procyonoides (loup viverin))

Castor canadensis (castor canadien)