RE-INTRODUCTION NEWS

Newsletter of the Re-introduction Specialist Group of IUCN's Species Survival Commission (SSC)

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Letter from the Chairman
MARK R. STANLEY PRICE

This last six months has seen a significant increase in interest in the group. This is largely because of the Re-introduction Guidelines being placed on the world wide web. These can be found at:

http://www.rbgkew.org.uk/conservation/RSGguidelines.html

In addition, RSG has been receiving more and more queries about the group from re-introduction practitioners in Russia, the Commonwealth of Independent States (C.I.S.) and Eastern Europe. A surprising number of re-introduction programmes have been on-going for many years in this part of the world; most of these, however, are now desperately short of funds and thus most such projects have been terminated. In this issue one section deals specifically with this area of the globe.

RSG has been moving forward in terms of the Nairobi based Project Officers working with RSG members on re-introduction projects. Together with the Plant Section Chair, Mike Maunder (Kew Gardens, UK) and RSG member Stella Simiyu (National Museums of Kenya, NMK), work is due to be carried out with *Saintpaulia*, (see RE-INTRODUCTION NEWS 11) a species which needs priority action. Kew and NMK are also running a course at NMK on plant conservation techniques, with input from RSG.

This is probably the last chance for any members or other newsletter readers who are keen to review the Draft Guidelines for Placement of Confiscated Live Animals to send in their comments. Some major issues have been raised, such as the issue of selling confiscated, illegally-traded live animals. It seems that national legislation is often such that to differentiate between legal sale and illegal sale is impossible, and to try to is extremely unrealistic.

The Re-introduction Guidelines have now been translated into Arabic thanks to the National Avian Research Center (NARC) in United Arab Emirates. RSG is extremely grateful to NARC for doing this. They have also been translated into French and Spanish thanks to IUCN/SSC. RSG is actively looking for them to be translated into Chinese and Russian.

An RSG initiative to develop species-specific guidelines with the relevant Specialist Groups, for both re-introductions and placement of confiscated animals, has raised some interest. Currently only a few Specialist Groups have been approached: Cat, Crocodile, Tortoise and Freshwater Turtle, Seals, Declining Amphibian Populations Task Force, some of which have shown an interest. If there are other Specialist Groups which are keen to develop such guidelines, please contact RSG.

In this issue there are an encouraging number of plant articles, together with some interesting and fairly diverse bird articles. The mammal section starts with an article describing a project being carried out by Scottish National Heritage, looking at the feasibility of re-introducing the beaver in the UK. This is particularly pertinent with regards to two articles in previous issues (RE-INTRODUCTION NEWS 9 and 10) outlining the arguments for and against such a re-introduction. The C.I.S. and Eastern Europe section outlines some work done re-introducing carnivores. Badridze's work was described in detail in RE-INTRODUCTION NEWS 8, but here his article concerns the potential conflict between wolves and local people, and how he went about involving the local communities in the project, thus gaining their respect and encouragement to continue with his work. A most valuable lesson.

There is a section on conservation introductions which contains two articles: antelope in Kenya and mice in Australia. Conservation introductions are often seen in Australia and New Zealand, and only occasionally in Kenya (the introduction of the Southern white rhino into Kenya is an example of a conservation introduction in Kenya).

In Re-introduction Issues the issue of 'quality' of captive bred individuals and their potential as re-introduction candidates is an extremely interesting issue, especially in light of current thinking with regards to zoos.

Please note RSG's new e-mail address:
awfnrb@form-net.com

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RECENT MEETINGS

Amphibian Re-introduction Symposium Summary, May 1995, Canada

The Royal Botanical Gardens (RBG) in Canada hosted a symposium on amphibian re-introductions in support of their amphibian habitat creation project that commenced during the summer of 1995. This project saw the creation of a five pond system in the valley of a wooded marshy floodplain, and is part of a long-term restoration of a 250 hectare urban marsh located on the extreme western edge of Lake Ontario. This area has lost ten out of 15 historically occurring species of amphibians since the 1920's. The symposium was organized to assist in the development of a plan for a proposed re-introduction programme of extirpated species at the newly created site.

There were a number of significant issues and recommendations that arose from the symposium. The first was that RBG should wait for between two to twelve years before attempting any amphibian re-introductions. This would give the site a chance to mature and consequently undergo a natural increase in the availability of suitable microhabitats post-pond construction, which in turn increases the possibility of success for any re-introduction. This period of time also allows populations of organisms which are already on site to stabilize. Re-introducing species into a stable system was viewed as having fewer risks to the area's community structure than a re-introduction into a system undergoing widespread change.

Investigating the possibilities of creating linkages with extant local populations and promoting natural recolonization was also recommended. Natural recolonization was viewed as preferential to re-introduction, with a greater, if less immediate, possibility of establishing a viable population at the target site. Reconnecting severed links between populations fosters the creation of a metapopulation, which greatly increases the chances of persistence of amphibian species in an area. While this is a possibility for some species, there are inherent difficulties associated with a heavily urbanized landscape.

Making a re-introduction at a number of separate but connected areas also fosters the creation of a metapopulation, which consequently increases the possibility of the successful re-establishment of a species. While populations at some sites will undoubtedly disappear due to ephemeral conditions or some other cause, others of the linked populations will remain viable, and can recolonize the empty sites when conditions permit. It may prove necessary to create more sites and develop linkages for a successful re-introduction.

Examination of the community structures at similar sites regionally would also prove beneficial. Determining which species can successfully coexist with others is of great importance in determining an appropriate candidate species for re-introduction. Some species naturally exclude others over time through competition for existing resources and/or predation. Adding a species with almost identical requirements to a site with another species already occupying those niches would prove to be detrimental to the success of the re-introduction, and to the survival of the species already present.

Interrelated to some degree with the above is the size of the site. A large site may have enough micro-habitats to support many species with slightly overlapping requirements, whilst a site too small may not be able to support a viable population of the re-introduced species. Connectivity to surrounding sites influences the latter point.

There was general agreement that genetic samples be taken from the re-introduced population and stored for future comparison with the population on-site once/if it has become established. This would indicate whether the population became established from the re-introduction effort, or from an unforeseen recolonization.

Monitoring the site on a regular basis, both pre- and post- re-introduction, with extensive documenting, was viewed as being of paramount importance.

The proceedings of the RBG's Amphibian Re-Introduction Symposium are being published and will be available in the fall of 1996. They will be available from RBG for a nominal fee.

For more information please contact: Royal Botanic Gardens, PO Box 399, Hamilton, Ontario, Canada, L8N 3HB.

Contributed by Brian Pomfret, Wildlife Biologist, Royal Botanic Gardens, Ontario, Canada.

COURSES

Dangerous Drugs/Wildlife Restraint Course: 1997

This three day course is being held in Harare, Zimbabwe, from Tuesday 18 February to Thursday 20 February 1997. On Friday 21 February there will be a wildlife seminar involving two themes: 'Veterinary constraints to wildlife utilization in Africa', and 'Human population and wildlife conservation'. The written and oral examination for the course will be on Monday 24 February.

The course is aimed at veterinarians, biologists and those involved in the handling, translocation and/or capture of wildlife. The cost for non-Zimbabweans is US$350.00, which includes the three day course with teas and lunches, the seminar and examination.

For more information contact: Janine Honywill, Wildlife Unit, Veterinary Research Laboratory, P.O. Box CY 551, Causeway, Zimbabwe. Fax: 263-4-707952.

BOOK REVIEW

Reintroduction Biology of Australian and New Zealand Fauna, edited by Melody Serena. (Surrey Beatty & Sons, Sydney, 1995) 264 pp, A4 hard-cover, RRP A$75.00).

In New Zealand, there is a long tradition of using translocations of threatened animals to aid species' conservation. The survival of a number of species of flightless birds, under threat from exotic mammalian predators introduced on mainland New Zealand, has relied on this

intervention. In Australia, the recent demonstration that the introduced red fox is currently threatening wildlife populations as a result of its rapidly growing population has proven that translocated individuals can successfully establish a self-sustaining population. This has resulted in a dramatic increase in the use of re-introduction as a conservation tool. Where once translocation was used in a somewhat arbitrary and haphazard manner, modern imperatives, fostered by the IUCN/SSC Re-introduction Specialist Group, require a more scientific approach.

This volume includes spoken papers presented at a conference entitled "Reintroduction Biology of Australasian Fauna" held at Healesville Sanctuary, Victoria, Australia in April 1993. The conference brought together representatives of government agencies, universities, community groups and private individuals involved in the theoretical and practical aspects of reintroduction biology.

The 38 chapters in this volume also include three articles added after the conference to broaden the final content. In the first section of the book, a group of three papers explores the value of applying population modelling techniques, for instance, to generate success/failure predictions and make recommendations about re-introduction strategies. A series of review articles follows, covering translocations in various areas and animal groups. The majority of chapters, however, contain accounts of re-introductions recently carried out or in progress, giving the book a very practical focus, with detailed accounts of successes and failures, lessons learnt, and strategies employed.

The taxonomic distribution of the research papers indicates the breadth of the book. There are 14 papers concerning projects on mammals, nine on birds, one each on reptiles, amphibians and fish and four concerning invertebrates. Given that the conference was held in Australia, the contribution of 11 papers from New Zealand underlines the strength of work in that country.

A strong message which emerges from eloquently argued chapters by Soderquist, Armstrong and Southgate is the necessity for re-introductions to be structured as experiments, if advances are to be made in knowledge about strategies and management techniques. It is encouraging that many of the projects reported in other chapters have employed this strategy.

The account of a project involving a high degree of public participation, namely the habitat restoration and faunal re-introduction project on the island of Tiritiri Matangi, near the city of Auckland, makes fascinating reading. In times when the public purse is shrinking and the private sector is sometimes slow to take over the funding of conservation, the potential contribution of volunteers is enormously important. The challenge is presented to government agencies to foster and utilise this resource.

Books on re-introduction biology as such are few and far between. Some recent additions have attempted to fill the gaps, but often their content has been restricted or limited to theoretical rather than practical aspects of the theme. This book contains a long list of papers on work at the coalface of re-introduction. It is required reading by practising re-introduction biologists, theoreticians wishing to make a contribution to the conservation of threatened species, and those who determine or influence wildlife conservation policy.

Contributed by Tony Friend (RSG Australia/Marsupial Section Chair), Dept. of Conservation, Western Australia.

BIRDS

Experiments and success with release of helmeted honeyeaters, Australia

The helmeted honeyeater *(Lichenostomus melanops cassidix)* is restricted to one population of about 100 birds along five kilometres of remnant streamside habitat in southern Victoria. Since 1989, it has been the subject of an intensive collaborative recovery effort led by the Victorian Department of Conservation and Natural Resources, Healsville Sanctuary and a community group, 'Friends of the Helmeted Honeyeater'.

Captive management of helmeted honeyeaters began at Healesville Sanctuary in late 1989 (see RE-INTRODUCTION NEWS 2, May 1991). This component of the recovery effort for the bird suffered a major setback when the incorrect dosage



Helmeted honeyeater (Lichenostomus melanops cassidix)

of a vitamin supplement resulted in the accidental mortality of most of the birds in late 1992. The captive population has been rebuilt since the 1993/94 breeding season by foster-raising helmeted honeyeaters from wild-laid eggs placed under Gippsland yellow-tufted honeyeaters *(Lichenostomus melanops gippslandicus)*. Consequently, the current breeding season is the first in which the captive group contains a number of birds old enough to reproduce consistently. Prior to this season, which commenced in August 1995, only one bird had previously been produced by captive helmeted honeyeater parents, in 1990.

The sudden loss of most of the captive group allowed an increased availability of staff time and resources from Healesville Sanctuary and occurred at a time when it was felt that the wild population had reoccupied all of the suitable habitat that was then accessible. Combined, this presented an ideal opportunity to commence experiments with establishing birds at sites the species had previously inhabited, but now apparently cannot reach by natural dispersal.

Re-introduction experiments

Since 1983 the Recovery Team has conducted experimental releases from two aviaries at a location beside Woori Yallock Creek in the Yellingbo State Nature Reserve and which was inhabited by helmeted honeyeaters until 1978. This site is separated from the closest group of wild birds, at Cockatoo Creek, by a little more than a kilometre of cleared farmland which these essentially sedentary, riparian zone birds are disinclined to traverse. The object is to develop techniques which will encourage birds to form fidelity to sites and remain resident, and then apply these in re-establishing groups of the birds more widely within their former range. The concept behind experimental design has been to begin with simple techniques and progress towards more complex methods only as necessary.

Initial trials involved translocation of wild birds, because the wild population has been increasing since its lowest ebb in 1990 and because no captive birds were then available. Birds of different ages and social status had been maintained in these aviaries for various periods prior to release.

In May 1993, an experienced breeding pair was moved from a rather small territory in the wild and housed in an aviary at the trial site. Six weeks later the male was released in the hope that the presence of his mate would hold him in the vicinity. Within 24 hours, however, he was found back at his original territory where he reestablished dominance over a son who was becoming territorial in his absence. A week later the female was liberated and she quickly returned to the original territory, where she subsequently bred again with her mate.

During June of 1993 a male and female bird, both of whom were of breeding age but not paired, were captured. They were held at the release site for ten months in the hope that they would pair and breed. After they failed to do so in the 1993/94 breeding season, they were released together in mid-April 1994. After a couple of days the female was found in her natal territory at Cockatoo Creek and has since moved into a breeding partnership on an upstream tributary. The male remained at the release site for 24 days, frequently taking supplementary food provided, but has not been sighted since.

The knowledge that released birds could cross the farmland to rejoin the wild groups, coupled with a greater understanding of dispersal behaviour, which shows that young females undertake exploratory excursions, was used in planning the next trial. Two bachelor males were kept in separate halves of an aviary at the trial site in the hope that they might attract such females and could then be released to join them. The males, one a wild-caught bird, the other a foster-raised captive, were maintained there throughout the winter and spring of 1994, but there was no evidence of visits by wild females.

Prior to the 1995/96 breeding season, the same two males were housed in different aviaries with two females from the captive population at Healesville Sanctuary. One female was taken into captivity four years earlier to treat a broken leg and retained after she recovered. The other had been captive-raised from a fostered egg. The wild-caught male and female and the captive-reared male and female were respectively paired with the intention of comparing reproductive and release behaviours.

A re-introduction success

The entire captive group, at Healesville and at the release site, began breeding well for the first time during this season and this has allowed a plan to be realized that all those working on the project had wanted to try for some years: it was to open the aviary whilst a pair were attending nestlings, thus capitalizing on their strong instinct to keep returning to feed chicks at a time when their familial bond and territoriality were likely to be at a peak.

The captive-raised pair in one release aviary were amongst the first of the successful breeders. In late October they had their second nest for the season and were attending a single nestling. At the end of October we opened the aviary door. The adult birds flew out of the aviary within minutes and we became a bit apprehensive when initially they seemed to have disappeared. However, after an hour and a half they both returned to a food station just outside the aviary and began taking food into the aviary and feeding the chick. They continued to do this for the next ten days, during which time the chick left the nest. Five days after fledging the chick emerged from the aviary with its parents. In the meantime the adults, especially the male, were showing all the signs that they considered the surrounding area to be their home territory, chasing other canopy-feeding birds away and alarm calling at the presence of potential predators like kookaburras.

The wild-caught pair in the second aviary successfully nested shortly afterwards and a similar release was attempted. For a whole day the aviary door was opened but the adults, preoccupied with a feeding a single chick, made no attempt to leave. The next day, however, the female flew out of the aviary before it was realized that the nestling had fallen from the nest and died and hence the attraction to feed no longer existed. Within two days she was seen at the territory at Cockatoo Creek from which she had been absent for four years!

At the time of writing, in March 1996, the pair released in October and their offspring were surviving at the release site, where they were foraging for natural food sources high in the Manna Gums. Initially, they had regularly attended the food table, but the supply of supplementary food began to be

decreased so that the birds would become reliant on natural foods during the summer, when these are most abundant. However, they seem to prefer natural foods and largely weaned themselves from artificial food provisions.

Following the release, the female built a nest and laid three eggs, inside the aviary. Shortly afterwards, however, she abandoned this in favour of nesting in natural shrubbery outside. Their next two nests went the way of many natural ones, with small chicks being lost to predators. However, a single chick did fledge successfully from their last nest before the breeding season finished and has survived, bringing the family's size to four.

Now that the birds have no further reliance on the aviary or supplementary food, are defending the territory in which they have remained, and have successfully bred in the wild, the re-introduction is considered a success. The use of individuals raised in captivity with no knowledge of the whereabouts of the wild groups, combined with the technique of releasing them when they were the most territorial, whilst feeding a nestling, are no doubt important reasons why they have remained at the site.

This important step forward foreshadows a valuable contribution for captive-raised birds to the recovery of the helmeted honeyeater and is perhaps one of very few conservation re-introductions for passerine birds. In the light of this success the 'Helmeted Honeyeater Recovery Team' has just re-evaluated directions for re-introductions. It has decided to continue with this technique, during the next year or two, to build a community of helmeted honeyeaters at this location similar to wild groups which consist of clusters of territorial pairs. At the same time the team will be assessing more distant locations, within the former range, for further re-introductions.

Contributed by Ian Smales, Healesville Sanctuary, Australia.

Scottish white-tailed sea eagles - An update

Summary of the 1994 breeding season

During 1994, (see RE-INTRODUCTION NEWS 9, December 1994), ten areas were occupied by territory-holding pairs (two more than in 1993), including one by a male with two females. One area during the year held a new pair consisting of an immature male and an adult female: eggs were laid but they did not hatch. The male (and probably the female also) are Scottish-bred and therefore this was the first confirmed breeding attempt involving Scottish-bred birds. A new territory was occupied by a solitary adult female that laid eggs which were presumed to be infertile. The female moved from an existing area which is now empty. Eight clutches were known to have been laid, compared with six in 1993. Four broods fledged five young, one of two chicks and three with single chicks, the same production as in 1993.

Summary of the 1995 breeding season

There were ten pairs or trios of territory-holding birds in 1995, the same number as in 1994. This includes the previously reported male with two females, and a new trio of a male and two females which occupied two adjacent areas (areas 6 and 12). In addition, two adults, probably not paired, occupied one area and a single adult female occupied another. A new nesting area was found, (area 17) where a Scottish-bred pair attempted to breed but was unsuccessful. The Scottish-bred pair, as referred to in the 1994 summary, attempted to breed again but were also unsuccessful (area 4). After many years of failure the pair in area 10 was finally successful and raised one young. This brings the number of known successful pairs of sea eagles in Scotland to six.

Nine clutches were known to have been laid, compared with eight in 1994, and a record six clutches hatched. Five broods survived to fledging, which was also the highest to date, and seven young were produced in two broods of two chicks and three of single chicks, equalling the record production of 1991 and 1992.



Scottish white-tailed sea eagle, Haliaeetus albicilla

Six year summary, 1990-1995

	1990	1991	1992	1993	1994	1995
No. of pairs or trios	9	9	8	8	10	10
No. of unpaired birds on the territory	3	1	2	4	1	4
No. of birds on the territory	21	20	19	21	22	26
No. of areas occupied	12	10	10	10	11	14
No. of clutches laid	9	8	9	6	8	9
No. of clutches hatched	2	4	4	4	4	6
No. of broods fledged	2	4	4	4	4	5
No. of young fledged	2	7	7	5	5	7
Cumulative no. of territories producing young	4	4	5	5	5	6

Contributed by John Love, Sea Eagles Project Team, Scottish Natural Heritage, Western Isles, Scotland.

Latest developments in the re-introduction of ostriches into Mahazat as-Sayd Protected Area, Saudi Arabia

The release in June 1994 of four male and three female captive-bred red-necked ostriches into the 2,200 km² fenced Mahazat as-Sayd reserve marked the start of the re-introduction of ostriches in Saudi Arabia (see RE-INTRODUCTION NEWS 9 and 11). Strictly speaking, the project is one of introduction, rather than re-introduction since the Arabian ostrich subspecies *(Struthio camelus syriacus)* is extinct. The last Arabian ostrich was probably shot in northern Saudi Arabia as recently as the early 1950's. The National Commission for Wildlife Conservation and Development has taken the decision to introduce red-necked ostriches *(S. c. camelus)* from Sudan, the nearest living relative of the extinct Arabian subspecies. In July 1995, a second release of one male and one female ostrich took place in Mahazat as-Sayd.

Because the released birds are closely related to each other, introductions at this experimental stage have been restricted to the fenced Mahazat reserve. Captive breeding undertaken at the National Wildlife Research Center is attempting to increase the genetic diversity of stock by obtaining new founders from Sudan and from collections in the Middle East. The goal of the Mahazat releases was to determine if ostriches can survive and breed without provisioned food and water. All the released birds were radio-tagged and their movements and behaviour monitored closely throughout 1994 and 1995.

In April 1995, after good spring rainfall in March, the first breeding attempt was initiated. A single female paired with one male and laid a total of eleven eggs. Incubation progressed normally until the 32nd day when the nest was uncovered and left for twenty four hours. The nest was finally abandoned after more than 60 days of incubation, and the eggs were collected and examined. Eight of the eleven were fertile, but all the embryos died when approximately four to five weeks old, possibly as a result of the exposure to direct sun for one day.

In August and September 1995, four ostriches died in the reserve, including the breeding pair and female from the second release. Veterinary examination suggested that at least three of the deaths were related to dehydration and progressive decline in body condition, whereas the fourth involved injury after a kick by a territorial male. It appears that some of the birds were unable to cope with the harsh conditions experienced during summer. The breeding pair may have been additionally stressed by incubation relatively late in the season.

A fifth bird, the male from the second release, was recaptured after being found prone, thin and dehydrated. This left four birds in the reserve, three males and one female.

In February 1996, a second nest was recorded, with laying throughout the month resulting in a total of 13 eggs. Incubation proceeded normally, but by mid-April, well after the normal 45 day incubation span, none of the eggs had hatched. Examination of several eggs showed them to be infertile. The remaining eggs were collected from the nest and found also to be infertile.

The deaths are disappointing but have answered some questions about the ability of the birds to survive. It is clear that some birds can survive, and that the loss of a proportion of ill-adapted ostriches may be expected. Future releases will attempt to extend the pre-release phase, with a gradual transition from captive-care through to full independence.

A further nine ostriches are currently being held in a 25 hectare enclosure in the reserve. They will be provided with food and water throughout the summer of 1996 and, after radio-tagging, will be moved into a 200 hectare naturally-vegetated enclosure. Food and water will continue to be supplied but the birds use of natural plants will be monitored. Depending on the behaviour and condition of the birds and the state of the vegetation in the wider reserve, a third release is scheduled for autumn or winter in 1996/7.

Should the results of this next release prove encouraging, new unfenced release sites will be sought. Prime candidate sites include the Harrat al-Harrah protected area in the far north of Saudi Arabia and the 'Uruq Bani Ma'arid protected area in the south, on the western edge of the Rub Al Khali. Both regions contained Arabian ostriches earlier in this century, and ostrich egg shell remains can be found in both reserves. In 'Uruq Bani Ma'arid ostriches would join re-introduced populations of Arabian oryx *(Oryx leucoryx)*, sand gazelles *(Gazella subguttorosa)*(see RE-INTRODUCTION NEWS 10 and 11) and mountain gazelle *(Gazella gazella)*.

Contributed by Philip J. Seddon and Mohammed Nayerul Haque, National Wildlife Research Center, National Commission for Wildlife Conservation and Development, Taif, Saudi Arabia.

Re-introduction projects in the Velino Massif, Italy

Over the last few years, the Italian State Forest Service has been carrying out a substantial environmental improvement programme in the 'Monte Velino' Natural Oriented Reserve in the Abruzzo Region, Italy; the main objective being restoration of some of the original faunal species to the area. Two species subject to re-introduction efforts carried out as part of the programme are the Griffon vulture *(Gyps fulvus fulvus)* and raven *(Corvus corax corax)*.

Background

The 'Monte Velino' Natural Oriented Reserve was established in 1987 to preserve the 57 km² wilderness within the mountainous area situated in the inner Central Apennines, ranging from 1,000 to 2,498 metres above sea level. Protected areas in the surrounding territory were established and, as a result, the total area protected today totals more than 600 km².

The Velino Massif consists of a principal chain of mountains with a large tectonic depression (Fucino Basin) in the southern part of the massif. The southern facing slopes are characterized by a typical summer dry Mediterranean climate, as opposed to the northern facing slopes which are characterized by a more humid climate. All vegetation belts found in the mountains are represented in the Velino area: 50% is grassland or dwarf shrubland, 20% is oak and beech forest and 30% is cliff and scree slope communities.

Griffon vulture

Apart from the odd vagrant individual, a population of Griffon vultures has not been present in the central Apennines since the 17th century; hunting and poisoning being the probable causes of population decline. The species has been extirpated from most of Italy, except west Sardinia.

As stated by IUCN re-introduction protocol, a preliminary feasibility study was carried out by Italian and foreign ornithologists, to evaluate the present day ecological conditions in the area and thus suitability for re-introduction of the species.

Firstly, the canyons and cliffs in the area were evaluated for their suitability as breeding sites. Secondly, the study looked at potential food resources for the birds: principally the availability of carrion within the territory. An abundant population of wild boar, and a rapidly increasing herd of re-introduced red deer *(Cervus elaphus)* would ensure a sufficient supply of carrion. In addition, Velino Massif is an area used extensively for cattle and sheep rearing during summer months, and free ranging horses are present at medium and high elevations all year round. Livestock mortality is relatively high due to dispersion and death on the steep rocky slopes, as well as attacks by wolves and feral dogs.

Thirdly, the habitat was evaluated with regards to human use. Human density, and thus pressure, was deemed to be low, with no hunting, restricted hiking only in the more vulnerable zones, and no economic-based activities, with the exception of grazing, being evident.

The results of the survey were positive, indicating the presence of potentially good vulture habitat.

The re-introduction consisted of releasing adult and sub-adult individuals with the aim of establishing a breeding group; all release stock being provided by Spanish raptor rehabilitation centres, thanks to the collaboration of the Spanish Government (ICONA) and Autonomous Regions of Aragona, Catalunyia, Castilla La Mancha, Madrid, Andalusia and Extremadura. Transferred birds, mostly juveniles, were placed for some years in purpose-built release aviaries situated in undisturbed area close to the Reserve, later being released as sub-adults or adults.

In July 1994, the first six Griffons were released. They were all equipped with tail-mounted transmitters to enable their dispersal movements to be monitored. In addition, some wing and tail feathers were coloured, every bird with a different pattern. This ensures that each bird is identifiable when in flight and from a considerable distance. Two feeding stations have been set up a kilometre apart, to supply the necessary food for the Griffons, and to encourage them to stay within the area.

By March 1995, three Griffons were regularly present in the Reserve. Two of the other Griffons had unfortunately died: one had been shot and the other died from unknown causes. The third was recaptured as it was considered unable to adapt to the wild habitat.

In the summer of 1995, another 14 birds were released. They were joined, by chance, by an individual who was part of a similar re-introduction programme which was underway in the eastern Alps, approximately 500 km away.

Today, 18 Griffons fly freely in the 'Monte Velino' Natural Oriented Reserve and it is hoped that first efforts at reproduction will be seen in the near future. Thirty six birds are presently captive in the aviaries, and are due to be released between 1996 and 1998.

Raven

In Italy today, the raven is found in the Alps, southern regions, Sardinia and Sicily. It had disappeared from the north and central Apennines mountain range, however, by the early 1960's. This gap in the species' distribution is due to human persecution, directly through the robbing of eggs and nestlings and, indirectly, and unintentionally, through the poisoning of foxes and wolves.

In the 'Monte Velino' Natural Oriented Reserve some old raven nests have been detected. In addition, a feasibility study carried out by Forest Service technicians revealed the presence of potential raven-habitat. Nowadays, the protection afforded to the area would help to minimize any potential risk to the species.

Birds were sourced for the re-introduction from Calabria, where there is still a viable raven population. Nestlings were removed from nests belonging to the wild population; at least one nestling always being left in each nest visited. Each year, nestlings were removed from different sites to avoid release stock that was too similar genetically. Translocated ravens were placed in aviaries in the Monte Velino area. The pre-release period spent in the aviaries was 9-20 months, with one objective being to experiment with the difference in dispersal behaviour of different age classes. All the age classes, however, showed similar dispersal rates.

In September 1991, the first ten ravens were released. In total, 47 have been released, with a mortality rate of 12%. Today, there are about 25 individuals in the Monte Velino region, and pairs or small flocks have been recorded in other mountain areas in the Abruzzo region. In the spring of 1995, the first successful reproductive effort, in the form of three young fledglings, was observed.

Contributed by Stefano Allavena and Marco Panella, Forest Service of Ministry of Agriculture, Food and Forest Resources, Italy.

PLANTS

Experimental translocations of endangered *Phebalium* spp. (Rutaceae) in South Australia: An update

As outlined in RE-INTRODUCTION NEWS 3 (Nov., 1991), trial translocations of the plants *Phebalium glandulosum* and *Phebalium equestre* were carried out in South Australia by the Black Hill Flora Centre (Botanic Gardens of Adelaide). This note summarizes the results of these trials to date.

Phebalium glandulosum

To examine the effect of propagule type on transplantation success, plants of *P. glandulosum* were raised from both seed

and cuttings, and were subsequently transplanted into Yookamurra Sanctuary, 100 kilometres northeast of Adelaide. Seedlings grew at a far greater rate than cutting-derived plants, particularly during their first summer when they almost doubled in height over seven months. Although growth rates slowed subsequently, seedlings continued to outgrow cuttings over three years of monitoring. Survival of seedlings was also higher than that of cutting-derived plants after three years (95% compared with 75%). Significantly more cutting-derived plants (90%) than seedlings (53%) flowered in their second year, although by the third year, the proportion of each propagule type with flowers was the same (95%). This trial established that seedlings were the preferred founder propagule for this species, yielding higher growth rates and survival than cutting-derived transplants.

Phebalium equestre

P. equestre was introduced on a trial basis into Beyeria Conservation Park on Kangaroo Island, about 4 km from its closest remnant populations. Seed and transplants were sown and planted into three sites to study micro-ecological effects on population establishment. After two years, the survival of transplants at the three sites was 27, 33 and 87% respectively, indicating an obvious habitat preference for Site 3. Seedling emergence reflected similar site preference for germination (39, 55, 62% respectively after four months). Survival of emerged seedlings declined equally at all sites over time, so that on average, after almost two years, only 5.1% of seedlings persisted in unprotected plots, while 92.3% remained in plots protected from grazing. The effect of grazing was also reflected in the average height of seedlings inside (47.2 millimetres) and outside (13.2 mm) protective baskets two years after sowing.

In situ germination was found to be very low for untreated seed or for seed treated with H_2SO_4 for five minutes (5% or 3% respectively after four months). However if seed was soaked in $GA_{4/7}$ for five to six days following H_2SO_4 treatment and prior to sowing, germination was increased to 52%. This suggested that a physiological trigger was required, together with physical weakening of the testa, to optimize germination.

A further trial examined the influence of the initial propagule (seed or cuttings) from which transplants were raised, on transplantation success. While survival of transplants did not differ significantly between propagule type, plant height was affected. Cutting-derived transplants grew rapidly in height during their first spring, but seedlings decreased in height over this time, showing evidence of grazing damage. Beyond 30 weeks, both sets of plants behaved similarly in height response. This result implies that seedlings may be more palatable than cutting-derived plants in the early stages of establishment, and as a result, succumb more readily to herbivores. Following acclimatization, grazing rates for both sets of plants equalized, but by that time, cutting-transplants had a significant height advantage on seedlings. This result contrasts with that for *P. glandulosum* where transplants were found to establish more quickly from seedlings than from cuttings.

As for *P. glandulosum*, flowering occurred earlier on cutting-derived plants than on seedlings. All cutting-derived plants flowered in their first spring (four months after planting), while flowers were not recorded on seed-derived transplants until second year after planting. Plants established as a result of direct seeding *in situ* had still not flowered by their third year. Furthermore, as a proportion of the number of initial propagules planted *in situ*, they also had the lowest establishment rate of all planting methods tested.

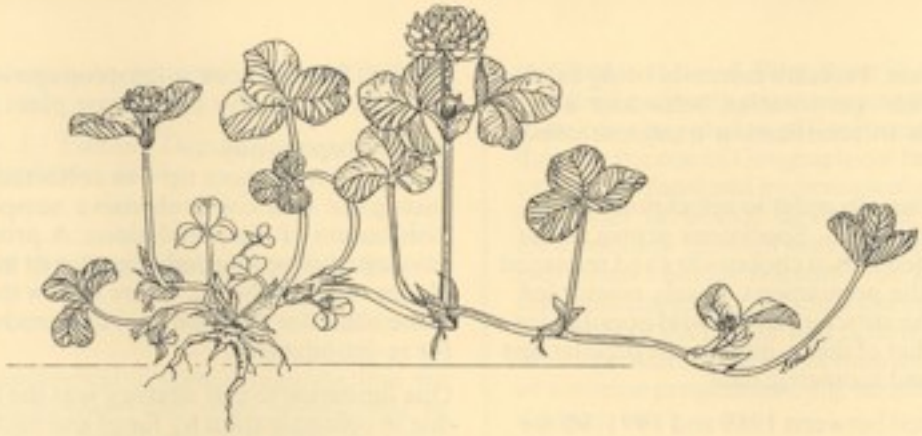
Contributed by Dr. Manfred Jusaitis, Black Hill Flora Centre, Botanic Gardens of Adelaide, South Australia

Re-introduction of running buffalo clover in Missouri, USA

Running buffalo clover, *Trifolium stoloniferum* Muhlenb. *Ex* Eaton (Fabaceae), is native to eastern North America and has been documented from eastern Kansas to West Virginia. Its common name derives from its stoloniferous habitat and its early association with the American bison. This perennial clover was collected with some regularity from the late 1700's until the early 1900's, but very few reports occurred after 1910. In 1987, running buffalo clover was listed as an endangered species under the U.S. Endangered Species Act of 1973. This action prompted surveys which led to the discovery of additional populations in several sites within the species range.

Neither Missouri nor the adjacent states of Kansas, Arkansas, or Illinois had extant sites for running buffalo clover when the Missouri Department of Conservation began to consider re-introduction in 1989. Missouri is fortunate to have numerous tracts of public land within the southern two-thirds of the state, which is the region where the project's four historical collection sites are located. These tracts provide sites where long-term protection and stable ownership is assured. Another positive factor that encouraged the project to attempt a re-introduction in Missouri was the presence in St. Louis of the Missouri Botanical Garden. As a participating institution in the Center for Plant Conservation, the Botanical Garden was already collecting cuttings and propagating running buffalo clover plants from many of the extant populations in West Virginia, Kentucky, Ohio and Indiana. The project was able to provide funding to the Garden to increase its propagation of clover plants and supply them to use during the four year period in which the project's plantings were established. The U.S. Forest Service established several plantings on national forest lands in Missouri, also using plants propagated by the Garden.

A serendipitous discovery of running buffalo clover in Missouri happened in 1990, the year in which the planting of clover plants using out-of-state genetic stock began. A botanist who works for the Department in St. Louis, Dr. George Yatskieych, had a load of topsoil delivered to his residence to use in the garden. He procrastinated spreading of the soil to the point that the seeds in the topsoil germinated and grew into identifiable plants. To everyone's amazement, several plants of running buffalo clover appeared there. After some investigative work to track down the source of the topsoil, the source area was searched for more clover, but none was found. There were thus a few plants, and the opportunity to propagate more, of what was being considered, with some uncertainty, to be Missouri genetic stock. The Missouri Botanic Garden incorporated cuttings from those plants into



Running buffalo clover, Trifolium stoloniferum Muhlenb. Ex *Eaton (Fabaceae).*

their propagation programme.

Between 1990 and 1994, 27 experimental planting sites of running buffalo clover using plants propagated from Missouri and out-of-state genetic stock were established. Sites were selected that most closely matched available descriptions of historical sites as well as extant sites in other states. Most sites contain four 1m² plots, each of which was planted with 16 plants. Sites typically contain plots from four different source states, but within a plot all plants originated from the same state. One half of each plot was caged with wire screen to protect the clover from rabbits, turkeys, or other herbivores. Plots are monitored annually for coverage of the clover, and numbers of rooted crowns and numbers of flower heads produced are also noted.

As of the last monitoring, in 1995, 25 of the 101 plots had failed, i.e. they had no living clover plants remaining. Twenty-four plots contained flowering plants, which have typically spread outside the plots. The remaining plots contained living plants that did not flower in 1995. Most plants in these plots are less robust, and some of these plots are expected to eventually fail. Several plant viruses have been identified on clover plants at the propagation facility as well as at our field sites. We believe that some mortality is due to virus infection. Research is ongoing to identify the viruses involved and to identify which plots are infested.

In the spring of 1994, a naturally-occurring population of running buffalo clover was discovered on private land in southeastern Missouri. It is the only natural extant site known to have existed in the state since 1907, except for the plants that appeared in Dr. Yatskievych's backyard topsoil. Recent genetic testing has shown that Yatskievych's plants and those from southeastern Missouri show genetic similarities to each other, but they differ from plants in other parts of the range. These results help lay to rest any doubts about whether Yatskievych's plants truly represent Missouri genetic stock.

Had the occurrence of native Missouri genetic stock in 1989 been known, those working on the project would probably not have decided to re-introduce plants from other parts of the species' range. That decision was made at a time when running buffalo clover was considered extirpated from Missouri based on an unsuccessful 1988 survey and no collections of the species in the previous 82 years. An advantage of planting the different genetic stocks in close proximity to each other, however, is that cross-pollination can restore genetic diversity that may have been lost through the previous isolation of populations. None of the plantings are near the natural population, the closest being approximately 60 km in distance. Therefore, the risk of contaminating the native Missouri genetic stock is negligible.

The re-introduction of running buffalo clover in Missouri will be considered a success if one or more of the plantings persist and become reestablished as part of the local flora. The project plans to continue to monitor the plantings to document the growth and spread of the clover in successful plots. Additional surveys in the vicinity of the natural occurrence in southeastern Missouri will probably be conducted in the hope of locating additional natural populations.

Contributed by Tim E. Smith, Botanist, Missouri Department of Conservation, USA.

Re-introduction of *Helianthemum juliae* (Cistaceae) in the Canary Islands

Helianthemum juliae is an endemic of the high mountains on the island of Tenerife, in the Canary Islands, and an extremely endangered plant. Only two small populations are known to exist within El Teide National Park which are located quite close to each other (and as such are a metapopulation). Combined, they cover an area of only 500 m², one with 238 specimens, and the other with just 24. Anthropological pressures, such as introduced herbivores (goats, Corsica mouflons, rabbits) and landslides, which are difficult to control, have had a negative effect on both populations.

With the declaration of the area as a National Park in 1954, all grazing activities were terminated. The species, however, showed little capacity for recovery, thus the park administration developed a Species Recovery Program. As a result, a series of activities was initiated six years ago in an attempt to ensure the long term conservation of the taxon.

Trials carried out under artificial conditions in the laboratory and greenhouse revealed that *H. juliae* seeds do not exceed a

35% germination success rate. Tests are currently being carried out to determine the species' germination behaviour after having subjected the seeds to scarification treatment using high temperatures.

A study of the species' habitat, in order to select potential re-introduction sites, was undertaken. Specimens grown in the greenhouse were then planted in two chosen sites and managed such that age structure of the populations closely resembled that of wild populations. The structure of the wild populations is now being compared to that of the re-introduced populations to compare demographic and biometric data.

Of the 350 specimens planted between 1989 and 1991, 90 are in good condition. In addition, these specimens have reproduced on several occasions.

In order to better understand the dynamics of the re-introduced populations, and the influence of herbivores on the populations, two quadrats established in the restoration site are being monitored; one of them being fenced to protect it from predators. Using data collected up until now, the life expectancy in both quadrats is around seven years, with mortality rates similar in both cases. This indicates that there is only low predation pressure on *H. Juliae* within the area.

During the winter season for several consecutive years, many plants reproduced. A significant proportion of the progeny died out during the following summer drought, with only a 15% survival rate. However, the result has been an increase in size of the re-introduced population, albeit slowly, but with results similar for both quadrats.

Contributed by Manuel Marrero Gómez and Angel Bañares Baudet, Parque Naciona del Teide, Tenerife, Canary Islands.

Re-introduction of showy stickseed in the Cascade Range of the American Pacific Northwest

Snowy stickseed *(Hackelia venusta)* is an endangered short-lived perennial of the borage family. A white-flowered form of this attractive herb consists of one population of fewer than 100 plants. Surrounded by conifers, the plants grow on a steep, unstable sandy slope in the Wenatchee National Forest of Washington State's Cascade Range. Because of planned road construction, other human threats to survival, seed scarcity, and a decline in population, the U.S.D.A. Forest Service developed a cooperative recovery programme for the species. Major priorities are to:

1. Evaluate the taxonomic status of the white-flowered form relative to blue-flowered populations of *H. venusta* at higher elevation;
2. Examine reproduction, pollination, seed production, germination, and seedling establishment to gain an understanding of impediments to natural regeneration; and
3. Propagate the species off-site and re-introduce it to similar, but protected, habitat nearby.

The rapid population decline and high fire risk in the region prompted immediate action to attempt to conserve the gene pool off-site. Because seed was unavailable and conventional cuttings failed to root, micropropagation was the only practical alternative available to increase plant numbers.

Micropropagation

One vegetative shoot tip was collected from shoot clusters of each plant in a comprehensive sampling across the spatial distribution of the populations. A protocol was successfully developed over a period of a year to multiply, root, and store clones of microshoots. There is now the capability to create a clone blank for the gene pool and produce multiple populations for re-introduction.

One limitation to this strategy was the loss of some genotypes due to contamination by fungi and bacteria during the critical first stage of tissue culture. Lost genotypes have to be re-sampled at additional expense and increased risk of injury to donor plants. Another possible drawback to this off-site approach is that inherent to vegetative propagation in greenhouse or laboratory is the possibility of occasional random change in gene expression. Because such change is generally undesirable for plant conservation, we micropropagated axillary shoots rather than less genetically stable adventitious shoots. We also minimized culture time and use of plant growth regulators to further reduce the possibility of producing off-type plants. Careful screening revealed a negligible occurrence of abnormal plants.

Acclimatization of plantlets

Container grown plantlets (micropropagated plants) were acclimatized year-round in a heated greenhouse to allow re-introduction experiments to be undertaken during spring and autumn planting periods, the most appropriate timing in the Pacific Northwest. Young shoots of *H. venusta* were, however, susceptible to aphid infestations that rapidly destroyed plantlets if pesticide was not applied. Care was taken to avoid algal, moss and liverwort growth in the containers.

Experimental re-introductions

Plantlets were transplanted to potential re-introduction sites in November 1994 and April 1996. For the first trial, plantlets were hardened off to near-freezing temperatures and transplanted dormant but with green leaves still attached. Transplanting was timed just before a winter storm so that snow could provide an insulating layer to prevent damage from severe low temperature conditions. In this first establishment trial, 82% and 41% of 140 plantlets at each of two planting sites were alive at the end of the following growing season, of which 97% (115) and 75% (105), respectively, were reproductive. The lower survival rate was on a harsher site.

In the second establishment trial, actively growing plantlets were transplanted to re-introduction sites at a time that coincided with first new spring growth in the native population. Clones of equal size were transplanted at random to assess genotypic response. Initial data indicate that survival rates are high.

Clones from the blue-flowered population are currently being propagated for comparative garden studies with the white-glowered forms of *H. venusta*. Genetic analyses now underway should soon clarify the taxonomic status of the two forms. Regular monitoring of re-introduction trials will continue to assess natural regeneration and determine what

further trials are necessary to proceed towards full re-introduction.

Contributed by John L. Edson, Department of Forest Resources, University of Idaho, USA.

Re-introduction of the European beaver to Scotland

Introduction

Both written and archaeological evidence suggests that the European beaver, *Castor fiber,* was once widespread in Scotland, although there are no records of it from the Outer Hebrides, Orkney or Shetland. A recent investigation into the history of the species in Scotland suggests that it was resident in this country until the 12th century, although there is strong evidence that it persisted to a much later period, possibly until the 16th. The demise of the species in Scotland reflects the pattern of decline across continental Europe where beavers were subject to a similar hunting pressure for their pelt and castoreum (from the scent gland). The latter contains salicylic acid which as long been associated with medicine, and is the main constituent of modern aspirin. However, although valuable medicinally, evidence from the historical literature suggests that the main trade in Scottish beavers was attributable to the much sought after pelt: this supported an export trade in Scotland, with evidence of foreign merchants visiting the country to purchase skins.

By the end of the 19th century, viable beaver populations in Europe were restricted to the Elbe Basin in Germany, the Rhône Basin in France and southern Norway. Small numbers also remained elsewhere in Belarus, Russia and Mongolia. Several re-introduction programmes have been carried out across Europe since 1920, in order to conserve the species and to restore it to its former range. In 1992, the threatened status of the European beaver was recognised by the European Commission and the species was listed on Annex IV of the EC Habitats Directive for additional protection. Under the terms of this Directive, member states are asked to '*...study the desirability of re-introducing the species.....that are native to their territory where this might contribute to their conservation...*'. Thus Scottish Natural Heritage (SNH) is currently addressing the feasibility and desirability of reintroducing this species to Scotland.

The research programme

Work is being carried out in accordance with IUCN's *Guidelines for Re-introductions* . Three stages have been identified within the work programme:

1. Investigation of the feasibility of re-introducing this species;
2. Investigation of the desirability of re-introducing this species;
3. Establishment of a re-introduction protocol and programme.

The programme is currently in the early stages and SNH is addressing the first of three questions, i.e. the feasibility of re-introducing the beaver to Scotland. Two projects have been initiated to this end. First, there is an investigation into whether Scotland currently possesses suitable habitat to support a self-sustaining population of European beavers (being undertaken through the use of Geographical Information Systems analysis using woodland and hydrological data). Second, an assessment protocol is being developed to provide a standard methodology through which to determine the suitability of individual sites for releases. The latter project will include a full assessment of individual sites through Population Viability Analysis (PVA). This will determine the suitability of a site over a protracted period of time and suggest required elements of a release programme, e.g. number of animals to be released, timings, etc.

The results of these two projects will be published in due course in order to distribute the relevant information more widely and to identify gaps in our knowledge which require further investigation. Work currently being initiated includes studies into the potential interactions between beavers and fisheries in the context of the Scottish angling industry, with similar plans to investigate the impact of beaver re-introduction in Scotland on forestry and agricultural land practices. It is the intention to complete these studies by mid-1997.

Consultation

One of the requirements of Article 22(a) of the Habitats Directive is that re-introduction may only take place after '*proper consultation with the public concerned*'. Consequently, stage two of the study is to investigate the *desirability* of a re-introduction, taking into account the opinions and concerns of land owners and other land users. This stage has been scheduled to follow completion of the study of the ecological feasibility of re-introducing the beaver, allowing an informed debate to take place.

Stage three

The final phase of the planning programme would be the implementation phase, addressing in more detail the logistics of re-introduction (preparation of an action plan, protocol, etc.). However, this is totally dependent on the outcome of the first two stages and progress will only be made on this if the feasibility and desirability studies indicate this to be a viable option.

The final decision

Recommendations will be made to the UK Government by S.N.H. on completion of the study as to whether it is feasible and desirable to restore this species to Scotland under current conditions. Any such re-introduction to Scotland would have to be licensed by the Scottish Office under Section 14 of the Wildlife and Countryside Act 1981. In view of the potential for beavers to colonise areas some distance from the original release sites, the implications for other parts of the UK (England and Wales) would also have to be taken into account, discussed and agreed with the appropriate Departments and agencies.

Considerable publicity has been generated as to the suitability of Scotland for the release programme and subsequent colonisation by European beavers. This is an issue which SNH continues to investigate and hopes to clarify within the next one or two years.

Conroy, J.W.H. & Kitchener, A.C. 1996. The Euroasian beaver *(Caster fiber)* in Scotland: a review of the literature and historical evidence. SNH Review Series report No. 49.

Macdonald, D.W., F.H. Brown, E.D. & Balharry, D. 1995. Re-introducing the European beaver to Britain: nostalgic meddling or restoring biodiversity? Mammal Review 25(4): 161-200.

Contributed by Dr. Mairi Cooper, Species Conservation Officer, Scottish Natural Heritage, UK

Black bear repatriation to Cumberland Plateau

Black bears, *Ursus americanus,* have been extirpated from many regions in the United States due to habitat destruction and unregulated harvest. Range contraction and fragmentation is particularly evident in the southeast, where black bears occupy only 5-10% of their original range.

The Big South Fork area of Tennessee and Kentucky is among those regions in the southeast where bears have been extirpated. The Big South Fork area consists of about 81,000 hectares of sparsely developed land, much of it owned by the National Park Service (NPS) and the U.S.D.A. Forest Service (USFS). Historically, the area has been extensively logged and mined, but federal acquisition of lands beginning in the 1930's has resulted in recovery bear habitat.

Range expansion by the male segment of a black bear population is common as young male bears are forced to disperse from their natal range. Conversely, young female bears typically reside within a portion of their mother's home range and range expansion is very slow for this portion of the population. Unfortunately, because of limited numbers of dispersing females, natural colonisation and subsequent establishment of a reproductively sustainable bear population at the Big South Fork is uncertain without human intervention. Although a few bears have been sighted in the area over the past few years (most likely young males), the repatriation of females to the Big South Fork Area could be a means of expediting bear population growth in the area.

Although the habitat at Big South Fork appears to be sufficient to support black bears, it remains unclear how these animals will react to various forms of human activity, and how people will react to the presence of bears. A working group comprised of various relevant agencies decided to carry out an experimental reintroduction under controlled conditions to address biological and sociological concerns.

The Southern Appalachian Field Laboratory[1] was contacted to perform the research, and has been involved in this project since 1951.

Ultimate success of such translocations is enhanced if the number of released individuals (founders) is large, the rate of population increase is high with low variance, the effect of intraspecific competition is low, there is low environmental variation, the species has herbivorous food habits, there is high genetic variability, and there are refugia. Unfortunately, bears fail on almost all counts: population growth is low with high variance, there is great environmental variation (e.g., fluctuations in annual acorn production), bears are omnivores and many species compete with them for food, and they may have low genetic variability relative to their population size. In addition, bears have large home range sizes and powerful instincts for homing.

Only a limited number of bear re-introduction efforts have been attempted and thus there are no clear protocols to follow. In Louisiana, 161 bears were released in the Tensas River area and the Atchafalaya Basin during the mid-1960's, but the failure or success of the repatriation program has not been well documented. The most successful bear re-introduction occurred in Arkansas, where an estimated 254 bears were stocked into unoccupied range. The population increased to more than 2,500 in a 30-year period. Factors that contributed to that success include the use of wild-captured animals, elimination of former extirpation factors, release into prime habitats, multiple release sites, and release of sufficient numbers of animals over a period of several years.

The black bear has a remarkable ability for homing and movements greater than 300 km by translocated bears are not uncommon. Extensive post-stocking movements and the associated high mortality may be the most critical parameter that will govern the success or failure of bear re-introductions to Big South Fork. Therefore, methods of reintroduction tested here are designed to reduce those immediate post-stocking excursions.

Wildlife releases have been characterised as hard (capture, transport, and release at a new site without a period of acclimatization) or soft (provision of food and shelter to serve as a period of acclimatization prior to release). Hard releases have been used extensively, usually in conjunction with nuisance bear capture-release programs. Hard releases can result in significant movements after repatriation, and testing to further document that is unnecessary. However, it has been suggested that a soft release, consisting of a short period of acclimatization, may result in stronger site affinity. The evidence for the latter is scant; Rogers[2] however, reported that food troughs were placed at some bear release sites in Arkansas and were used to some extent by the bears. Benefits of soft releases are better documented for other carnivore species. Belden[3] advocates holding translocated mountain lions *(Felis concolor)* in release pens prior to restocking; this species also is capable of dramatic post-release movements. Likewise, re-introductions of red wolves *(Canis rufus)* have been more successful when soft release methods were used.

Another variation of the soft release technique for bears is the capture, translocation, and release of hibernating animals during the winter. The technique was developed in Pennsylvania and appears promising. With this method, hibernating bears are tranquillized, removed from their dens, and transported to the release area. The anaesthetized bears are placed in natural dens at the new site. The idea is that after the bear adjusts to its different surroundings, it will resume its previous state of torpor. When springtime comes, their movements are restricted due to the presence of newborn cubs, tender foot pads, and limited food availability. This technique is thought to be most effective for pregnant females, resulting in much greater site affinity than releasing wild bears in summer with reduced post-release excursions. Therefore,

pregnant females will be targeted for this portion of the study.

The project objective is to test both of the above release protocols at Big South Fork. A total of 12 female bears will be released. Females may be less predisposed to homing and, being a polygamous species, a disproportionate number of females would increase the population growth potential.

Objectives of this experimental repatriation are to:

1. Compare two different release techniques with regards to ability of each to limit the homing instinct of translocated black bears.
2. Determine whether mortality or post-release movements are affected by release method, age or other factor.
3. Determine dispersal and mortality rates of reintroduced bears.
4. Evaluate the effects of bear-human interactions and document any property damage.
5. Assess the feasibility, methodology, approach, and probability of success of releasing bears to establish a permanent, viable population in the Big South Fork Area.

From May 1995 through August 1995, bears were trapped in the Great Smoky Mountains National Park in eastern Tennessee and western North Carolina, resulting in 33 female bears being radio-collared. In addition, eight females in Tennessee and four in North Carolina were thought to be wearing radio collars as a result of the 1993 and 1994 trapping seasons, thus resulting in 45 radio-collared females.

The translocation of bears with year-old cubs, or females thought to be too young or too light to give birth, was not considered. After excluding these, 25 bears remained as candidates for the winter release technique. Bears were tracked to den sites to determine if translocation would be possible. As had been expected, many bears denned high in hollow trees (some 25+ m) and were, therefore, inaccessible.

Congruent to trapping bears, prospective den sites at Big South Fork were located.

The first successful translocations took place in early January 1996: three bears (60 kg, 85 kg and 81 kg respectively) were moved to Big South Fork. All three bears were placed in rock crevices lined with straw.

Winter translocation efforts were temporarily halted after moving the third bear, to avoid the parturition period. However, the remaining three bears were successfully moved with their cubs in March. The fourth bear (81 kg) was placed in a den at Big South Fork in early March with her two male, and an additional orphaned male, cubs. The fifth bear (77 kg) was then translocated with one male and one female cub. The last winter translocation was completed in mid-March when a female (71 kg) was moved with one female and two male cubs. That bear and her cubs had to be lowered from a tree cavity about 10 metres above the ground and carried 6 km to transport vehicles.

The first three bears translocated to Big South Fork moved from the dens they were placed in, but all three promptly redenned in sites of their own choosing. The last three bears were radio-located throughout winter; there has been no movement.

No homeward or substantial movements have occurred with any of the bears.

Two acclimatization pens were constructed in May 1996 and trapping at the Great Smokies also resumed at this time. Bears will be moved from the Great Smokies to the acclimatization pens; one bear will occupy each pen for about two weeks. However, no bears have been placed in the pens as yet. After this acclimatization period, the bear will be released and radio-located daily. Frequency of radio-locations will gradually be reduced to twice weekly through the remainder of the summer and fall. We expect the bears to den again in late fall.

So far, things have gone extremely well. Since spring, all the bears have emerged from their winter dens. We had one adult mortality; a result of a uterine infection and not associated with the move. Several of the bears at Big South Fork have been sighted with cubs, including bears that we only suspected as pregnant at time of their stocking. We will continue this work through this next winter and summer.

Based on data on dispersal, mortality, habitat use, and landowner-bear interactions, the minimum number of reintroduced bears required to establish a sustainable population at Big South Fork will be determined. The criteria being used for proximate success are that most of the released bears successfully establish home ranges in the immediate vicinity of the region, and that projected reproduction and recruitment exceeds mortality of released bears. The appropriate timing, duration and release protocols will all be considered, as well as the possibility of natural re-establishment without translocation. Information on damage caused by released bears will also be provided.

The project goal is to provide information on a release strategy that has as low an impact as possible, while maximizing chances for ultimate success.

[1]The laboratory is part of the National Biological Service, the research arm of the U. S. Department of the Interior which includes the U.S. Fish and Wildlife Service, NPS, etc. The bear research project is coordinated by Dr. Joseph Clark, Laboratory Director, but the field work is led by Mr. Rick Eastridge, M.S. candidate for the project. The research is being jointly funded by the NPS, the Tennessee Wildlife Resources Agency, the Kentucky Department of Fish and Wildlife, and the U.S. Forest Service.

[2]Rodgers, M.J. 1973. Movements and reproductive success of black bears introduced into Arkansas. Proc. Southeast. Assoc. Fish and Wildl. Agencies 27: 307-308.

[3]C. Belden, Fla. Game and Fresh Water Fish Comm., pers. commun.

Contributed by Joseph D. Clark, National Biological Service, University of Tennessee, USA.

An assessment of past introductions and re-introductions of ungulates into South African National Parks

The results of 36 attempts to re-introduce or introduce 18 different ungulate species into five national parks in South Africa undertaken, prior to 1970, were assessed (*see Novellie P.A. and M.H. Knight, 1994, Repatriation and translocation of ungulates into South African national parks: an assessment*



Buffalo, Syncerus caffer
Credit: Doreen McColaugh, African Wildlife Foundation

of past attempts. Koedoe *37(1): 115-119*). The relatively long time interval (a minimum of 22 years) allowed adequate time to evaluate the success of these attempts. The species considered included: black rhino *Diceros bicornis michaeli* and *Diceros bicornis minor;* white rhino *Ceratotherium simum;* zebra *Equus burchelli;* black wildebeest *Connochaetes gnou,* blesbok *Damaliscus dorcas phillipsi;* buffalo *Syncerus caffer;* bushbuck *Tragelaphus scriptus,* kudu *Tragelaphus strepsiceros;* eland *Taurotragus oryx;* gemsbok *Oryx gazella gazella;* grey rhebok *Pelea capreolus;* mountain reedbuck *Redunca fulvorufola;* reedbuck *Redunca arundinum;* oribi *Ourebia ourebi;* red hartebeest *Alcelaphus buselaphus caama;* springbok *Antidorcas marsupialis;* warthog *Phacochoerus aethiopicus;* and hippopotamus *Hippopotamus amphibius.*

As much of the information relating to the number, age, sex and, in some cases, origin of founders, was poorly documented, the analysis was restricted to assessing the success based upon the suitability of the habitat and historical distributions of the species. Habitat suitability appeared to be an important factor influencing the success rate of these operations. Over 80% (N=6) of introductions into habitats outside of their historical ranges failed, while 90% (N=10) of re-introductions and translocations into unsuitable habitat within historical ranges of the species concerned failed, as opposed to the 85% (N=20) success of re-introductions within the historical ranges where both sufficient and suitable land existed.

This reaffirms the necessity for using historical information in planning translocation or re-introduction programmes. Moreover, it exposes the importance of undertaking adequate habitat assessments prior to any such operation and the need for detailed record keeping of numbers, origins, sex and age composition. A further analysis is planned using a broader base of information with the hope of exposing the role played by founder population size.

Contributed by Mike Knight and Peter Novellie, National Parks Board, South Africa.

THE C.I.S. AND EASTERN EUROPE

Translocations of kulans in the former Soviet Union

In 1941, the Badkhyz Reserve in Southern Turkmenistan, close to the borders of Iran and Afghanistan, was established, to protect the last remaining indigenous population of kulans *(Equus hemionus kulan).*

In 1953, efforts to re-establish kulan populations in areas within the species' former range was initiated; kulans were translocated from the successful population in Badkhyz.

Kazakstan
Eight young animals (1m:7f) were captured in Badkyz and released on Barsa Kelmes, an island in the Aral Sea in Kazakhstan, where other mammals such as saigas *(Saiga tatarica)* and goitered gazelles *(Gazella subgatturosa)* were also released. After the translocation of one more stallion in 1955 the kulan group began to reproduce. More kulans from Badkhyz were added in 1961 (1m:4f), and by 1963, the population numbered 47. Although an additional five kulans (3m:2f) were released in 1964, the population had decreased to 39 by 1967, as a result of drought, cold winters and of food deficiency. By 1967, 78 foals had been born on the island, 58 of which subsequently died. From 1966 onwards the animals were tended with hay and their condition improved. By 1980, the population numbered 205.

The kulans drank the sea water, and ate snow in winter months. Due to the shrinking of the Aral sea, the salt content increased (1960: 6grams/litre, 1978: 20g/l) and survival became more difficult for the animals.

Within a few years they became totally dependent on drinking water from a man-made well and being fed by humans. Efforts to translocate kulans from Barsa Kelmes elsewhere were initiated in 1982 with the removal of 23 animals. In spite of this, however, the population continued to grow; in 1983 it numbered 272 (3 herds, 47 bachelors and 7-8 single males). Between 1982-1991, a total number of 183 kulans was moved

from the island to other nature reserves in Kazakhstan, leaving, in 1992, a population of 96 mares, 57 stallions (among them: 13-15 singles) and 25 foals on Barsa Kelmes.

Kulans from Barsa Kelmes were brought to the Kapchagaiskoye Reserve (100 km northeast of Almaty) from where the indigenous Kazakhian kulans *(E.h. finschi)* had become extinct in 1936/37. In 1982, 23 animals (7m:16f) were kept for five months in three enclosures, where some foals were born. After their release the animals split up into three groups. The largest of the groups travelled 10 km eastward, the others as far as 65 km. Eight foals were born in 1983 and one mare died. Four additional mares were translocated from Barsa Kelmes and joined the biggest herd. After a final release in 1984 of five, (3m:2f), by 1988 the population in Kapchagaiskoye numbered 83 animals, by 1990, 129 animals, and 150 by 1992. The animals eventually formed two sub-populations with range areas of between 60-70 km^2 and 100-120 km^2 respectively. The animals avoided water sources which were frequently used by cattle, and springs which were in dense vegetation. Some kulans were killed by wolves and shepherds' dogs, whilst others fell victim to poachers.

In 1986, 55 kulans from Barsa Kelmes were translocated (11m:18f) and 1987 (4m:22f) to the Andasaiski Reserve, west of Almaty in the Beptak Dala Desert near the River Chu. The first animals translocated were kept in a holding pen from March to June. One animal died during transportation, four mares lost unborn foals and one mare died on arrival. Following the release, most animals travelled between 80-100 km westwards, but two mares and one foal remained next to the pen which they entered daily to drink. Occasionally some of the other released kulans appeared in the vicinity of the enclosure. By 1990, the population numbered 85 animals (9m:49f, 19 foals, 8 unidentified) when a further 65 kulans were translocated from Barsa Kelmes. By 1992, the population in Andasaiski totalled 164 kulans.

After independence, in 1991, the new ministry in Almaty continued translocating kulans from Barsa Kelmes, and released some in the Aktau-Busatchinski Reserve in West-Kazakhstan (northeast of the Caspian Sea). Thirty one animals (10m, 21f) were transported in three loads (14,9,8) by helicopter, plane and truck. One female died during transportation. The kulans were released immediately, four of them equipped with radio-transmitters.

Turkmenistan

The growing population of kulans in Badkhyz in the 1970's and the rising conflicts with livestock grazers in the surrounding areas gave occasion to translocate animals to other places in Turkmenistan.

The Meanachaachinski Reserve is a desert area in the foothills of the eastern Kopet Dag Mountains about 250 km from Badkhyz, and it had kulans until 1938. In 1979, eleven kulans (3m:8f) were translocated from Badkhyz, and kept in an enclosure for some time before being released. In 1980, seven out of the eight mares produced foals, one of which died. In 1981, five foals were born, and in 1982, six were born. Following the release of more kulans (number (between 21 and 68) and year are unclear), the Meanachaachinski population numbered 103 by 1986. The casualty rate during transport was 7.2%. After release, 12 kulans died, and 26 disappeared. The mean annual population growth rate was 20.3%.

Three other places in the northern foothills of the Kopet Dag Mountains also received kulans from Badkhyz. In early 1981, 11 kulans (3m:8f) were kept in an enclosure for four months, before being released into the Kuruhaudan Reserve, which is 4 km from Ashkhabad. One mare died and one stallion disappeared. Four foals were born in May 1981, and four in May 1982. Translocations to two other locations west of Ashkhabad were unsuccessful. Seven kulans released at Kurtusu-Gaudanski and 13 at Germab disappeared and were never seen again. A possible reason for the failure was that the animals were young and they were not kept in an enclosure before release.

The area around Lake Sarakamysh which is situated in northern Turkmenistan close to the Uzbekistan border, was inhabited by kulans until the last century. In 1983, 11 kulans were translocated from Badkhyz (4m:6f, 1foal) onto a peninsular in the lake, which was fenced off from the mainland. One female died during transport. A heavy storm caused the peninsular to flood, but the kulans escaped. One female was later found dead. In 1984, 21 kulans were translocated into the Mergenash Delta, were they were initially kept in an enclosure. However, 11 of them perished here from either contaminated food or water. After the ten remaining kulans were released, a group formed of between three and five individuals which was occasionally seen. In 1985, 20 kulans were translocated from Badkhyz, one of which did not survive transportation. The other 19 (4m,12f, 3 foals) were placed in an enclosure 18 km from the lake. One animal died before, and one soon after, the gate to the enclosure was opened. Fifteen of the 17 walked 120 km. In 1986, small groups of three to seven animals, along with some foals, were observed. In 1987, shepherds reported far more scattered sightings, and the total population was estimated to be 45.

Later, in 1987, 50 more animals, in four groups, were brought from Badkhyz to Sarakamysh. The truck travelled during the hot month of August, cross country through the Karakum Desert, and coupled with insufficient water, caused the death of eight kulans. Six animals died in the pen (on the peninsular) after drinking water from the lake. Some animals escaped. A group of 20 females were finally released and dispersed. In the spring of 1988, a total of 50-60 kulans with two to three foals were counted, but by the following winter, there were only between 15-20 kulans remaining. A few kulan footprints were found in places as far as, for example, Kaplankyr. Between 1989 and 1991, small, scattered groups of either three to four, or eight to 14, were known to exist.

Since 1987, a new kulan population has been building up in the Turkmenian region of Karakala, which is near the Sumbar River in the western foothills of the Kopet Dag Mountains. Before releasing the first group of nine (5m:4f) Badkhyz kulans, the animals were kept for nine months in an enclosure. A second group of 43 animals (6m, 24f, 12 foals) was kept for seven months in the enclosure. Six animals died, but the others were released in May 1989. They did not travel far, only three to four kilometres, and the maximum distance from the point of release was only between 34-40 km.

Uzbekistan
Uzbekistan had kulans until the middle of last century. In 1978, five animals were translocated from Barsa Kelmes (1m:4f) to the Djeiran Econcenter, a fenced steppe area of 5000 hectares south of Buchara, and in 1979, two (1m:1f) more were translocated (1 female died during transport). By 1991, the population numbered 34. Because the area within the Econcenter was overgrazed due to a high density of other ungulates (gazelles and Przewalski's horses), it was considered a better option to release the kulans into the surrounding areas.

Ukraine
Askania Nova in the Ukraine, a special game farm 150 km southeast of Nikolayev, has been breeding kulans since 1950 in a big enclosure. Seven founders (3m:4f) have produced 135 foals (62m:73f) till 1980. In 1982, 11 of kulans (3m:8f) were translocated from here to the Beruchi Peninsular in the Asov Sea (connected to the Black Sea). Many others were given to zoos and by 1992, Askania Nova had only 60 kulans. By 1990 they numbered 20, but by 1991 there were only 18.

Concluding comments
Some of the translocated kulan populations should receive an additional three to four animals from Badkhyz to increase the populations' genetic diversity. In addition, Kazakhstan has other suitable regions for kulan relocation, e.g. the valley of the Sarysu or the area north of the Balkash Lake.

An interesting observation worth mentioning is that removing kulans from Barsa Kelmes caused an increase in reproduction rate in the remaining population.

Contributed by Michail P. Pavlov, Research Institute of Game Management and Fur Farming, Kirov, Russia.

NB: Michail P. Pavlov has completed a manuscript (more than 300 pages) for the third volume of 'Translocations of Game Animals in the former Soviet Union' in 1992. The first two volumes on 'fur-bearing animals and deer' have already been published (in Russian). Due to financial problems the third volume has not yet been published. The author is looking for a sponsor or publishing house to get the whole document published. The unpublished third volume (Hoofed Animals) contains chapters on the European bison, musk deer, Przewalski's horse, saigas and some other species of antelope, wild sheep, wild goat, and gives information on the former distribution, history of decline, measures of protection, re-introductions and translocations. One chapter (41 manuscript pages) is devoted to kulans. This article is extracted from this volume and translated into English by Gertrud Neumann-Denzau, member of the IUCN/SSC Equid Specialist Group, Germany, with kind permission of the author.

Local participation in re-introduction: the case of the wolf in Georgia

The attitude of local communities towards predators greatly affects the success of the recovery of any large predator species. Irrespective of the recovery method, i.e. natural migration, translocation or re-introduction, this issue is of fundamental importance.

A method for preparing captive-raised large predators for reintroduction into their natural habitat has been developed (see RE-INTRODUCTION NEWS 8); a main objective being to avoid conflict between people and re-introduced animals. Animals re-introduced by this method shun strangers and do not prey on domestic animals.

The Trialeti Range was chosen as the site for wolf reintroduction. Wolves had been exterminated from this area and their ecological niche has since been occupied by feral dogs. The Noah's Ark Centre for the Recovery of Endangered Species (NACRES) worked in this region between 1974 and 1979. A base was established in the village of Khekordza at the beginning of the Trialeti Range 40 kilometres from Tbilisi.

Before starting the actual process of re-introduction, the aim of the experiment needed to be explained to local people; they needed to be assured that re- introduced wolves would create no threat to people or domestic animals. Despite explanatory talks with representatives of local communities, an agreement was not reached. They strongly opposed the idea of such an experiment being carried out, and even shot two of the project wolves in their enclosures. It became clear that representatives of the local communities should participate in the experiment and according to results that they themselves would witness, the project leader could make a decision as to whether to continue with the experiment or not.

As a result of massive propaganda during the Soviet period, the wolf was viewed as an insatiable and sinister animal which was man's rival and therefore should be subject to extermination. A bounty system was introduced to encourage people to kill wolves, and the research took place during the times of massive 'predator genocide' carried out by the Soviet Government. With the general feeling of contempt towards wolves, it was therefore particularly important that people had the opportunity to observe wolves and appreciate them. The animal which they hated so much, though, was once highly esteemed, and even considered as the totem of Georgian tribes.

Between 1974-1979, four groups of wolves numbering 22 individuals in total, were released in the Trialeti. All wolves were released between 3-5 km from the nearest populated area, in the following villages: Khekordza, Lelobi and Nakhshirgora. Two groups were released near Lelobi at different times.

More than a hundred local people participated in some way during this period, either alone or in groups. The principal task for certain volunteers was to cross the territory in question at a given time at different places: avoidance training was carried out when wolves smelled where a person had passed nearby. A second task was more direct sighting avoidance training (upon hearing voices, etc.): humans carried sticks or weapons or were empty-handed and appeared at different moments during the experimental period. Apart from those who had volunteered, the project tried to invite the more respected people in the villages to take part in the experiment as they have a significant influence on their villagers and thus their opinion of the project would be important with regards to the project's success. The volunteers observed the relationship between the author and the 'ruthless and aggressive' wolves, and they were shocked to find the animals rather friendly. What they had witnessed made it clear to them that their idea of wolves was completely erroneous.

It takes 30-40 days to teach a wolf to avoid strangers. The

volunteers found the process quite impressive. But when it was explained how wolves could be equally successfully trained not to attack domestic animals, they all agreed that the experiment should continue. They were able to observe how the wolves could be taught not to attack and to keep away from domestic animals. Either a single animal (sheep or cow) or a herd was used to teach the avoidance reaction. It is interesting to note that separate reactions must be produced to the herd as a whole and to individual animals, since wolves do not necessarily associate individuals as belonging to a group.

During the experiment, the volunteers often asked for permission to bring their friends, children and grandchildren so that they also could actually see what sort of animal the wolf is. The local population's attitude towards the wolf has changed, ensuring the successful completion of the experiment. Participation of the local community representatives was much appreciated, as it was thanks to them the experiment was successfully completed. For four years after the reintroduction, some of the same people helped with monitoring to determine to what extent the re-introduced wolves had maintained their stranger avoidance habit.

Contributed by Jason Badridze, Noah's Ark Centre for the Recovery of Endangered Species, Republic of Georgia.

Bear cubs re-introduced into the wild, Russia

The winter time in Russia is the traditional bear hunting season. Inevitably, such hunting results in a significant number of bear cubs being orphaned; the ones that survive generally end up in captivity.

In 1974, an investigation was initiated into brown bear,*Ursus arctos* behaviour in an environment very similar to that in the wild. From 1985, this research has been carried out at a research station called 'Tchisty Less', meaning 'Clear Forest'.

The information and knowledge on bear feeding and defense behaviour which has accumulated during the course of this research, has enabled the team to develop a special technique for raising bear cubs during the first few weeks of the cubs' lives; bear cubs raised according to this technique were deemed suitable for release into the wild.

It was established that bear cubs develop the basis of feeding behaviour by the age of 3+ months, and defensive behaviour by between five to six months. According to the data collected, bear cubs are capable of surviving in the wild after the age of six months. This information suggested that bear cubs could potentially be released into the wild at this age.

Bear cubs which are raised according to the newly established technique and released into the wild, tend to avoid obvious contact with humans. They are quite capable of surviving the winter, and their tendency to avoid humans and human activity seems to increase during the spring. It seems that, in this case, the behaviour of released orphan bear cubs differs very little from the behaviour of the wild bears.

The release of several orphan bear cubs in the State Reserve 'Bryansky Less' is planned in the near future. The objective of this release is to try to improve the demographic situation of the local bear population in this Reserve.

The work was supported by RFFR, The MacArther Foundation, IBF, and IGAW Foundations.

Contributed by Dr. Valentin S. Pazhetnov, Biological Station 'Tchisty Less', Pozhnia, Toropetz Region, Russia.

Re-introduction summary: European beaver, bison, elk and lynx in Poland

In Poland, many different forest habitats are poor in terms of fauna as a result of human activity, including the elimination of human competition: predators. Additionally, the degradation of most habitats has had a negative effect on most faunal species.

Beaver

After World War II, Polish naturalists initiated efforts to restore the country's native fauna; the European beaver, *Castor fiber*, being one example. Its restoration in northeastern areas of Poland (near Osowiec) started as early as 1949. Twenty six specimens, mainly from Russia (the Voronezh district) were released. The only surviving native population of the Central European beaver *(Castor fiber vistulanus* Matschie, 1907) was near to the Niemen River basin, close to the Polish-Lithuanian border. There was also a small local colony of Canadian beaver in the Masurian Lakes region, near to the Pakleka River, which were introduced there several years before by the German inhabitants of the region.

In 1973, a European beaver re-introduction project was launched. Beavers from the densely populated region of the Czarna Hanza river basin in northeastern Poland, and also from two captive breeding centres, were released in various areas within Poland. Generally, only young beavers (between 1-2 years old) were moved; the first translocated beaver, released in the area of the Sniardwy Lake did not survive as the individual was too old. In 1980, an additional seven beavers of different ages from the northeastern district of the Wigry Lake and Suwalki area were released into Kampinos National Park. In the park today there lives a resident beaver colony consisting of several families.

In the course of the study carried out by the author, beavers showed some unique adaptation patterns to different habitats, food availability and anthropogenic influence. The beavers observed all lived close to areas highly utilized by humans. The animals occupied, for example, a river bank close to a potato processing factory. In the author's opinion, beavers are a typical example of a highly adaptable species. Consequently, through natural dispersion from areas of release, beavers have managed to penetrate many parts of Poland where there was the necessary habitat: lakes, rivers etc. from where they had been extirpated before the releases. As an example, in western parts of Poland there are now several thousand beavers, whereas before 1974, the species was totally absent from this area. Both the Elbe-beaver(*Castor fiber albicus*) and the Central European beaver (*Castor fiber vistulanus*) are expanding their distribution; the distributions of these two sub-species may soon cross.

Bison
In 1952, after about 30 years of captive breeding, the first European bison (*Bison bonasus*) were released into the Bialowieza Primeval Forest. At the time, re-introduction of captive bred animals was a fairly novel concept, but this project succeeded in saving this highly endangered European species from extinction. In the sixties, the bison was re-introduced into the Borki Forest and the woodlands of the Bieszczady Mountains. By 1973, the species was breeding in the Knyszyn forest, and by 1980, in the Nadnotecka forest in the western part of Poland.

Elk
The Polish elk re-introduction project was initiated in 1951, in the Kampinos Forest; the last remaining elks (*Alces alces*) having been extirpated from the Kampinos Forest in the 18th Century. The released individuals originated from White Russia (Belorussia). They were bred in an enclosure before being released into forest habitat in 1958. From this nucleus group, and also from some specimens re-introduced in the northeastern district of Rajgród, the elk population has dispersed and successfully established new populations in other parts of Poland; the reintroduction is considered extremely successful. For example, between 1962-1965, the elk population growth in Kampinos averaged 20% per year, and between 1961 and 1966 the Kampinos National Park recorded that 30% of births were twins. Today, the estimated population of elks in Kampinos is between 100-120 individuals with a density of 3-4 individuals per 1000 hectares.

Restoration Project
In 1992, a project was initiated looking at the restoration of various other native Polish fauna through breeding programmes. The project concentrates primarily on rare and endangered species of birds and mammals including the European mink (*Mustela lutrcola*) (extinct in Poland) and the golden eagle (*Aquila chrysaetos*) (Critical). Both species are listed in the top category of threatened species. From the second category, the project is involved with some birds of prey (greater spotted eagle (*Aquila clanga*), lesser spotted eagle (*Aquila pomarina*), osprey (*Pandion haliaetus*), and other species such as the European roller (*Coracias garrulus*), the stone curlew (*Burhinus oedicnemus*), the European wild cat (*Felis silvestris*), the European otter (*Lutra lutra*) and the grey seal (*Halichoerus grypus*).

Of all these, the species given highest priority is the golden eagle, which not only appears on the project's emblem, but is Poland's national flagship species. Thus, since 1992, the Green Library Foundation, together with Poznan Zoo has initiated a captive breeding programme for the golden eagle; so far, 11 golden eagles have been placed in an aviary for breeding. In addition, a popular book explaining the role of the 'white' eagle in Polish national history is under preparation. This has all been regarded as one small step towards the restoration of Poland's native fauna.

Lynx
Restoration of the lynx, *Lynx lynx,* is also part of the overall restoration project. It has been observed that in some forest habitats in Poland, the herbivore populations are high; they are not being regulated by predators, and thus the habitat shows significant stress. The lynx project, which aimed to re-introduce the lynx into central Poland to Kampinos National Park, was able to show that given the local climate and lowland forest condition, the predator seemed to be a necessary and welcome component to the ecosystem.

The lynx project itself is exceptional in several respects. It is unique in Poland in that it uses telemetry to monitor the released animals and in Europe (together with the release of captive bred wolves in Georgia - see RE-INTRODUCTION NEWS 8 and 12), in that it involves the release of captive-bred carnivores.

The three major reasons for lynx becoming exterminated from the Kampinos Forest in the 19th Century were human pressure, including hunting, agricultural development and the lynx's economic value. Initiated in 1992, the project sourced four males and seven females from various captive breeding institutions, different breeding stocks and thus different gene pools for later release in Kampinos National Park. The project has had three phases:

- the lynxes needed to adapt to the local microclimate and environment (minimum three months), and their feeding habits needed to be tuned to the potential available food: roe deer, wild boar, elk. At this stage the animals were kept in individual enclosures;
- the lynxes were trained to kill;
- research was carried out into the interaction between different lynxes and their social relations and ranking; i.e. male-female relationship before and during mating periods; mutual cooperation in hunting etc. During this phase the lynxes were in a big enclosure (of at least 2000m^2).

After the breeding season, the lynxes were released one by one by opening the door of their hunting enclosure into the forest. Usually, following their release, the lynx would stay for a few days close to the enclosure, travelling no further than 1-2 km, until dispersing.

Typically with the changing seasons, the lynx will shift territories. Occasionally, they will stay for a longer period in the same area. For example, the dominant female 'Theresa' occupied the same hunting territory for three years (last winter with a young female from Sweden). The radio-telemetric data shows that lynxes usually prefer the same forest habitat.

Kampinos National Park is equivalent to an ecological island: to the north it borders the Vistula river, to the south the Berlin-Moscow highway, to the east lies Warsaw, the capital of Poland with its three million inhabitants, and to the west it borders an agricultural zone. Thus, it was quite a surprise to learn that one of the released females (released in the summer of 1994) was found in another forest located 60 km from the southwestern corner of Kampinis National Park. She must have migrated there, having found a natural ecological canal along the Bzura river basin. The female lived in this forest until she was caught by a local poacher.

In 1995, during the second breeding season since the lynx were released, a lynx and her 10-month old kitten were seen. All project staff were overcome with joy to see a young lynx, born from captive parents, in excellent shape, behaving like a

typical wild cat. In 1996, a second female produced offspring. One case of extraordinary breeding behaviour was observed when an adult female 'Theresa', having spent two breeding seasons in the forest, returned to the enclosure to mate with a breeding male 'Spencer'.

Between 1995 and 1996, however, four lynxes (2m:2f) were lost; all were road kills. Thus road deaths are a significant problem and to develop some means of reducing traffic related mortality is a priority.

The author would like to thank Pawal Tyrala and Dr. Michael Boer for assistance and cooperation in lynx project. The lynx project was stimulated during a conference at Antwerp by Dr. Ulysses Seal, Chairman of CBSG. Its implementation has been possible thanks to the financial support kindly provided by Polish National Found of Environment Protection, British Airways Assisting Nature Conservation, as well as many other organizations and private sponsors, whom I would hereby like to thank for the help.

Contributed by Dr. Jan Smielowski, Agricultural University of Poznan, Poland.

Beaver re-introduction in Volga-Kama National Preserve, Tatarstan, Russia

Rationale and significance

The territory surrounding the Volga-Kama National Preserve (VKNP) in Raifa district, in Tatarstan, Russia, is greatly influenced by anthropogenic factors. The erosion taking place in the surrounding agricultural areas, which are the watershed of the reserve's rivers and lakes, are placing the reserve in great danger. There is a possibility that there will be a change in the hydroregime and that the ground water level will lower due to erosion. This could lead to the degradation of the most valuable taiga biosocieties that require biotopes of high humidity; the effect of this is already being seen in some areas.

One means of restoring the biodiversity within the Raifa region is to restore the European beaver (*Castor fiber*) which was extirpated in early 1800. It is believed that beaver activities can lead to the humidification of forest biotopes and thus stimulate the increase in biodiversity.

The beaver has been successfully re-introduced into Tatarstan, but it is unable to increase its distribution through natural dispersal because only 16% of the area is covered by forest; thus, the beaver population is effectively marooned.

Beaver restoration in Raifa district may result in the establishment of a self-regulating population that can serve as an example of rational management for other beaver populations in similar regions.

Beaver re-introduction in Raifa would provide an opportunity to study the process of beaver establisment from the moment of release.

Project Goal

The project goal is to restore the genetic- and bio-diversity in the reserve and to study the effect of beaver landscape-forming activity on the ecosystem.

Main objectives

To evaluate:

- The effect of beavers on hydrological, hydrochemical and hydrobiological indexes in the inhabitated water systems;
- Dynamics of vegetation on experimental plots;
- Dynamics of beaver density and population structure;
- Population dynamics of other species, i.e. beaver competitors;
- Comparison of the dynamics of a beaver population under a management and trapping regime, to the dynamics of the reserve's beaver population.

Timetable

1. Investigation of potential sites for obtaining beavers and of which families to trap, preparation of equipment to trap beavers (May-July, 1996);
2. Classification and identification of proposed release sites (June-July 1996);
3. Detailed description of the proposed places of release (June-July 1996);
4. Trapping, transportation, marking and release of beavers (August 1996);
5. Monitoring of beaver movements, migration and other activities, including feeding, building of dens, inter- and intraspecific activity (on-going);
6. Monitoring of hydrological, hydrochemical and hydrobiological indexes in the water systems after beaver release (periodically in the course of the programme);
7. Monitoring the vegetation dynamics of experimental plots (on-going);
8. Monitoring the dynamics of beaver density and population structure in Raifa territorial group (April -May 1997, September-October 1997 and then on-going);
9. Identification of an experimental beaver population outside the reserve (1997 and then on-going);
10. Monitoring the changes at the landscape level (1998 and then on-going);
11. Trapping and management of the experimental population, evaluation of the effect of these activities, and comparison to the population dynamics of the released population in the reserve (November-December 1998 and then on-going).

Releases of additional beavers are possible in the course of the programme, but the ecological capacity of VKNP within Raifa district has been estimated at 25-30 beavers.

Contributed by Dr. Yurii Gorshkov, Head of Volga-Kama National Preserve, Tatarstan, Russia

Saving the European Beaver in the Russian Lapland

Introduction

The range of the European beaver,*Castor fiber*, used to extend into the western section of the Colski peninsular in Murmansk, Russia, and, together with the Scandanavian population, was the northern most distribution of the species. The species was exterminated from the Colski peninsula during the 19th Century, and by the end of century the beaver had been exterminated from the entire region, with the exception of Norway.

The first attempt to re-introduce animals to Colski peninsula was not successful; on this occasion animals were from the Norwegian population (*C. fiber fiber* L). The second attempt at re-introduction involved the release of 14 beavers from Voronezh National Reserve (*C. fiber orientoeuropaeus* Lavrov subsp. Nova) in Eastern Europe, into the Lapland National Reserve in the Colski peninsula. Adaptation to the extreme conditions proved difficult for the animals, and currently the population is low and threatened, and urgent measures need to be taken to save this most northern population (68°20' North) of the species. It is classified as Rare, and is included in the 'Red Book' for endangered species for the Murmansk Region.

Background

Many years of monitoring the released animals in the Lapland National Reserve showed that survival rates are low, largely because of the relatively poor food base, unstable water regime, long periods of snow cover and human activity within the area. By the end of the 1950's, the population had started to decline.

Proposed activities

The future of the European beaver in the Russian Lapland is dependent on several factors: distribution and availability of food resources, the rate of population growth and the quality of available shelter. Thus, to help ensure the long-term conservation of the population, a further release of beavers in the national reserve would seem to be necessary. Ideally, any released beavers should be from the extant Norwegian population as individuals from there are likely to adapt better to the harsh ecological environment of the Colski rivers.

It is proposed that 4-5 pairs of Norwegian beavers are released in the Colski peninsula, effectively increasing the size of the extant population; such a translocation would be conducted over a course of 2-3 years. A survey of the areas most frequented by beavers needs to be carried out to determine their ecological capacity and productivity. In addition, further research into the beaver in Norway needs to be undertaken. This information can then be used to help establish the best sites for release within the Lapland National Reserve. It is proposed that Norwegian and Russian specialists work together on these various activities.

After the release, the following activities will be carried out:

1. Provision of adequate protection for the beavers;
2. Monitoring of all released individuals;
3. Informing and involving of all interested parties and organizations;
4. On-going development and improvement of re-introduction techniques.

Contributed by Dr. Kataev Genadi Danilovich, Senior Scientist at the Lapland Biosphere Reserve, Murmansk Region, Russia. (Dr Kataev has been studying the ecology of the beaver at northern Colski since 1971).

CONSERVATION INTRODUCTIONS

Conservation plans for hunter's hartebeest

The endangered hirola (also known as the Hunter's antelope or hartebeest) might yet be saved from extirpation. Plans by a Hirola Task-force, a multi-disciplinary group formed by several institutions led by the Kenya Wildlife Service, to implement a Hirola Conservation Plan are at an advanced stage. The Hirola Conservation Plan was prepared with assistance from the IUCN/SSC Antelope Specialist Group, in consultation with the Task-force.

Hirola, according to the Mace and Lande's (1991) extinction risk criteria, is one of the three most endangered ungulates in the world, and the most endangered in Africa. Its confirmed wild population is 302 individuals at its natural range in south eastern Kenya, and 57 animals in Tsavo East National Park. The latter population is the product of a conservation introduction carried out in 1963.

The Brownsville Zoo in Texas holds one individual. A Somali population, which occurred in the south west of the country, could have been extirpated.

Largely unknown to the public, the hirola is a large antelope averaging one metre at shoulder level and weighing approximately 70 kilograms. It is a rufous tawny colour, has a face like that of hartebeests, and horns like impala. The female is smaller than the male and has lighter horns. Hirola graze in herds of between 12-25 individuals.

Hirola's phylogenetic status is confused. Many people, using morphological criteria lump hirola with the topi in the genus *Damaliscus*. These people consider hirola as closely related to hartebeests *(Alcelaphus sp)*. One person classified it as a subspecies of the topi *(D. lunatus)*. Other people using fossil evidence have more recently classified it as a separate genus Beatragus *(B. hunteri)*. These people consider hirola as antedating the common Alcelaphus-Damaliscus ancestor in the Alcelaphine lineage of the family bovidae.

The Kenya population, estimated at 14,000 in 1973, had plummeted to 2,000 by 1993, and to 302 by 1995. Poaching, competition with livestock, disease, drought etc. are believed to have caused the decline. The Somali population probably succumbed to these same factors, exacerbated by the civil war in that country.

The main *in situ* conservation measure for the hirola was the creation of the Arawale National Reserve in 1973, but very little work has been possible on the ground due to insecurity in the area. A survey carried out in 1995 found no hirola in the reserve. The present vegetation type, mainly thickets



Hunter's hartebeest or hirola
Credit: Des Bartlet

(hirola prefers open habitats) and human settlement in the reserve means Arawale has lost its potential as valuable protected hirola habitat.

Other conservation measures have been *ex situ*. In 1963, the Kenya Game Department captured 100 hirola for translocation to Tsavo National Park, 100 kilometres southwest of its natural range. Only 30, mostly juveniles, reached Tsavo alive: nineteen having travelled by air and eleven by road. The eleven probably died shortly after release. Therefore, the founding population in Tsavo probably only numbered between ten and 15 individuals. The population has now increased to 60.

Neither have hirola done well in captivity. At the Dvur Kralove Zoo in the former Czechoslovakia, a population originating from seven individuals was established in the 1970's, at one time numbering 15 individuals. It later fell victim to disease. Attempts to establish a population in the Ruhe Zoo in West Germany in the early 1970's failed after the founding stock and their offspring succumbed to various causes.

In the United States, the Brownsville Zoo in Texas originally held four individuals; one individual remains today. This individual is apparently behaviourally abnormal. She was subject to recent media attention as she was wrongly thought to be the sole captive survivor of a species extinct in the wild; the U.S. was unaware that there was an extant wild population of hirola. The Texas A&M University was thus attempting to achieve in vitro fertilization.

The above experiences pre-empt the need for careful planning and implementation of the Hirola Conservation Plan. The present plan proposes several *in situ* and *ex situ* rescue measures. *In situ* measures will involve securing hirola range through improved security and extension work among local communities. This is a long term strategy as the insecurity in hirola range precludes routine work on the ground.

Ex situ measures include a proposal to airlift hirola to Tsavo National Park to reinforce the present population of 57, and to private ranches. One hundred animals could be moved. The challenge here will be to reduce mortality during movement and to establish viable breeding populations. The Hirola Conservation Plan also proposes international cooperation for a captive breeding program.

Despite the urgency of the hirola situation, implementation of the Hirola Conservation Plan is likely to be a slow process. First, the costs of translocating 100 hirola will be substantial. Secondly, the vulnerability of hirola to handling mitigates against haste. Whatever the pace of implementation, the Hirola Task Force seems determined to avoid past mistakes. One only hopes that the task force will carry this on during implementation of the Hirola Conservation Plan.

Mace G.M.,R. Lande 1991. Assessing extinction threats: toward a re-evaluation of the IUCN species categories. Conservation Biology 5: 148-157.

Contributed by Njoroge Ngure, African Wildlife Foundation, Nairobi, Kenya.

Thevenard Island Mouse: Translocation To Serrurier Island, W. Australia

Policy now exists in Australia which ensures that any transfer of vertebrate fauna is prepared as a Translocation Proposal. This is then reviewed by two experienced scientists who recommend whether the proposed transfer is warranted, properly planned and executed. The policy guidelines are based on the 1987 IUCN Position Statement and include translocation objectives and criteria to define success.

Conservation introductions, although frowned upon by some for their risk to the release site, can provide important arks for threatened populations. The Thevenard Island Mouse Translocation Proposal is an example of a conservation introduction recently approved in Western Australia. The proposal considers the logistics involved in introducing a population of these mice, native to Thenard Island, to another offshore island for the purpose of conservation of this taxon.

The Thevenard Island short-tailed mouse, *Leggadina lakedownensis,* is found on one sandy bay off the coast of north-western Australia. The introduction of house mice, *Mus domesticus,* to Thevenard Island in 1985/86 - and their subsequent periodic plagues - became a concern with

regards to the future of the native mice. Thevenard Island mice had became absent from areas where numbers of house mice were high. In 1994, the Thevenard Island Mouse Recovery Team was formed to implement the guidelines for the conservation of this species. Actions are now underway selectively to remove house mice with little or no impact on the Thevenard Island mice. One of these actions is to establish a second population of Thevenard Island mice elsewhere as security for the single population should a general or selective baiting programme ensue.

Target site
Serrurier Island was considered to be the most appropriate site to provide suitable habitat for the conservation introduction. It lies 35 km south of Thevenard Island, and at 350 hectares, is just over half the size of Thevenard Island. From a botanical, zoological and geological perspective, both islands share near-identical features to satisfy shelter, food and water requirements for *L. lakedownensis*; making Serrurier Island a suitable site for translocation. The presence of one feral cat on Serrurier Island suggests that it is not in a pristine and unmodified state, and surveys have identified no significant species of flora or fauna. The cat was recently removed using poisoned baits.

Translocation
A founder group will be established, consisting of 3% of the estimated *L. lakedownensis* population on Thevenard Island, and will comprise mice of different age class and reproductive condition. An equal sex-ratio will be given priority. A minimum of 20 mice will be considered for translocation at any one time. Lactating females will not be translocated. If numbers for the initial translocation are as low as 20, it is proposed to booster numbers on Serrurier Island on subsequent trips if there is evidence that individuals comprising the founder population are surviving.

The Thevenard Island Mouse Recovery Team did not advocate the release of a population of *L. lakedownensis* to the mainland. Nor did it consider captive breeding as suitable because of the financial costs incurred towards the maintenance and facility set-up of a mouse colony and, more importantly, because breeding was unsuccessful in one pair of mice currently held in captivity despite various husbandry techniques.

Post-release monitoring
Immediately following the initial release, mice will be monitored by radio-tracking over a 12-15 day period, to coincide with the length of the transmitter batteries. Only adult mice will be radio-tracked with collars; pregnant females will not be collared. The day-locations of each individual will be recorded to ascertain patterns of dispersal and settlement. A second field trip to monitor the translocated population will proceed within a month of release. Radio-collars will be replaced, and additional monitoring - employing track-searches, trapping, and radio-tracking - will assess the current home ranges. Monitoring is expected to continue at least biannually over the next two years.

The success of the translocation will be gauged to be a self-sustaining population that is breeding and increasing in number. Minimum populations of mice on Serrurier Island are predicted to fluctuate over the year in accordance with fluctuations of mice on Thevenard Island. Density per hectare estimates of *L. lakedownensis* on Thevenard Island have varied from highs of 2.6 and 4.4 in May 1994 and June 1995, respectively, to a low of 0.2 in April 1995. A density per hectare estimate for Serrurier Island will be 0.2 if 50 mice are initially released. This estimate can be used as an indicator to the fate of mice on Serrurier Island during future monitoring trips.

The translocation will proceed during late 1996. A second population is believed practical for the security of the extant population of *L. lakedownensis* on Thevenard Island.

Contributed by Dorian Moro, Principal Investigator, Thevenard Island Mouse Recovery Team, The University of Western Australia, Australia.

RE-INTRODUCTION ISSUES

Requirements for Captive Propagation

International Endangered Species Breeding Programs and Global Masterplans can help prioritize species, and even higher taxonomic units, with regards to captive breeding needs, and are critical with respect to providing appropriate individuals for re-introduction projects. Typically however, population managers have to deal with the implications resulting from decisions made based predominantly on a few demographic and genetic parameters, and aspects of zoo carrying capacity. The latter in particular seems to influence the management of captive populations. However, an open minded analysis of what is required to ensure the survival of a species through captive propagation is necessary.

Guidelines to assist with the genetic management of captive populations have been provided by a number of authors who sometimes do not consider that different species may have varying requirements with respect to the founder population, or that genetic considerations may conflict with a species' mating system or an individual's social skills.

Guidelines concerning the behavioural management of captive populations may help to overcome the resulting problems. Establishing reserve and model populations is a complex task, but should take into account basic evolutionary biology principles as well as the phenomenon of 'adaptation'. Some of the terms and concepts which need to be considered and possibly integrated into breeding programmes are outlined.

Breeding programmes have to establish adaptive populations which are successful in terms of maximizing fitness. 'Successful' has to be defined with reference to competing populations of the same or different species. 'Fitness', on the other hand, is predicted based on the existence of adaptations, i.e. the capacity of an organism to adapt to its environment. According to Dunbar (1985)[1] 'it refers to some problem set by nature and entails the notion of a solution that permits the organism to overcome that problem efficiently'.

There are two types of adaptation:

1. Phylogenetic adaptation; and
2. Adaptation via adaptive modification, or learning.

The importance of adaptation by learning is emphasized by Parker (1985)[2]. An organism is determined by its genotype which provides the genetic conditions for developing adaptive modifications via learning during early development. The phenotype of the organism comprises both genetic dispositions and characters acquired via modifications, and it is the phenotype as a whole which is exposed to selection.

Whether an individual's genes survive and can be transferred to the next generation depends not only on the genes' qualities in terms of providing predetermined patterns to cope with the environment, but also on whether traits and skills can be acquired via learning. These enable the individuals to cope with environmental pressures and changes of a short term character.

Selection for adaptive traits results from permanent competition and can have different forms, with possibly extremely important implications for the management of captive populations. They have not yet been worked out.

A trait of a population which is regarded of crucial importance for its fitness and in particular for its stabilization under patchy and dispersed food distribution, is the degree of phenotypical inter-individual variability. Differences between individuals can affect a population's fitness directly or indirectly, i.e. those studying population dynamics do not look for the average individual, but for differences in individuals and how these affect reproduction and survival.

With reference to captive populations, this approach requires that captive conditions are established which allow a species to realize as much of the species-specific physical, anatomical and behavioural characters as is possible.

Whether the existing phenotypes in a captive population are adaptive and would sum up to a fit population is, however, difficult to predict. Natural selection, i.e. in the years following a re-introduction, is the only rigorous enough test.

If captive propagation programmes and re-introduction projects intend to justify efforts and costs of such undertakings, ways have to be found to overcome potential behavioural and adaptability problems, and analytical tools have to be developed for assessing a captive population's quality. A better integration of the theoretical and methodological framework of evolutionary biology might help.

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[2]Parker, G.A. 1985: Population Consequences of Evolutionary Stable Strategies. In: *Behavioural Ecology. Ecological Consequences of Adaptive Behaviour*. R.M. Sibly and R.H. Smith (eds), Blackwell Scientific Publications.

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Contributed by Werner Kaumanns, German Primate Centre, Germany.

RE-INTRODUCTION BRIEFS

- Progress has been made with the brown bear *(Ursus arctos)* re-introduction project in the Pyrenees, France. Two female bears have been translocated from the Melved Forest, Slovenia to the Haute-Garonne Pyrenean Forest, France. Two animals were captured, and underwent a thorough veterinary examination. Both have been equipped with a radio collar, and are being monitored by a team from the Large Mammal Research Institute (IRGM), Toulouse, France. The bears moved some distance from the point of release, and settled in the forests where bears were still present 10 years ago in Ariege. Dependent on the will of the farmers, hunters, the local administration, and other local inhabitatants, further translocations will take place in 1997. Scientists and veterinarians from France, Slovenia and Croatia have been working together on this project.
- With the proclamation in 1994 of Marakele National Park, situated in the bushveld area of north western South Africa, a total of 20 black rhino *Diceros bicornis minor*, 39 elephant *Loxodonta africana*, 25 white rhino *Ceratotherium simum* and 16 buffalo *Syncerus caffer*, as well as a host of other species have been re-introduced into the park.
- Since 1990, the South African National Parks Board has re-introduced two black rhino from zoological gardens back into the wild. The first was the re-introduction of a sub-adult *D.b. bicornis* cow from Lisbon Zoo into the Augrabies Falls National Park. The re-introduction was successful with her giving birth to a young female calf in 1994. In 1995, as part of an arrangement with the Howletts Port Lympne Wild Animal Park, UK, a young male *D. b. michaeli* was re-introduced into an enclosure adjacent to the rhino and elephant camp at Addo Elephant National Park, into which he will be released in due course. These document the first such re-introductions of captive bred black rhinos in South Africa.

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Chairman, RSG: Dr. Mark R. Stanley Price

Editor: Annabel Falcon (Fairclough)

We welcome comments and contributions. Please send them to:

RE-INTRODUCTION NEWS
IUCN/SSC RE-INTRODUCTION SPECIALIST GROUP
African Wildlife Foundation
P.O. Box 48177, Nairobi, Kenya
Tel: 254-2-710367 Fax: 254-2-710372
e-mail:awfnrb@form-net.com

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