

RSG



RE-INTRODUCTION NEWS

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CARNIVORE
ISSUE**

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Letter from the IUCN/SSC Re-introduction Specialist Group Chairman MARK. R. STANLEY PRICE



This is the second issue of our newsletter that is devoted to a particular group of animals. Again, authors have contributed willingly and promptly; the reaction to our last issue on amphibian and reptile re-introductions indicates that we have a formula that is useful to many re-introduction practitioners. But, at the same time, we will not neglect our overview newsletter issues.

It is a pleasure to thank Mike Phillips for his role as RSG section chair for carnivores, and for his personal commitment to the Turner Endangered Species Fund's sponsorship of this issue. One of the Fund's pillars is the restoration of habitats and communities.

Restoration and re-introduction were key elements of the recent 7th World Conference on Breeding Endangered Species, held in Cincinnati, Ohio in May. The conference theme was "Linking zoo and field research to advance conservation." Mike Maunder, RSG Vice Chairman, presented a joint paper "The role of in-country ex-situ facilities in supporting species and habitat recovery: some perspectives on East Africa". Two points worth mentioning were that 11 out of 18 presented papers were on re-introductions involving captive-bred stock, and paper presentations were limited to allow participants to spend some 8 hours in workshop sessions.

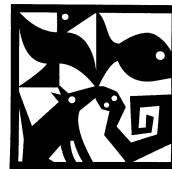
The potential topics for workshops came from the papers and plenary discussions. Gratifyingly, some 70 participants wanted to work on aspects of re-introduction. This large total was split between 3 groups, on the topics of pre- and post-release, and re-introduction policy.

The latter group made a number of recommendations that were very helpful to RSG. The most notable was the suggestion to use an Internet web approach to develop the re-introduction policy guidelines into planning protocols. This we shall be starting on, and will be keeping members informed, while also soliciting input.

We are also embarking on strategic thinking over the future of the group for the next IUCN triennium, which will kick off at the World Conservation Congress in late 2000. There are exciting prospects to build on RSG's increasing profile and technical role worldwide.

Mark Stanley Price

Letter from the Executive Director, Turner Endangered Species Fund MIKE PHILLIPS



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The world is now firmly in the grip of a great extinction crisis. While the exact rates of loss are unknown, studies

indicate that it is at least 4 orders-of-magnitude faster than background rates evinced in the fossil record. The overwhelming majority of losses are due to anthropogenic forces working at odds with nature. If trends continue the world will soon be a more dismal place with silent springs and hot summers and little left to excite the senses other than weeds.

For myriad reasons, carnivores tend to be especially vulnerable to factors which drive the extinction crisis. Some subspecies of carnivores have been exterminated and the geographic ranges of most others have contracted. As a group, carnivores' grip on existence is weakening as destructive forces continue unabated, gaining the momentum that attends any ever-increasing scale of enterprise. Desperate measures will become commonplace if the wondrous diversity of carnivores is to persist into the distant future.

Re-introduction is one such measure that will become increasingly important as carnivore restoration efforts are developed. This issue of Re-Introduction News focuses on that topic. The pages that follow present insights into reintroducing myriad meat-eating species ranging from canids, felids, ursids, and a delphinid. Successes are highlighted along with failures: clearly much remains to be learned to achieve the requisite knowledge to successfully restore carnivores to their rightful place.

The Turner Endangered Species Fund is proud of our alliance with the IUCN/SSC Re-Introduction Specialist Group and pleased to sponsor this issue of Re-Introduction News. We hope you find it interesting and informative.

Mike Phillips



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MESSAGE FROM THE SPONSOR

Wolf re-introduction and the Turner Endangered Species Fund (TESF)

Some of the greatest re-introduction success stories during the last 15 years involve wolves in the United States. In 1986 the U.S. Fish and Wildlife Service launched the red wolf re-introduction project in the southeastern United States. From 1986 - 1994, 66 wolves were released. Currently the population seems to be self-sufficient and includes close to 100 individuals. The red wolf project led to efforts to re-introduce gray wolves to Yellowstone National Park. From March 1995 through March 1996, 31 wolves translocated from Canada were released in the Park. The population now includes over 110 animals and reproduction is surpassing the wildest expectations. The Yellowstone project gave rise, at least in part, to recent efforts to re-introduce Mexican wolves in the southwestern United States. While it is too early to tell, we have every reason to believe that the howl of the wolf can be restored to some of the rimrock canyons and Ponderosa pine forests of the southwest.

These re-introduction projects represent a revolutionary change in how U.S. citizens viewed themselves relative to nature. Nothing less than a paradigm shift had to occur before wolves could be re-introduced. Our country had to abandon the view that humans

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have the right to exploit nature without responsibility. Indeed, wolf restoration tacitly acknowledges that we must be responsible for violations of nature.

The magnitude of the shift is best understood by remembering that as recently as the 1800s wolves were one of the most widespread large mammals in North America. Historically you could find wolves from coast to coast, east to west and north to south. You could find wolves in the deserts and swamps, and the prairies and the forests. At least until we killed them. And we didn't kill just a few, we killed thousands and thousands of wolves. In a little less than 100 years we drove a once common species to the brink of extinction.

A variety of research projects have clearly shown that large carnivores serve as keystone species, differentially modifying the composition and structure of the ecosystems they inhabit. But re-introducing wolves did more than simply return important pieces to complicated puzzles. Their return served to prompt, at least in part, media executive Ted Turner to launch a significant private effort to save imperiled species.

I first met Mr. Turner in the spring of 1995 when he visited the Yellowstone wolf project, an effort he had supported for many years. During the course of the visit Mr. Turner expressed concern about the precipitous decline in biological diversity. He was troubled over the fact that every year thousands of species and attendant ecological interactions fine-tuned by time and place, disappear at the hand of mankind. Losses are so severe that the redundancy and certainty of nature is being stripped away, wearing thin the lives of millions. This bothered Mr. Turner and the wolf project helped to convince him that the trend could be reversed, that restoration was an alternative to extinction.

During the visit we discussed the myriad factors which drive the extinction crisis. We shared the belief that a most important cause was loss of habitat, mostly on private land, that occurs as landscapes are modified in the name of development and economic growth. Moreover we shared the belief that arresting the extinction crisis would require the keen involvement of private landowners.

Soon after the visit Mr. Turner, in close consultation with his son Beau and other family members who were equally concerned about the extinction crisis, concluded that current with land holdings of 1 million acres (3,900 km²) and a desire to acquire more land, the family's active involvement in the conservation of imperiled species could (1) significantly improve the recovery prospects for many species, (2) serve as an example to other landowners that co-existence with endangered species was possible, and (3) illustrate the great utility of the Endangered Species Act. Without doubt it was this triad of possibilities and the success they saw attending the wolf re-introductions projects which prompted them to launch the Turner Endangered Species Fund (TESF) and Turner Biodiversity Divisions (TBD) in June of 1997.

The TEF and TBD are private efforts dedicated to conserving biodiversity by ensuring the persistence of imperiled species and their habitats. The Fund and the Divisions concentrate on carnivores, grasslands, plant-pollinator complexes, species with historic ranges that include Turner properties, and dissemination of credible scientific and policy information about biodiversity conservation. Our projects, which are based on the principles of

conservation biology, involve state and federal agencies, universities, and non-governmental organizations. We operate on the belief that wrapping many minds around a problem leads to success. In our endeavors, whether managing extant populations or re-introducing individuals to restore extirpated populations, the ultimate goal is population persistence with little or no human intervention. We believe that self-sustaining populations of native species indicate a healthy or at least a recovering landscape.

Currently we have 27 projects underway including several re-introduction efforts involving plants, birds, and mammals. Our flagship effort for 1999 concerns conservation of migratory pollinators and their plant partners along a 1,500 mile migration corridor which stretches from the southwestern U.S. to southern Mexico.

We realize that our task is daunting, largely due to the newness of our approach of emphasizing private stewardship of biodiversity. We know that many of our projects will be controversial, slow to succeed, and fraught with uncertainty. We know that some may fail. Not because we were ill-prepared, because we won't be. And not because we didn't work hard, because we will. But because restoration is an imprecise process about which we know very little. The difficulty of our task, however does not diminish our resolve which is substantial and based on the belief that any ultimate solution to the extinction crisis will rely on the genius and adaptability of humankind. And the TEF is determined to contribute by establishing a new measure for the conservation of Earth's biotic diversity.

We are proud to sponsor this issue of *Re-Introduction News* as one of our first efforts to facilitate dissemination of credible information about biodiversity conservation. We hope you find the issue informative and timely.

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CANIDS

GRAY WOLF

Wolf Re-introduction in Yellowstone National Park, USA

Wolves *Canis lupus* were extirpated over much of North America during European settlement. They were relentlessly killed mostly because they preyed on domestic livestock after their natural prey had been eliminated by people. The plains bison *Bison bison*, for example, were almost completely wiped out and wolves had little else to prey on other than domestic stock. By the 1960s only about 500 wolves remained in the continental United States, and they were much reduced across Canada and Alaska.

In the U.S. during the 1960's attitudes towards the environment changed including a re-evaluation of the value of predators. In



Gray wolf *Canis lupus*, Alpha male # 10, Yellowstone National Park © Barry & Teri O'Neill

1973 the passing of U.S. Endangered Species Act required recovery of animals and plants made rare by humans. This wide-reaching legislation made restoration of the gray wolf, extinct in the Rocky Mountains since the 1930s, mandatory. Wolves, however, were still a controversial subject, and even though an environmental movement had taken hold in the U.S., many, especially people who would be exposed locally to recovered wolf populations, were adamantly opposed. To deal with this contentiousness, planning had to be deliberate and extensive involving as much of the local and national public as possible. Actual planning to restore wolves began in 1974 and was not completed until 1994. Through that time numerous biological, ecological, and sociological studies were completed. Public surveys found that a majority of the local people were supportive of wolf recovery, but were strongly opposed to restrictions placed on commercial or recreational use of public lands. Visitors to Yellowstone National Park (a cross-section of the national public) overwhelmingly favored wolf recovery. Interestingly, the surveys also found that many people had misconceptions or inaccurate information about wolves, a problem that has plagued wolves historically. Accurate, scientifically based public education about wolves remains one of the major challenges for conserving the species.

The amount of public outreach about wolf recovery in Yellowstone was unprecedented in the United States: 1700 copies of the full plan (Environmental Impact Statement), 42,000 copies of its summary, and 750,000 related documents were distributed. Public meetings across the region numbered 130. This outreach produced a record public response of 170,000 written comments, a majority of which favored wolf restoration, from every state and 40 foreign countries. The recommended plan was to re-introduce wolves to Yellowstone and central Idaho as "nonessential

experimental", a designation under section 10(j) of the Endangered Species Act that allows more management flexibility of wolves when they cause problems for local people, but still enforces protection which will promote recovery. The most significant departure from full endangered species status management was the provision that allows a livestock producer on private land to kill a wolf in the act of killing their livestock. The final plan was approved on 14th April 1994.

With final approval came litigation. Groups most strongly opposed to and in favor of wolf recovery voiced their concerns with lawsuits, a disappointing spin-off given the effort and time spent developing the plan. A group comprised mostly of farmers and ranchers sued to stop re-introduction entirely. Another lawsuit claimed that wolves were already present in Yellowstone and represented a unique gene pool and any re-introduction of other wolves would dilute and eventually replace unique resident wolves. Another lawsuit, put forth by wolf proponents, claimed that the "experimental nonessential" status did not protect re-introduced wolves enough, that wolves should be re-introduced, but as a fully protected endangered species. These lawsuits were combined and in December 1997 a judge ruled the re-introduction illegal and all the wolves had to be removed. The judge immediately stayed his ruling, however, expecting an appeal. The judge's ruling was based on the possibility that a naturally occurring wolf from northern Montana, which is fully protected under the Endangered Species Act, could disperse into the "experimental nonessential" area and be legally killed in some situations (e.g., found killing livestock). Thus, that individual dispersing wolf would have been stripped of protection it was born to and that this was illegal. The case has been appealed by the US Justice Department and several environmental organizations and a court date is still upcoming.

Despite all of this wolves were successfully captured in Canada and re-introduced to Yellowstone and Idaho in 1995 and 1996. A total of 31 wolves in seven family groups were released in late winter over a period of two years in 1995 and 1996. The objective of the Yellowstone re-introduction was to capture family groups, acclimate them in pens at their release site, and then release them slowly ("soft" release). In Idaho individual wolves representing many packs were captured and released immediately (a "quick" or "hard" release). Originally the plan called for three to five years of re-introductions because of expected high dispersal and mortality, but this did not happen, and only two years of re-introductions were necessary to establish the populations. In Yellowstone groups were created in the pens by introducing an adult male and female prior to the breeding season. This was a successful strategy that resulted in reproduction the first year, unlike Idaho where there was no reproduction initially.

Since re-introduction growth of the wolf population has been very high, among the highest recorded for the species. By 1998, most of the suitable habitat for wolves within the 9,000 km² area of Yellowstone National Park had been settled, and wolves began occupying areas outside the park. Their major prey has been elk *Cervus elaphus*, the most abundant ungulate in the system, but six other ungulates (moose *Alces alces*, bison, mule and white-tailed deer *Odocoileus hemionus* and *Odocoileus virginianus*, pronghorn antelope *Antilocapra americanus*, and mountain goat *Oreamnus americanus*) have been killed. Bighorn sheep *Ovis canadensis* have not been documented as killed by wolves. Wolves have been aggressively killing coyotes *Canis latrans* and

have reduced their population where the two species overlap. The interaction with grizzly bears *Ursus arctos* has largely been beneficial to bears. Bears are especially dependent on protein upon their emergence from winter dens and have been able to usurp carcasses from wolves. One bear successfully defended a carcass from nine wolves. The relationship between cougars *Puma concolor* and wolves is still unclear, and a lower interaction rate is predicted because of differences in habitat preferences.

Depredations on livestock have been rare and not widespread. The re-introduction plan forecasted that a recovered wolf population would kill on average 20 cattle and 70 domestic sheep/year. In four years wolves have killed only eight cows and 83 sheep. In every case the depredating wolf or wolves has been captured and either relocated or euthanized. Compensation for these livestock losses was paid by a private "pro-wolf" group.

Future carnivore re-introduction projects should consider what kind of release strategy to employ. In Yellowstone wolves were put into pens which was expensive and labor intensive, but after release they remained in the area and some reproduced immediately. Some tooth damage occurred from wolves fighting the pen but in all cases this did not affect their ability to kill prey. In Idaho, where wolves were not put into pens, less time and money was involved but the wolves traveled widely after release and did not reproduce the first year. Five years post re-introduction there was no difference in population size between Yellowstone and Idaho.

Wolves are arguably one of the more difficult animals to manage in all of North America. They need large land areas, a diminishing resource in today's modern world, may compete with humans for wild prey, and sometimes kill domestic animals. Any wolf re-introduction process will require extensive planning and public outreach and education. Indeed, the main lesson is that the public must be involved from the beginning and even that will not circumvent certain problems. A consideration for other carnivore re-introduction projects is the use of wild rather than captive stock. The immediate success of our project can be attributed to obtaining wolves that were already experienced in the wild. Other wolf re-introduction efforts (e.g., red and Mexican wolves) have not had the quick results partly because they were releasing animals raised in captivity. Finally, large tracts of public land contributed to the success of the Yellowstone and Idaho re-introduction projects.

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Preparing captive-raised wolves for re-introduction, Georgia, Commonwealth of Independent States (C.I.S.)

Introduction

Twenty two mature wolves, comprising four groups, which during postnatal ontogeny developed normal behaviour including normal cognitive activity, were selected and prepared for re-introduction. The experiment was carried out on each wolf when they were fed and when hungry. Thirty six local volunteers unknown to the

animals took part in the experiments. The minimum age of the volunteers was 15 years and the maximum 70.

How to avoid people

The wolves were taught to avoid people in a large enclosure. One of the local volunteers left his footprints in the area of 1 ha crossing the territory in 2 – 4 directions. After this, one of the wolves was released. This animal had been kept in a portable cage with non-transparent walls. About 3 – 5 minutes later, after the wolf had investigated the area and the footprints, the stranger reappeared. After 4 – 5 seconds the animal received a remote-controlled electric shock (300 – 400 v.) from the electric collar it was wearing. We had to make this equipment ourselves. However, ready-made ones such as electronic dog trainers are now available. Such experiments were carried out in different locations 3 – 4 times a day. After each session the animal was put back into the cage so that it could not see the stranger. During the experiments the volunteers carried different objects such as backpacks, bunches of hay or sticks, rifles etc. or nothing at all. The wolves were subjected to the above experiments until they developed a firm avoidance of strange people. The reaction was considered firm when the wolves would avoid strangers without electroshock in no less than 100 experiments. Another important requirement was that the wolves maintain a distance out of rifle range (see table 1 below).

We began to teach the wolves not to hunt livestock as soon as

	Reaction of alarm	First signs of avoidance	Flight distance of 10-15 m	Complete avoidance
Duration of development (days)	5 – 6	10 – 12	16 – 18	30 – 40

they got familiar with the area they were to be released. In this series of experiments the same approach was used. The wolves were exposed to a herd of cattle or sheep or to individual animals. At any attempt to attack the livestock they would receive an electric shock. These experiments continued until the wolves had a firm reaction of avoiding livestock i.e. they did not attack them without receiving an electric shock even after four days without food (see table 2 below).

By the time they were re-introduced, all the wolves had a firm

	Reaction of alarm	First signs of avoiding livestock	Avoiding Livestock
Days	3 – 5	6 - 10	20 – 35

avoidance reaction to both humans and livestock. After their re-introduction we carried out close observations for the following 4 years (approximately 823 hours per group) on the re-introduced wolves as well as their descendants (generations 1 and 2). We also wanted to get as much information on the re-introduced animals as possible and to assess the chances of them being killed by hunters. Therefore, we put metal collars on every wolf with the name of the researcher and the address of the Institute of Zoology as well as a note saying that the person who had obtained the collar could claim a bonus twice as much as that paid by the Government for killing a wolf (the Bounty System on all carnivores was abolished in 1993). To our satisfaction, there have been no such cases. In addition the results of our observations show that all the 22 wolves we released actively avoided strange people and never killed livestock. Moreover they taught their

offspring the same skills and habits.

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MEXICAN WOLF

Re-introduction of the Mexican wolf to the southwestern United States

The Mexican wolf *Canis lupus baileyi* is the most southern and most endangered subspecies of gray wolf *Canis lupus* in North America. Weights of wild Mexican wolves range from 25 – 45 kg. Adult Mexican wolves range from 140 – 170 cm in total length (nose to tip of tail), and 72 – 80 cm in shoulder height. The pelt of the Mexican wolf contains a mix of gray, black, brown, and rust colors in a characteristic pattern, with white underparts. Their historical distribution included wooded mountainous areas in southeastern Arizona, southern New Mexico, and southwestern Texas in the United States, and northern and central Mexico.

The Mexican wolf was extirpated from the wild in the United States by the mid – 1900s. The present status of wild populations in Mexico is unknown, but recent surveys in Mexico have not confirmed its presence. It appears unlikely that viable populations, if any wolves at all, remain in Mexico. The Mexican wolf was listed as endangered under provisions of the Endangered Species Act (ESA) in May 1976.

Between 1977 and 1980, 5 wolves were live-captured in Durango and Chihuahua, Mexico, to establish a captive population of Mexican wolves. Based largely on the results of DNA studies, 2 additional lineages of captive Mexican wolves were certified for inclusion in the official breeding program in July 1995. The current captive population of Mexican wolves exceeds 200 individuals held in 40 zoos and wildlife sanctuaries in the United States and Mexico. With 7 founders, some inbreeding cannot be avoided. However, no evidence of inbreeding depression has been detected in the population.

After 6 years of planning, evaluation, and public review the Secretary of the Interior approved in March 1997 the re-introduction of 100 or more individuals of the Mexican wolf with the aim of establishing a wild population. Genetically-surplus, captive-raised Mexican wolves are being released into the Apache National Forest in eastern Arizona and allowed to recolonize the Blue Range Wolf Recovery Area in eastern Arizona and western New Mexico.

The Blue Range Wolf Recovery Area includes all of the Apache and Gila National Forests, encompassing about 17,700 km². Elevations range from about 1,200 – 3,350 m. Vegetation varies from grasses and shrubs in the lowest areas; pinyon, juniper, and evergreen oaks at low to middle elevations; and mixed-conifer stands at higher elevations. Open grassy meadows occur throughout. Water is available in natural springs, streams, and rivers. Wild ungulate species include white-tailed deer *Odocoileus virginianus*, mule deer *Odocoileus hemionus*, elk *Cervus elaphus*, pronghorn *Antilocapridae americana*, bighorn sheep *Ovis canadensis* and javelina *Tayassu tajacu*.

Eleven Mexican wolves in 3 family groups were "soft released" on 29th March 1998 after about 2 months of acclimation in chain link fence pens. Supplemental feeding is used as a management tool in specific situations to maintain wolf health and influence behavior. Three weeks following their release, 3 subadult members of 1 family group killed a mature cow elk, demonstrating that these captive-reared wolves retained basic hunting abilities. All predation has been on native prey species, and no killing of domestic livestock has been confirmed.

Of the original 11 wolves released, 5 were shot (4 illegally): 1 disappeared and is presumed dead; and 3 were captured and returned to captivity. The 2 remaining alpha males were paired with new mates and re-released in December 1998. Three additional family groups have been released in 1999. The current free-ranging population includes at least 24 Mexican wolves (10 adults, 2 subadults, and 12 pups) in five packs, plus a wild-born litter of undetermined number.

In March 1998 the New Mexico Cattle Growers Association *et al.* filed a suit in the Federal District Court of New Mexico in an attempt to stop the re-introduction project. This case is pending. Biologists from 2 state and 2 federal agencies constitute the Interagency Field Management Team which implements the USFWS – approved Mexican Wolf Interagency Management Plan. Field staff live in local communities within the re-introduction area.

The ultimate success of Mexican wolf re-introduction rests on the fates of released wolves and their offspring and human tolerance of their presence in the wild.

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RED WOLF

Red wolves 12 years after re-introduction: managing hybridization, North Carolina, USA

Red wolves were declared extinct in the wild in 1980 after the U.S. Fish and Wildlife Service captured the few remaining wild red wolves and placed them in a captive breeding program for eventual re-introduction. Hybridization with coyotes threatened the continued existence of these wolves in the wild. Hybridization became a threat to the red wolf after anti-predator campaigns and habitat alteration caused coyote numbers to increase and wolf numbers to decrease. Ultimately, only 14 red wolves were placed in captivity as the founder population of the captive breeding program.

In 1987, red wolves were released onto the 150,000 acre (600 km²) Alligator River National Wildlife Refuge (ARNWR) in North Carolina, USA. Alligator River National Wildlife Refuge was chosen, in part, because it was free of coyotes. Almost 12 years after this initial, landmark re-introduction, an estimated 75 red wolves roam free over approximately 1 million acres (4,000 km²) in northeastern North Carolina. However, coyotes are now present in the area and hybridization again threatens the red wolf. Initial



Red wolf *Canis lupus* © USFWS

estimates indicate that the red wolf population in northeastern North Carolina would be unrecognizable as such within as few as 3 – 6 generations (12 to 24 years) if the potential current rates of hybridization were not controlled.

In the face of hybridization, there are 2 fundamental approaches to saving the red wolf. The first would be to control coyotes; however, previous attempts to do this have proven remarkably unsuccessful. Witness the fact wolves were rather easily exterminated from the U.S. during the predator control efforts of the early 20th century, while at the same time the range of the coyote increased. Decades of effort have been spent removing coyotes to protect domestic lambs from predation, with little success. In contrast, because coyotes are territorial and typically kill lambs to feed their pups, researchers are studying whether sterilized coyotes, by holding and defending space, can be used to protect lambs from coyotes that do have pups. It is this concept of holding space that is being applied to manage hybridization and help save the red wolf.

Coyotes and hybrids captured in the red wolf re-introduction area are being sterilized, radio collared and released, whenever possible, to hold space until red wolves can be inserted. The underlying tenet of this approach is that space (territories) is limited and that non – breeding pairs of coyotes, non-hybridizing mixed pairs, and breeding wolf pairs are best to occupy that space since the introgression of non – red wolf genes will be controlled and the space they occupy will be unavailable for other pairs to establish themselves. This underlying tenet however, assumes that coyotes and red wolves do not share space and are antagonistic towards each other when not paired. Data to test these assumptions currently do not exist but will be collected as management progresses.

It is clear that if nothing is done to manage hybridization, we will again lose the red wolf in the wild. The plan outlined above not only provides an opportunity to save the red wolf in the wild, but it will also provide information that may be helpful to future red wolf re-introductions, if attempted, or other small populations of

carnivores that may hybridize with closely related species. Hybridization is not unique to the red wolf. Hybridization seems to threaten a species when it occurs in small populations that are sympatric with closely related species of similar size, such as the gray wolf in eastern Canada with coyotes, the red wolf with coyotes, and the Ethiopian wolf with domestic dogs, for example. If this is true, it is noteworthy that the Mexican gray wolf is similar in size to red wolves and is currently being re-introduced in small numbers into coyote range.

The red wolf program is the first of its kind to be successful. Captive born and raised animals were used to establish a carnivore previously declared extinct in the wild. However, the program had no template to pattern itself after. A plan for the re-introduction was crafted, but many of the techniques used and the approaches taken were learned during the re-introduction. What has been learned during the red wolf program has, wisely, not only been integrated into the red wolf program itself, but integrated into subsequent gray wolf re-introduction efforts as well. Examples include: interfacing with private landowners, managing wolves on private land, release techniques, the importance of public education and outreach prior to and during restoration, captive breeding and husbandry techniques and, finally, the need for information by which to manage the wolf once it is restored.

Although a difficult challenge, managing hybridization may prove to be another example that can be integrated into the red wolf recovery program and or applied to the management of other small populations of carnivores.

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Correlates of red wolf re-introduction success in the southeastern United States

Re-introduction of the endangered red wolf *Canis rufus* to portions of its historic range in the southeastern United States began in 1987 on the Alligator River National Wildlife Refuge, North Carolina. Wolves for this re-introduction effort were captive stock from a successful captive breeding program. Subsequent to that, wolves have been released on Bulls Island in South Carolina (1987), Horn Island in Mississippi (1989), St. Vincent Island in Florida (1990), and Great Smoky Mountains National Park in Tennessee (1991). The accumulation of detailed records on those releases has provided an opportunity to quantitatively assess factors that influence red wolf release success. We used 320 independent releases to identify correlates of past red wolf release successes and developed 4 logistic regression models based on different definitions of success, such as survival or the need for recapture due to conflicts with humans.

The results of this study suggest that the characteristics of the release animals are as important as those of the release area and that factors influencing success seem to change over time. In the short term (<6 months), management actions may be reduced and survival increased by releasing wolves in areas where conflicts with humans are less likely to occur (i.e., areas with low human populations, low road densities, and limited development) and by

using wild-reared wolves after a relatively short acclimation period.

We speculate that factors such as the history of the release animal and habitat conditions that may contribute to conflicts with humans play an important role in the early stages of re-introduction efforts. However, our analysis indicated that other factors, such as social structure and inter-specific interactions, become more important for long-term success (1 – 2 years).

Long-term survival was associated with releases in spring, which typically included a wolf pair with a pregnant female or a pair with young pups. Adults accompanied by young pups tend to form cohesive groups, exhibit fewer wide-ranging movements, and are less likely to cause conflicts with humans or experience vehicle-related mortality. Thus, the formation of a cohesive social group seems to be associated with survival beyond the first year after release. Long-term release success was also related to the presence of coyotes. High coyote densities may be an important obstacle to successfully maintaining wolves in the release area for >1 year.

Many release failures seemed to occur when wolves moved off the targeted federal lands into developed areas, which was one of the reasons for ending the re-introduction in Great Smoky Mountains National Park. Except for island sites, few land units in the southeastern United States under one ownership can contain a viable wolf population. Therefore, establishing cooperative agreements with landowners adjacent to prospective release sites will be vital for future releases. This observation and the variables in our models that are directly or indirectly related to human influences also suggest that public support is essential to avoid conflicts and enhance the probability of re-introduction success.

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SWIFT FOX

Swift fox re-introduction program in Canada

The swift fox *Vulpes velox* is native to the grasslands of the great Plains of North America. This diminutive speedster was very numerous from accounts of early explorers and settlers. The historic range is reported to have included as much as 1.6 million km², but more conservative estimates place the range at less than that figure. However, dramatic shrinkage of its range did occur after the turn of the century so that by the 1930's the species became extinct in Canada, the extreme northern edge of its range.

The decline has been attributed primarily to human-related factors such as habitat fragmentation, increase of coyote populations following the loss of wolves in the prairie ecosystems, predator control programs and manipulation of natural grazing regimes. In Canada the presence of a harsh climate likely



A Captive Raised Swift fox *Vulpes velox* in a Cochrane Ecological Institute Enclosure © Peter Neuhaus

accentuated the problems for the swift fox populations, in the northern edge of its range.

Trying to bring back the fox was a gamble. Had those conditions that contributed to the loss of the species in the first place changed? Small farmsteads had given way to large holdings, fewer people trapped in the prairies and cattle ranching had given way to bison herds.

In the mid 1970's Calgary University professor, Dr. Stephen Herero, and his students began researching the possibilities and concluded that it would be worthwhile to attempt a re-introduction program. Captive foxes were already available at a private facility and the owners of that facility, Beryl and Miles Smeeton, were very supportive of such a program. Out of this initiative grew a major effort involving many agencies and individuals.

By 1983, the project had expanded and first releases of captive foxes took place in southern Alberta. The first releases were from pens constructed at the release sites and subsequently all foxes were released directly, either from captive facilities, or from animals captured in the wild and transported for release at the northern sites within both provinces of Alberta and Saskatchewan. From 1983 to 1997 a total of 942 foxes were released, 805 as a result of direct releases and 137 from pens. A majority of these foxes were captive raised. Studies have shown predation by coyotes and golden eagles were the principal cause of mortality.

Approximately 30% of the foxes were radio-collared and their survival documented. In addition several graduate students completed projects. The most recent, and most ambitious of these projects was carried out by Axel Moehrensclager (University of Oxford) and Erika Klausz (University of Alberta). These studies, and all the work that preceded it, have shown that the ecological niche for the species had not been lost. The swift foxes survived harsh winters and successfully reproduced. Some foxes have known to have survived for up to 7 years. Released foxes survived and reproduced and their offspring form the core of a fledgling northern nucleus, with some indication of numbers spreading into the neighboring state of Montana in the United States. In 1998, another project to use similar methods had been started on American Native lands south of the international border.

The Canadian swift fox population was censused throughout much of its suspected range in the winter of 1996/1997. A calibration-based technique was designed to develop a

correction factor. Data collected by Moehrensclager and his team were useful and allowed for more precise population estimates. Fifty - eight townships were surveyed representing about 50% of the suspected swift fox range in Canada. From these surveys (95% confidence interval; 179 - 412 foxes) a conservative population estimate was established at about 300 foxes. This figure does not include the adjacent swift fox numbers in Montana.

As of 1997 the program has been reduced. Foxes are no longer released at this time, although the Swift Fox Recovery Team continues to monitor numbers. The next major census is planned for the winter of 2000/2001. The primary goal of the National Recovery Plan is to remove the species from the endangered species list in Canada, by allowing numbers to increase to stable (fluctuating within allowable ecological limits) self - sustaining levels. This will also mean that a population viability study will have to be developed in the near future. Efforts by so many have borne results. because the ecological niche of the species was still there and many have persevered, despite the inevitable trials and set backs. Yet one has to realize that the long term survival of this species is not necessarily secured, either in its northern distribution or elsewhere. This canid is not as "robust" as its bigger cousin, the coyote. Both stochastic events and anthropogenic events can still plunge numbers down towards extinction. We have to be ever vigilant and continue to direct our energies to getting to know more about this vulnerable North American faunal element.

Contributed by Ludwig N. Carbyn, Ph.D., Past Chairman, Swift Fox Recovery Team, Scientist Emeritus, Canadian Wildlife Service, Edmonton, Canada. E-mail: Lu.Carbyn@EC.gc.ca

Social and cultural aspects of swift fox re-introduction to Blackfoot Tribal Lands, Montana, USA

The swift fox, *Vulpes velox*, once abundant throughout the plains of North America, shared its range with the great tribes of the plains. These plains peoples considered the swift fox to be an "Animal of the Soul" and, as such, an integral part of their spiritual and cultural identity.

The Plains Tribes studied the behavior of the indigenous wildlife they lived amongst. They especially observed the survival skills of the animals and looked for qualities which were applicable to human personalities and believed they carried a spiritual message. The human qualities associated with the swift fox, which is a social, monogamous and sedentary species, were gentleness, humility, courage, persistence, speed, observation, and attentiveness. The Swift Fox Warrior Societies, looked for people with these qualities and they became the policemen of the tribal communities.

The impact of European contact with the tribal peoples of the plains was catastrophic. The Plains Tribes were decimated by war and introduced disease, enclosed in reservations, and their physical habitat and spiritual landscape transformed. The swift fox, like many plant and animal species of the plains, became extinct or reduced to remnant populations occupying only a fraction of its historic range. The swift fox was extirpated from its Canadian range, and extirpated over 90 per cent of its U.S. range.

A Canadian re-introduction of the swift fox (1983 - 1997) demonstrated that a successful re-introduction of the species to suitable range was possible. Although the stated goal number for a self sustaining population had not been achieved before the re-introduction program ceased, nevertheless re-introduced animals have survived, bred, and successfully raised their young in the wild. It also demonstrated that without the backing of local governments the re-introduced animals would not be fully protected. In Canada, because the release sites have not been closed to the use of 1080 poison and coyote trapping, swift fox continue to die from those causes. The Canadian re-introduction has been an intellectual and not a spiritual exercise, and as such is effected by economics. If trapping and poisoning is perceived to enhance the monetary return from the land the re-introduced swift fox will not be protected from these activities.

In contrast, in an effort to repair their cultural and spiritual integrity, part of the mandate of various tribal fish & wildlife branches is ecosystem restoration through species re-introduction. Among the Plains Tribes the spiritual value of re-introduced animals holds hope for a cultural regeneration in their people, a people brought very low as result of the destruction wrought through European contact. The re-introduction of extirpated indigenous species to tribal lands is more than an intellectual exercise, and the determination of the Blackfeet to successfully protect their newly re-introduced swift foxes is greater because of this.

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FELIDS

AFRICAN LION & CHEETAH

Large felid restoration: lessons from the Phinda Resource Reserve, South Africa, 1992 - 1999

Historically, translocation and re-introduction of large African carnivores has been widely practiced, but such efforts have been poorly researched and the little data which exist indicates these projects are largely unsuccessful. Daily monitoring of 13 lions *Panthera leo*, 15 cheetahs *Acinonyx jubatus* and their offspring which had been re-introduced into the Phinda Resource Reserve (180 km²) in northern KwaZulu - Natal, South Africa was conducted for 40 months (May 1992 - September 1995) to collect information on various aspects of their behavior and ecology. The same populations have been monitored intermittently from September 1995 to the present. The study aimed to assess the success of such restoration attempts and to determine whether re-introduction is a viable method for the re-population of large felids in areas of their former distribution. An earlier report (*Re-introduction News* 11: 15 - 16) presented greater detail of the study site and preliminary findings from this study. This article is a summary of the author's completed PhD thesis, (Hunter, L.T.B. 1998, "The behavior and ecology of re-introduced lions and cheetahs in the Phinda Resource Reserve, northern KwaZulu - Natal, South Africa." PhD Thesis, Mammal Research Institute, University of Pretoria, 205pp), available from the author.

Most previous efforts to translocate or re-introduce large African



Male cheetah Acinonyx jubatus © AWF Library

felids were 'hard releases' usually lacking consideration for various factors which would be expected to influence the success of such procedures. Parameters such as trauma or disorientation associated with capture and translocation, the presence of resident conspecifics, the availability of space for released individuals, and the probability of individuals leaving the release site and conflicting with humans were often poorly known. During the present study, significant effort and resources were invested to attempt to address these factors and overcome at least some of the problems typically associated with carnivore translocation. Following experience from Europe and North America (largely with non – felids), the Phinda study adopted 'soft-release' techniques, the first large-scale project to do so with African cats. All individuals in the present study underwent a pre – release captivity period of 6 – 8 weeks at the release site. Additionally, release events were staggered and took place from different locations within Phinda to allow individuals sufficient time and space to establish home ranges before the potentially disruptive effects of subsequent releases, and to reduce the chances of newly released individuals encountering territorial conspecifics soon after release by locating later release sites outside the home ranges of established individuals. Finally, the reserve lacked resident lions and cheetahs and was entirely surrounded by electrified fencing to attempt to discourage re-introduced cats from leaving the site.

All re-introduced lions and cheetahs remained at the reserve. Animals generally did not display 'homing' behavior characteristic of many previous carnivore translocations. Three groups of lions and cheetahs (largely young males) showed evidence of homing for two months following release, but all subsequently established home-ranges at Phinda. The reserve's boundary fence was a critical factor in restricting post-release movements of felids. The study also demonstrated that, when co-housed during the pre-release captivity period, unfamiliar and unrelated individuals of each species established enduring relationships which persisted long after release. This has important implications for translocation attempts where individuals are frequently captured opportunistically, usually when they leave conservation areas and come into conflict with humans. This technique facilitated the formation of socialized groups composed of such 'problem animals', which for social carnivores, are probably better suited for

re-introduction purposes than lone individuals.

Re-introduced lions and cheetahs at Phinda which survived the crucial early post-release period established home ranges in the reserve, most of which endured for the duration of the study. This suggested that re-introduction may be a viable method for re-establishing resident felids. Lions (of both sexes) and male cheetahs were territorial whereas female cheetahs showed no signs of establishing territories and, in some cases, used the entire reserve as their home range. Lion individuals and groups used between 27.56 km² and 130.20 km² as their home-ranges in Phinda. Mean home range size of female groups was 52.83 km² ± 35.68 km² (range: 27.56 km² - 105.60 km², n = 3). Male home – ranges reflected their attempts to encompass as many female territories as possible and were as extensive as 78.7% of the entire reserve (which is 180 km² in size). Lions showed evidence of home-ranges shrinking during the dry winter, probably reflecting the distribution of artificial water sources in the reserve. The placement of such waterpoints may be an important issue for the management of predator-prey relationships in small reserves.

Mean size of the territories of male cheetah coalitions was 92.89 km² ± 59.39 km² (range 56.79 km² - 161.44 km², n = 3). Territories were fiercely contested and fights between rival coalitions resulted in four deaths of males during the study. The 'patchiness' of available preferred habitat may have increased the likelihood of conflict between male cheetah coalitions. Such habitat, particularly open grassland, formed the core areas of both male and female cheetahs' ranges. In 'reclaimed' conservation regions such as Phinda where historical human influences such as cultivation, intensive livestock farming and the extirpation of indigenous bulk grazers and browsers (for example, elephants) may radically alter the structure of habitats. Therefore the planning of a restoration attempt of cheetahs must include consideration of available suitable habitat. The 'rehabilitation' of human – altered landscapes may be an important factor affecting project success.

The greatest cause of mortality to re-introduced felids was human activity, particularly poaching. Five re-introduced lions and two cheetahs were killed in wire snares. Other human – mediated causes of mortality included road-kills and poor boundary security which allowed individuals to leave the reserve and enter farming communities where they were ultimately killed by humans. Re-introduction practitioners need to be aware of the influence of human activity on carnivore re-establishment and allocate resources accordingly to moderate its effect. Intra- and inter –



African lions Panthera leo © AWF Library

specific conflict with other large carnivores was also a significant cause of deaths of re-introduced cheetahs and their offspring. While this is inevitable in any natural system, practitioners of multi-species re-introductions such as at Phinda should consider establishing competitively vulnerable carnivores prior to releasing ecologically dominant species. Delaying the release of lions until re-introduced cheetahs have had a chance to reproduce and their offspring have dispersed and established home ranges may ameliorate the effects of lion predation on cheetah re-establishment.

Despite mortalities, population characteristics suggested lions and cheetahs are rapid and effective in re-colonising vacant areas. Most lions and cheetahs survived the critical early post-release stage (three months) and a minimum of 60% of females of both species survived to reproduce. Three lionesses bore litters before their third birthday and five male lions sired cubs at 26 - 28 months old which is generally earlier than in established populations. Cheetahs at Phinda probably also had opportunities to reproduce younger than elsewhere, though this is based on circumstantial evidence. The opportunity for hastened reproduction may have arisen as a result of low population density allowing normally subordinate individuals to breed earlier than in established populations. This was probably a significant factor in rapid population growth at Phinda. At least 47 lion cubs and 48 cheetah cubs were born during the study. 77% of lion cubs and 63% of cheetah cubs reached independence during the study and high rates of cub and sub-adult survival was a further factor contributing to rapid population growth. Increased cub survival (compared to other studied populations) was probably due to low density of established predators (conspecifics and competing species) and a high density of non-migratory prey. Population modeling suggested that low mortality rates for juveniles and sub-adults is a critical factor for rapid re-establishment.

Re-introduced lions and cheetahs foraged successfully following their release and the post - release survival of re-introduced felids was clearly unaffected by their ability to acquire prey. Certain ungulates were preferred prey of cheetahs and lions, to the extent that some species experienced severe population declines as a result of predation. Wildebeest *Connochaetes gnou* were the most important species for lions and were killed at three times their availability, despite the greater abundance and availability of species such as nyala *Tragelaphus aneasi* and impala *Aepyceros melampus*. Predation by re-introduced lions on wildebeest resulted in a population decline of an estimated 30% during the study period. Similarly, cheetahs preyed upon reedbuck *Redunca arundinum* at eight times their availability at Phinda and reedbuck numbers declined by an estimated 53%. Given its small size (180 km²) and total enclosure by electrified fencing, Phinda probably lacked predation-free refuges, so that preferred prey species were unable to migrate to areas of decreased predation pressure. The decline of wildebeest and redbucks at Phinda prompted intensive population management (capture and removal) by the reserve's owners of cheetahs and especially lions, and is clearly one of the most pressing concerns of re-establishing predator-prey relationships in small, enclosed conservation areas.

The study of the Phinda lions and cheetahs is ongoing. Other sites of large felid re-introduction in South Africa have been added to the project which aims to unify efforts to re-establish large carnivores in the region. Further information of the ongoing research can be accessed at:

www.lionresearch.org/current/reintro.html

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ASIATIC LION

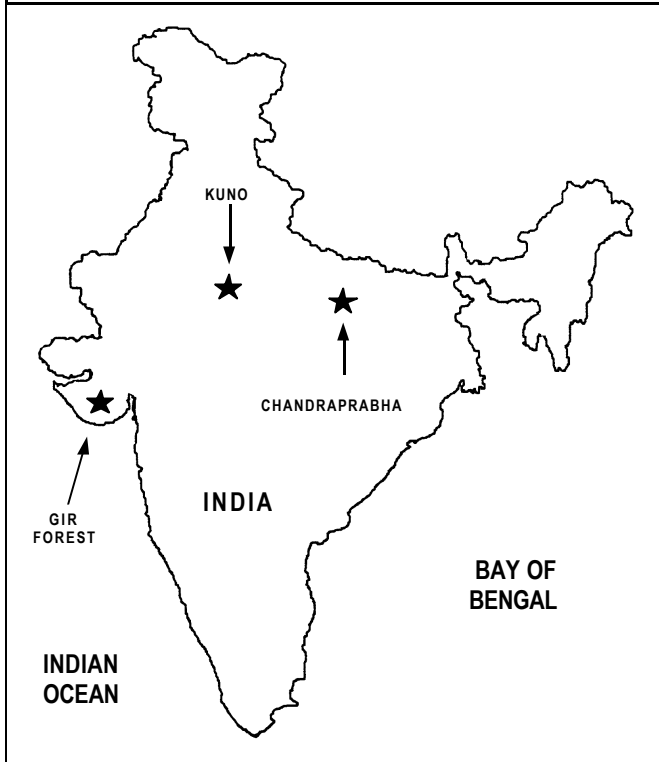
Translocating Asiatic Lions, India

Historically the Asiatic lion *Panthera leo persica*, had a fairly wide distribution, ranging from Syria through Iraq, Iran, Pakistan and most of northern and central India. The Asiatic lion suffered a rapid and drastic reduction in its distribution range and numbers. By 1888, the lions in India were restricted to the Gir forest, in the western Indian state of Gujarat. The last sightings of lions in Asia (outside of Gir), were reported in the early 1940s from Iran. For more than a century the lions in India have been restricted to the Gir forest and for more than fifty years now the lions in Gir are the sole surviving free-ranging population of lions in Asia (Fig. 1).

The surviving portions of the Gir forest were declared as a Wildlife Sanctuary in 1965 and the central part of the sanctuary as a National Park in 1975. Currently a little over 1,400 km² has the status of a protected area and most of the lions are restricted to this area. In the last decade the lions have dispersed from the Gir forest and begun to establish themselves in coastal plantations and in the surrounding matrix of agricultural fields, human settlements and small patches of remnant natural vegetation. Some lions have been sighted as far as 70 km from the closest protected area boundary. The official estimate of the lion population based on the count conducted by the Gujarat Forest Department in 1995 is 304, inclusive of the lions outside the Gir forest. This in many ways represents a remarkable recovery in the lion population as it had a close brush with extinction in the late 19th and in the early 20th century when their numbers were reported to be as low as 20 or less. As a result of this, the surviving lion population has undergone a genetic bottleneck which may have reduced its overall genetic variability.

Hunting of lions and their prey species and the large-scale conversion of their habitats into agricultural fields and human settlements have been recognized as the major causes for the decline in the distribution range and numbers of Asiatic lions. Wildlife conservationists in India have been aware of the problems faced by the lions since the only free-ranging population is small, isolated and in all probabilities very highly inbred. Given the fact that the Gir forest is surrounded by dense human populations and there are no extensive natural habitats left in the vicinity, there is no hope for substantially increasing the area of the Gir protected area. Small and isolated populations of endangered species face severe threats of extinction from catastrophes including disease. The reality of this threat was brought home when a canine distemper epidemic played havoc with one of the largest lion populations in the Serengeti ecosystem. Translocating lions from Gir to establish a second free-ranging population has been for long recognized as the best way to ensure their survival and enhance their conservation status.

Fig. 1. The location of Gir Forest Wildlife Sanctuary, Chandraprabha Wildlife Sanctuary which is the site of the failed re-introduction in 1957 and Kuno Wildlife Sanctuary which is the site of the proposed re-introduction.



The Indian Board for Wildlife (IBWL), which is the highest policy making body on wildlife conservation issues in India has been discussing the lion translocation since the 1950s. In fact in 1957 an attempt was made to establish a free-ranging population of lions in Chandraprabha Wildlife Sanctuary (95.8 km²) in eastern Uttar Pradesh (Fig. 1). Two lionesses and a male lion were transported from Gir by train and released initially into a fenced in area in the sanctuary. Once these animals settled down the fence was removed and the lions were released into the wilderness. Unfortunately there was no systematic post-release monitoring of the lions and as a result there is no authentic information on the fate of these lions. The only available report states that the lions gradually grew in numbers from three in 1957 to 11 in 1965 and then they disappeared.

While the very fact that the Indian Board for Wildlife recognized the need for translocating lions is laudable, there are plenty of lessons to be learnt from the failure of this attempt. First and foremost is the need for good ecological information on the lions to enable the proper selection of the translocation site and also its management in preparation to host the lions. The other glaring failure was the lack of regular monitoring of the lions once they were released. Other shortcomings included the very small size of the chosen site, the long period of captivity that the lions had to undergo after their capture from Gir (nine months), no attempt at educating the local people to gain their support for this major conservation initiative, and the lack of a conflict resolution mechanism to deal with issues like livestock predation by the lions. Taking these lessons into consideration, the Wildlife Institute of India launched its research program in Gir in 1986. The initial attempt was to gather baseline data on the predation ecology, ranging patterns and habitat use by the lions. The major findings were that the lions largely preyed on the abundant wild ungulate population especially chital *Cervus axis* and sambar *Cervus*

unicolor. The seasonal home range size of males were about 140 km² and that of females about 70 km² and the lions extensively used areas outside the boundaries of the protected area.

Using these results a presentation was made at the Asiatic lion PHVA held at Vadodara, Gujarat in October 1993. State forest departments which administered parts of the former range of the lions were requested to propose sites for the lion translocation. They were also requested to provide basic ecological information related to these sites. Based on a preliminary evaluation of the data, three sites were short listed for the field survey; Kuno Wildlife Sanctuary in Madhya Pradesh, Darrah Wildlife Sanctuary and Sitamata Wildlife Sanctuary in Rajasthan. Field surveys were conducted from late 1993 till mid 1994 and the results were formally presented to the Government of India and the state governments of Gujarat and Madhya Pradesh in January 1995.

This survey aimed to determine the extent and continuity of the forest area, the abundance of wild ungulates, and the level of human disturbance at each site. Kuno emerged as the best choice of the three, largely because of its quadrangular shape and the large area of the forest tract (> 3,500 km²). It also had a diverse prey base but the densities were low. There was also a problem of human disturbance as many villages were present in the forest. The presence of a few tigers was also seen as a possible problem but this was resolved as there is evidence to suggest that lions and tigers have had overlapping distributions in the past.

The choice of Kuno was unanimously accepted as was the need for intensive long-term management to prepare the site to make it suitable for the lions. The recommended actions included the establishment of a National Park of about 800 to 1,000 km² which will form the core area for this translocation. The villages from this area will have to be relocated to prevent conflicts with the lions in the future. Fortunately Kuno has sufficient forested areas for the people to be relocated and the relocation, if sensitively implemented, will actually benefit the people as they are living in very remote areas. A widespread education campaign has to be implemented which will focus on the conservation objectives of this plan and also educate people about the lions and the precautions to take to avoid conflict. A conflict resolution mechanism has to be established in consultation with the local people as this will definitely earn the trust and co-operation of the local people. The other major management input that is required is the supplemental introduction of prey animals like nilgai *Boselaphus tragocamelus*, chital, sambar and wild pig *Sus scrofa*. Supplemental introduction of prey animals is very essential to enable the prey populations to build up to acceptable levels in a relatively short period of time prior to the release of the lions. Preliminary modeling has suggested that if 350 prey species are released the required prey biomass will be available in about 12 years and if 2,050 animals are released the time taken will be less than five years. It is very important that once the project is launched both the habitat and the animals get sufficient protection. The staff involved in the management of Kuno needs sufficient training and resources to accomplish their tasks.

By normal Indian standards for conservation projects this effort has really made rapid progress. It is less than five years now since we made the formal presentation to the government. In a matter of weeks our report was accepted and the Madhya Pradesh forest department came up with a management plan. Funds have been released and so far the emphasis of the management has been on relocating villages and creating

infrastructure. The biggest problem we see with this project so far has been a relative neglect of issues related to the ecology of the site and the sociology of the local people. There is a great need for the Government of India to take an active leadership and to involve all the concerned state governments including Gujarat in planning, executing and monitoring the implementation of this project. A much better mechanism for communication and sharing of information is needed as presently none exists. Recently the Madhya Pradesh government has taken steps to constitute a technical committee (of which both of us are members), to advise them on this project and hopefully this will provide the forum for better communication and also enable the monitoring of the project.

The plan is to initially ensure that the site is suitable in all respects for the lions and then only initiate the capture and transport of lions from Gir to Kuno. The initial target is 6 to 8 adult lions from a pride from the National Park area of Gir. These lions will be transported from Gir without any delay to Kuno and housed in a fenced enclosure for 6 to 8 weeks prior to their release. All these lions will be equipped with radio-collars to enable regular monitoring. To maintain the genetic link between the Gir and the Kuno populations, once the translocated lions settle down, a couple of lions (mostly males caught outside Gir), should be released in Kuno every five years. The target population for Kuno is about 75 lions and this population will need constant monitoring and management. An important aspect of this effort which has received little attention so far is the health of wild ungulates and large cats already resident and those targeted for release in Kuno. The animals to be released in Kuno will have to be screened for diseases to ensure that no new diseases are introduced.

It has often been suggested that fences should be used to retain the translocated lions within the boundaries of the protected area. Fences are hardly used in wildlife management in India and fencing a very dissected terrain with some wide rivers flowing through them is not really a viable option. To some extent we in India do lack the expertise and experience in mass capture and transport of large mammals. This is a much needed skill for this project to succeed and we feel international assistance in this respect will be crucial. For a project of this magnitude to succeed proper planning and monitoring, trained, motivated and committed personnel, full support from the politicians and bureaucrats, sufficient resources and a reasonable time schedule are very essential. We are looking at this project as something which will be implemented over 15 to 20 years. With regular monitoring and proper support and guidance this project has very good chances for succeeding, but, if it fails, there will really be no further opportunities for translocating Asiatic lions in India.

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EURASIAN LYNX

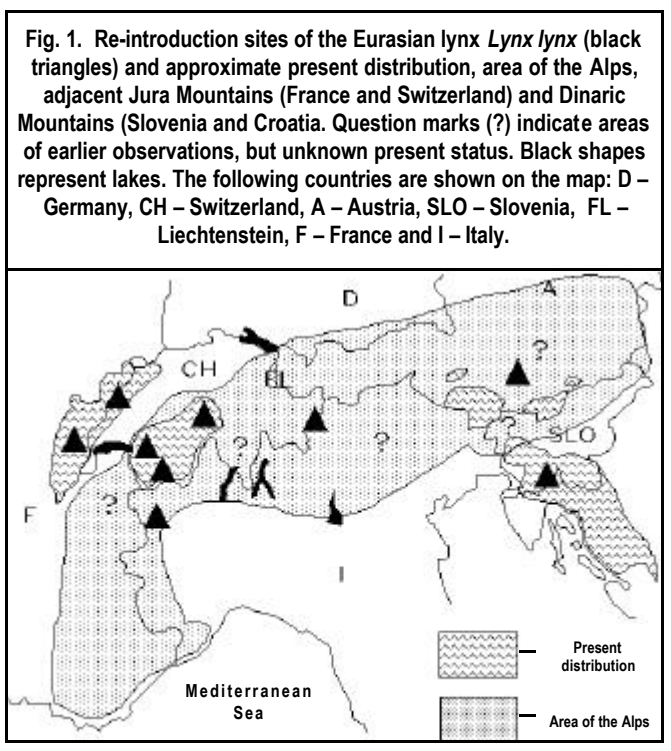
The re-introduction of the Eurasian lynx in the European Alps

In the Alps, the largest mountain range in Europe, all large carnivore populations became virtually extinct in the 18th and 19th

centuries. This was as a consequence of deforestation, reduction of wild ungulate populations, and direct persecution. In the 20th century, however, the forests and the herbivores in the Alps made a recovery as human populations decreased or concentrated in larger towns. Tourism has increasingly replaced agriculture, especially the livestock husbandry, as the main source of income. As a result, the ecological requirements for the existence of large carnivores in the Alps have improved.

In the 1970s, Eurasian lynx *Lynx lynx* from the Slovakian Carpathian Mountains were released at several sites in the Alps (Fig. 1). In this article, we will briefly summarize the present status of the lynx in the Alps and discuss the re-introduction procedures. The number of lynx released were few: 14 in Switzerland, 2 in Italy, and 9 in Austria. Additional re-introductions were made in the adjacent Swiss Jura Mountains (10 animals) and in the Dinaric Mountains of Slovenia (6). The exact number of animals released is not known, as in Switzerland, and most likely in Austria and in Italy, some more animals were set free clandestinely. None of the re-introductions was preceded by a habitat evaluation or population viability study, nor by a public information campaign. No field research was done to observe the animals (with exception of the Austrian project, where the first animals released were fitted with radio-collars which all failed after a few weeks), nor were any monitoring systems established to survey the development of the populations. The few reports about the development and spread of the populations were mainly based on non-verifiable information. The only reliable data came from Slovenia, where legal hunting of lynx started in 1978 and produced some statistical records, and from Switzerland, where research by means of radio-telemetry began in 1983. Only in the 1990s, younger biologists in the Alpine countries started to re-evaluate the status of the Alpine lynx population.

Today, lynx are permanently present only in two regions of the Alps: In western Switzerland and in the triangle of Slovenia, Italy and Austria (Fig. 1). In western Switzerland, the lynx population has recently re-increased. The effective population size is estimated to be about 80 individuals. Although the local lynx density is rather high, there has been no indication of a population



FLORIDA PANTHER

Florida panther re-introduction and recovery, Florida, USA

expansion over the past 15 years. The re-introduction into the Austrian Alps was not successful. The lynx existing in the triangle most likely origin from immigrants from the Slovenian re-introduction. The spread of this population, however, has halted after it was over-harvested in the late 1980s and early 1990s.

It is difficult to judge the survivability of the lynx in the Alps at present. On one hand, there is a thriving, but still small population in the western Swiss Alps. Other occurrences in the Alps have disappeared or are shrinking. The adjacent populations of the Jura Mountains and the Dinaric Range seem to be stable at the moment. Although the release programs in the 1970s were completely uncoordinated and have disregarded almost every rule for re-introductions – if we assess them according to contemporary Guidelines for Re-introduction (IUCN 1998) – the outcome of some of the attempts is still remarkable. Re-introductions are stochastic events. The most sophisticated project design gives no guarantee for success, but, on the other hand, the ill – considered release of some animals may by chance lead to the founding of a population. The lynx returning to the Alps found good habitat and plentiful prey. What they however did not find was the broad acceptance by local people. Retrospectively, we consider the lack of public information and involvement, and of a long – term conservation and management plan to be the most significant shortcoming of the re-introductions in the 1970s. In Switzerland, controversy about the return of the lynx has now lasted for 30 years. Interest groups such as sheep breeders and hunters, often supported by the local public, do still not tolerate the presence of the large cat. In all countries sharing the Alps, illegal killings were considered a significant threat for the lynx. Local people often mistrust the authorities, conservation agencies and scientists promoting the recovery of the lynx, as a result of the early misinformation and the lack of clear concepts.

Re-introductions of large mammals are long – term projects. Such species need huge areas to gain viable population size, and they grow slowly. Large carnivores have the additional burden of being competitors to man; human dimension aspects cause the most important problems to be solved. From the ongoing controversy about the return of the lynx to the Alps, we can learn that three points are especially important for the re-introduction of large carnivores:

- ⇒ to establish a viable population may not just take a few years, but some decades;
- ⇒ The site considered from the beginning must comprise the whole area of recovery and not just the release sites; and
- ⇒ to gain broad acceptance, public information and involvement is crucial, and unambiguous plans not only for the recovery, but also for the subsequent management of the population must be communicated early.

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Recovery planning for the Florida panther *Puma concolor* during the early 1980's placed re-introduction as a very high priority. At least three self-sustaining populations would be required to satisfy the recovery plan and implementation schedule cooperatively developed by the U.S. Fish and Wildlife Service (FWS) and the Florida Game and Fresh Water Fish Commission (GFC). Eventual re-introductions were to be preceded by experiments in the wild using surrogate animals from Texas, and the establishment of a captive breeding program. Although re-introduction experiments were completed and a captive population was started, by the mid-1990s neither approach was a viable component of panther recovery. What began as a vigorous effort to restore the panther to large parts of its original southeastern United States range, has been reduced to a very localized attempt without long-range goals, to manage a single, isolated population through genetic introgression.

An initial re-introduction experiment in north Florida indicated that some of the cougars from Texas were quite capable of finding sufficient prey (white-tailed deer) and established regular movements that were termed home ranges. Others, however, wandered widely and did not appear to settle down. This led researchers to recommend a second experiment with more animals in hopes that a normal social arrangement with overlapping, small female home ranges, and larger, stabilizing male home ranges would occur as the result of a larger sample. Both of the experiments suffered losses due to automobile collision, and poaching, but the second experiment was of interest because several litters of kittens were produced. This was unexpected because all males had been vasectomized before their release in north Florida. While these events unintentionally suggested the ability of the landscape to support panther reproduction, they created problems for the study. Because reproduction was not expected in this sterilized population (females were reproductively intact), researchers were not looking for the stereotypic behavior that females exhibit during denning and kitten-rearing. Nor were they prepared to look for and mark kittens at their dens. Once reproduction was finally confirmed in the population, efforts were made to account for all kittens. But some may have been of sufficient age to be independent of their mothers. Thus, the appearance of a full-grown, unmarked male in north central Florida stirred a debate between researchers and those who believed that panthers had existed in this part of Florida all along. The ensuing publicity was not a boost to wildlife agency image as many citizens openly criticized planning efforts and agency competence. Others openly accused the GFC of covering up the fact that Florida panthers already existed in much of Florida.

Although the flurry of activity surrounding this single cougar took place over several months, it was truly a tempest in a teapot. A reconstruction of the movements of potential parents and genetic analyses suggested strongly that the cat in question was produced by Texas cougars. But this was not the only setback in the experimental re-introduction. The disposal of animals became an issue after the experiment was over, and all animals were removed from the wild. The experimental animals eventually found their way to a hunt for hire establishment, and once again

they became the center of controversy and the GFC became the target of criticism by animal rights activists. Because insufficient planning preceded the experiment, agency image suffered.

Captive breeding was originally intended to serve two purposes. First, it would create a safe population that represented as much of the genetic variability of the south Florida population as possible. These animals would become the founders of a captive population numbering 500 in several zoological parks. Theoretically, genetic variability would be enhanced by increasing the captive numbers very quickly. Second, some of the offspring born in captivity would become the foundation for populations that would eventually be re-introduced into former panther range. By 1992, 10 Florida panther kittens had been removed and taken to 3 zoos. However, even after they reached adulthood, no reproduction was allowed. This decision apparently stemmed from two factors. First, administrative anxiety within GFC was increasing as experiments with Texas cougars suggested difficulties with re-introduction. Some of the animals in the experiment were juveniles from Texas that were raised in captivity. These animals did not exhibit sufficient wariness in the wild to keep them away from human habitation and livestock. Another concern was the realization among zoological park administrators that maintaining 500 panthers in captivity would be extremely expensive - especially because there were no subsidies promised from panther recovery agencies. The final decision to scuttle captive breeding occurred when a population viability analysis suggested that genetic restoration of the south Florida population was the most urgent need in panther recovery.

Following the decision to pursue planned genetic introgression, eight female cougars from Texas were released into south Florida. They have now produced at least 16 kittens sired by Florida males. In at least one instance a Texas female has produced a litter of F2 hybrids that was sired by an F1 male (the resulting kittens are genetically 75% Texas). This situation is problematic. There were no clear guidelines at the advent of genetic introgression to suggest when the proper infusion of Texas genes had been attained. If Texas females continue to be successful in breeding and they are not removed from the population, there is a very real probability that the Florida panther genome will be swamped by genes from Texas. There are those who do not believe that local adaptation is an important conservation issue with the Florida panther, even though south Florida is the most unique landscape inhabited by *Puma concolor*. This raises a final issue in the recovery of the panther - namely that despite the fact that habitat loss is acknowledged as the greatest threat to the subspecies, there have been no consistent efforts to expand the potential range of an animal that individually can require as much as 1,000 km², and as a population numbers fewer than 100.

The principles of conservation biology argue for the maintenance of biodiversity in all of its forms. By abandoning so many management options in the recovery of the panther, management agencies are left with an impoverished tool kit.

Conservation lessons:

- ⇒ Don't put all of your conservation eggs in one basket.
- ⇒ Expect the unexpected, particularly with experiments that involve sterilization.
- ⇒ Thoroughly assess the availability of space and funding for establishing zoo populations before individuals are taken from the wild.

- ⇒ Monitor wild and experimental populations very closely in order to detect anomalies that might jeopardize the project or agency credibility.
- ⇒ Develop clear guidelines and success criteria for projects that involve genetic introgression before introductions take place.
- ⇒ Develop humane disposal criteria for animals that are used in experimental re-introductions.
- ⇒ Take a multi-faceted approach that includes a landscape perspective especially when dealing with wide-ranging carnivores.

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CANADIAN LYNX

Lynx recovery project: background and post-release monitoring of lynx re-introduced to the southern Rocky Mountains of southwestern Colorado, USA

PHASE 1:

Introduction

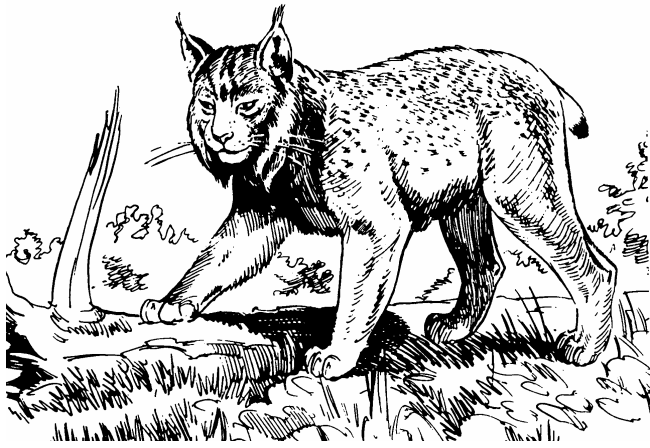
Lynx *Lynx canadensis* are native to Colorado, USA and there have only been about 22 positive records of lynx in Colorado. It is generally assumed that lynx were common and widespread in the state prior to the turn of the century and since 1935 there have only been 4 positive records of lynx. All of these records occurred from 1968 to 1973 and were taken in the central part of the state. The last known lynx in Colorado was illegally trapped on the Vail ski area in 1973.

Since 1979, 15 surveys have been conducted in Colorado to detect lynx or wolverine. Intensive efforts using snow tracking, hair snags, remote cameras and snares recorded 11 sets of tracks that appeared to have a high probability of being lynx. Also, the Colorado Division of Wildlife has offered a \$500 reward for any positive information on lynx and wolverine since 1993.

Interagency team

In May 1997, the Colorado Division of Wildlife decided that it was not prudent to spend more money on detection surveys, rather than using the lynx survey money to do something proactive and positive for lynx recovery. This was the first step in the formation of the interagency team to recover lynx in Colorado. Later this team drafted a conservation strategy for lynx, and realized that if lynx are still present in the state, they are extremely rare and probably not viable. The team also believed that, because the Southern Rocky Mountain ecosystem, was disjunct from the North Rocky Mountain ecosystem, it appeared that the only way for the lynx to recover is through re-introduction. The team also started work on the process to re-establish wolverine in Colorado. The Colorado lynx recovery team lacked the relevant expertise on the biology of lynx and wolverine and on carnivore re-introductions in general. A team of experts from the U. S. and Canada was therefore established and was considered very beneficial.

The first step in the re-introduction effort was to determine if lynx native to the Southern Rockies are a sub-species. Five Colorado



Canadian lynx Lynx canadensis @ Gene Byrne

lynx specimens were sampled and compared to samples from Wyoming and Canada. The results showed <1% mitochondrial DNA sequence divergence from these samples.

The lynx advisory team recommended and the Colorado Division of Wildlife completed a two step, statewide habitat assessment. Due to the lynx dependency on snowshoe hares, this effort was primarily focused upon two questions: what area has the most snowshoe hares and is the hare density adequate to support a lynx population?

Winter track surveys of snowshoe hares in 1997 – 1998 indicated the San Juan and Rio Grande National Forests (SW Colorado) supported the highest relative snowshoe hare abundance. Snowshoe hare pellet plot surveys in the summer of 1998 revealed that Block 5 (which contains the San Juan and Rio Grande National Forest) had the highest density of hares. The density was as found in the ranges of other lynx populations (e.g. Wyoming, Bow River Valley in Alberta and Northwest Territories in the low hare cycle). The second best area was the Flat Tops (block 3, NW Colorado) and the other three blocks (blocks 1,2, & 4) in north central Colorado contained most of the lodgepole pine forests in the state. When lodgepole pine forests are in early successional stages, they probably represent the best snowshoe hare habitat in the state. However, due to fire suppression and lack of manipulation, most of these forests are now in the mature to old growth structural stages and they provide very little snowshoe hare habitat. Lodgepole pine can be prime hare habitat when it is 20 – 40 years old, but it rapidly deteriorates thereafter.

There is speculation on the role of alternate prey for lynx in the southern ecosystems. The Krebs surveys do not take into account alternate prey such as cottontail rabbit, red squirrel, marmot, ground squirrels, etc. that also occur in this area. Also, it is generally assumed that snowshoe hares do not cycle in the southern part of Canada and the lower 48 states but remain at a constant, low level. Care must be used to interpret Krebs snowshoe hare plot results due to the different analysis formulas and survey techniques.

Re-introduction project

After numerous public meetings and press releases, the Colorado Wildlife Commission decided in November 1998 to proceed with the re-introduction project. Contacts were made with relevant authorities in Alaska, British Columbia and Yukon. While it would be desirable to obtain lynx from the lower 48 states, these populations are proposed as "threatened" under the Endangered Species Act. A total of 20 male and 22 female lynx were received

in the winter of 1998. The Colorado Division of Wildlife built a 20 unit holding facility and custom made 30 International Air Transport Association (I.A.T.A.) approved shipping containers. At 2 a.m. on January 30th 1999, 11 lynx arrived at the holding facility from British Columbia.

PHASE 2:

Goals and objectives

The post-release monitoring for the re-introduced lynx has three primary goals. The first goal is to obtain regular locations of released, radio-collared lynx through aerial tracking whereby general movement patterns and habitats used can be determined. The second primary goal is to, where possible, determine cause of any mortalities of re-introduced lynx. Thirdly, information gained from the post-release monitoring throughout the initial release effort would be used to modify release protocols to provide the greatest possible chance of survival for each lynx re-introduced to the southern Rocky Mountains of southwestern Colorado

Additional goals of the post-release monitoring for lynx re-introduced to the southern Rocky Mountains include refining descriptions of habitats used and movement patterns through snow-tracking of the released lynx, recording hunting behavior and prey taken, and obtaining information on reproduction. The final objective of the post-release monitoring is to refine habitat protection recommendations based on information collected from released lynx. The release protocols and post-release monitoring will continue to be modified as new information becomes available to us through experience and as we improve field techniques to best accomplish the goals of the lynx re-introduction project.

Assessment and modification of release protocols

A total of 41 lynx (all radio-collared) were released into the mountains of southwestern Colorado from February through May, 1999. Initial re-introduction protocol called for the immediate release of the animals once they passed a veterinary inspection by the Colorado Division of Wildlife. Four lynx were released under this protocol (3 females, 1 juvenile male) and three of these four lynx died of starvation within 41 days of their release. The remaining adult female from this initial release was recaptured and returned to the holding facility in poor condition, where she recovered and was later re-released.

Because of such a high mortality rate, a second release protocol was developed. This second protocol required each lynx to be held in the Colorado holding facility for a minimum of three weeks. During this holding period, the lynx were fed high quality diets to encourage weight gain, assuring each lynx would be released in optimal physical condition. Such a minimal holding period also provided an opportunity for the lynx to acclimatize to the climate, elevation, and local conditions of the environment into which they would be released. Although most lynx were housed in individual pens, with a few sharing a pen with one other lynx, the holding facility allowed the lynx to hear and smell each other throughout this acclimation period. Such contact may also have provided time for social interactions to occur. Nine lynx (3 females, 6 males) were released under this second protocol. To date, only one juvenile female from this protocol has died. Her death was attributed to starvation as well, although she lived for 50 days after her release, and was known to have made kills.

Following the death of the lynx under the second protocol, a third release protocol was developed in an attempt to provide the highest chance of survival for each lynx. The third protocol called

for keeping all lynx in the holding facility for not only the minimal three week period but until spring. A spring release would assure the lynx were released when prey was most abundant (i.e., young of the year would be most abundant and hibernating prey would be available). Coupled with the minimum holding period of three weeks, these lynx would also be released when in optimal physical condition and after a period of acclimation to their new surroundings. Twenty-eight lynx were released under this third protocol (16 females, 12 males). To date, one adult female has died of starvation under this protocol and no other mortalities have been detected.

Snow-tracking results

Snow-tracking of lynx on the ground began immediately after release. By back-tracking lynx, ground crews have been able to document habitat use, movement patterns, day bed use, and hunting behavior. Habitat use and movement patterns have varied greatly. However, five drainages have been used repeatedly by more than one lynx, possibly suggesting route selection based on olfactory cues. Prey chases and kills, as determined from snow-tracking and scat analysis, show the lynx are feeding on snowshoe hare, squirrels, and waterfowl.

Current status

Current status of the lynx re-introduction project is optimistic. Of the 36 lynx remaining in the wild from the total of 41 lynx released, 20 have remained within a 110 km² area surrounding the 11 release sites. Another nine have recently been located within a greater (200 km²) area surrounding the release sites. There have been five mortalities, all from starvation, and seven lynx have not been located since the most recent releases in May. Three lynx released under the second protocol have been in the wild for nearly four months and two of those lynx, a male and a female, appear to have settled into territories.

Future monitoring and research

The Colorado Division of Wildlife will continue aerial monitoring of the remaining 36 lynx throughout the next year. If starvation deaths of the lynx released under the third protocol remain less than 50%, another 40 – 50 lynx will be re-introduced to southwestern Colorado in the spring of 2000. Once the releases are completed, a core research area will be identified. This core area will be defined as the area where the highest density of lynx are regularly located. Research objectives to address within this core area include survival, reproduction, habitat use, and movement patterns.

Acknowledgements

Many people contributed to the Colorado lynx reintroduction effort. Special thanks must be given to John Seidel and Dave Kenvin of the Colorado Division of Wildlife for their tireless efforts to provide technical and biological expertise and assistance in transport and holding of the lynx. Dr. Margaret Wild, DVM, of the Colorado Division of Wildlife provided the veterinary services for the lynx while in Colorado. Susan Dieterich and Dr. Herman Dieterich, DVM generously donated their time, care, and wildlife hospital facilities to the lynx while they were kept at the Colorado holding facility.

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MUSTELIDS

BLACK-FOOTED FERRET

Adapting species management to endangered species management: black-footed ferret recovery, USA

Black-footed ferrets *Mustela nigripes* were considered extinct in the wild in 1985, when the last known free-ranging population collapsed to an epizootic of canine distemper and 18 free-ranging animals were brought into captivity. Captive propagation has been successful, with more than 2,600 kits born during the past 11 years and, presently, there are seven facilities involved in a Species Survival Plan (SSP®) breeding program. Re-introduction efforts began in 1991 and, since then, 873 captive-born black-footed ferrets have been re-introduced in five different sites within four Rocky Mountain states. The black-footed ferret recovery program follows an adaptive management approach and has incorporated relevant research results to the conservation and management of this endangered carnivore.

Pre-release training and black-footed ferret survival after re-introduction

Captive black-footed ferrets released to date have either been raised in indoor cages (with an approximate surface area of 1.5 m² supported on 1 m legs) or exposed to pre-conditioning pens for varying periods of time. Outdoor pre-conditioning pens provide ferrets with a naturalistic environment where they can coexist with prairie dogs and live in their intricate burrow systems. When comparing post-release survival success of captive-raised black-footed ferrets re-introduced in several western states, results demonstrated that ferrets pre-conditioned in outdoor pens enjoyed a significant postrelease survival advantage from cage-reared counterparts. Data collected and analyzed by D. Biggins and collaborators, showed that survival rates were highest for ferrets reared from early developmental stages (< 60 days of age) in pre-conditioning pens. Short- and long – term survival was 3- and 10-times higher, respectively, for ferrets raised in pre-conditioning pens than for ferrets reared in indoor cages. Ferrets transferred to pre-conditioning pens at 90 days of age showed intermediate levels of survival success. Telemetry information indicated that pre-conditioned ferrets showed adaptive behavioral responses to the new environment by remaining closer to the release area and by minimizing the amount of time spent above ground, behaviors that would likely decrease the chances of encountering predators. Cage-raised ferrets tended to travel further and often were detected in substandard habitat.

Research results on the effects of captive rearing on black-footed ferret post-release survival have led to management changes in the black-footed ferret recovery program. Since 1997, all ferrets destined for release in the wild have been pre-conditioned. Three release sites, Arizona, South Dakota, and Colorado-Utah have built on-site pens to breed and/or pre-condition re-introduction candidates. Montana is presently constructing pens for re-introduction efforts and the Turner Endangered Species Fund (TESF) has also built off-site pens in New Mexico to provide additional ferrets for release in approved re-introduction areas. The combination of enhanced productivity and increased post-release survival for pen-born ferrets will likely lead to a more effective and expedient approach to black-footed ferret recovery.

Re-introduction update

The first black-footed ferret re-introduction took place in 1991 in a white-tailed prairie dog complex in Wyoming, but releases in this state were unfortunately suspended in 1995 due to an epizootic of sylvatic plague *Yersinia pestis* that severely affected the re-introduction area. In 1994, two new sites were initiated in black-tailed prairie dog towns in Montana and South Dakota. To date, 325 ferrets have been released in plague-free habitat in South Dakota (see table 1) and, for the last two years, this site has pre-conditioned a large part of their allocated ferrets on site. The Charles Russell National Wildlife Refuge in Montana has received 163 ferrets since 1994. This site has carried out intensive post release monitoring every year, and is presently studying the relationship between carrying capacity and ferret re-introductions. South Dakota and Montana have experienced multiple years of reproduction in the wild, with more than 30 litters produced in 1998 and over 100 wild-born young found between both sites. Arizona, which began re-introduction efforts in 1996, has received a total of 79 ferrets for release and approximately 60 for pen



Black footed-ferret *Mustela nigripes* © USFWS

breeding efforts. The Arizona program has recently experienced important progress with the first-time production of kits in on-site pre-conditioning pens. A fifth ferret re-introduction site was established at the Fort Belknap Indian Reservation, Montana, in 1997, and a total of 78 kits have been released to date. A site in Colorado – Utah has joined black-footed ferret field conservation efforts in 1998, and will receive 20 ferrets for breeding in on – site pre-conditioning pens.

Recovery program direction

Post-release survival has been greatest for ferrets released in black-tailed prairie dog complexes, possibly due to higher prey densities in the habitat of this species. Additional re-introduction sites are being considered and preliminary efforts are being made to raise interest in ferret recovery by states/sites with potentially good habitat (Native American lands in South Dakota; Chihuahua, Mexico; Thunder Basin, Wyoming). Allocation priority will be given to sites with large plague-free black-tailed prairie dog complexes. In addition, the program will continue to support disease research, specifically focused on the development of distemper and plague

Table 1. Black-footed ferrets (juveniles and adults) re-introduced between 1991 and 1998 (does not include ferrets allocated to pen breeding efforts in Arizona, Colorado-Utah, or the Turner Endangered Species Fund). WY (Wyoming) = Shirley Basin; SD (South Dakota) = Badlands National Park and Buffalo Gap National Grasslands; MT-CMR (Montana) = Charles Russell National Wildlife Refuge; MT-FB = Fort Belknap Indian Reservation; AZ (Arizona) = Aubrey Valley.

Year/Site	WY	SD	MT-CMR	MT-FB	AZ	Total
1991	49 (32.17)	0	0	0	0	49 (32.17)
1992	90 (55.35)	0	0	0	0	90 (55.35)
1993	48 (29.19)	0	0	0	0	48 (29.19)
1994	41 (24.17)	36 (22.14)	40 (25.15)	0	0	117 (71.46)
1995	0	66* (37.29)	38 (25.13)	0	0	104 (62.42)
1996	0	66 (35.31)	43 (22.21)	0	50** (24.26)	159 (81.78)
1997	0	63 (36.27)	20 (10.10)	23 (12.11)	0	106 (58.48)
1998	0	94 (59.35)	22 (11.11)	55 (35.20)	29*** (18.11)	200 (123.77)
Total	228 (140.88)	325 (189.136)		78 (47.31)	79 (53.26)	873 (511.362)

Adapted from Vargas et al, 1998

* SD received 26 (12.14) adult ferrets for an experimental Spring release in 1995

** Only 15 (9.6) of the released ferrets were kits.

*** Some of the kits allocated for release in Arizona in 1998 might be retained in onsite preconditioning pens for breeding.

vaccines for use in the field. As wild ferret populations increase, translocations from established populations will be used to maintain or establish other wild populations and to begin new re-introductions. Such management will require determining and defining surplus wild stock and, eventually, scaling down the production of ferrets in the SSP captive population.

With successful captive-breeding and re-introduction techniques, the greatest challenge now facing ferret recovery is whether suitable habitat can be secured to establish multiple, viable populations of black-footed ferrets in the wild.

Contributed by Astrid Vargas, Mike Lockhart and Pete Gober, US Fish & Wildlife Service, National Black-footed Ferret Conservation Center, Laramie, Wyoming, USA.

EUROPEAN OTTER

An otter re-stocking project in Sweden

Introduction

In the mid 1970's Otter *Lutra lutra* populations in Sweden and England were found to be declining. For example, in Sweden otter populations harvested during the hunting seasons dropped from approximately 1,500 animals in the late 1940's to only 50 in 1968.

Surveys in other European countries indicated that populations were declining and were at the edge of extinction in many parts of Europe. In Sweden, in the mid 1980's, otters were found only in fragmented populations in the south of the country. One of these sites was chosen for the re-stocking program.

Otter decline has been attributed to habitat destruction, eutrophication, acidification, toxic chemicals and changes to the extent and quality of wetland and freshwater habitats. During 1966, PCB's (polychlorinated biphenyls) were identified as an environmental contaminant and were later also suggested for the possible cause of decline of the Baltic grey seal *Halichoerus grypus* and ringed seal *Phoca hispida* populations. In the 1980's PCB's were suggested as a reason for otter decline. By the late 1980's and early 1990's, PCB levels had declined to low levels and the Baltic grey seal and ringed seal populations were increasing. Hence, it was decided to start otter re-stocking in 1987.

Study area

The aim was to boost a low-density otter population in an area where the environment was considered to be suitable. The study area comprises of an area roughly 5,200 km² and is situated in southern Sweden approximately 150 km SW of Stockholm. The area has an abundance of very productive lakes and rivers with most water bodies having dense shore vegetation. Analysis of fishes and amphibians showed that PCB levels were low (in fish <0.4 mg PCB/kg lipid weight) and was one of the areas where otters persisted during the 1980's. Surveys in this area had estimated that there were less than 10 individuals (maybe as few as five) in the area.

Source of otters

During 1987 and 1988, a total of 11 otters were released and they were all marked with an individual code tattooed on the inside of the lip. A further 36 otters were released between 1989 and 1992 and these comprised 11 which were wild caught in box traps from the Norwegian coast. The other 25 were born to two females in captivity from the Swedish breeding station. These 36 otters were all code tattooed on the inside lip but were also implanted with radio transmitters.

Radio tracking was done by car using an omni-directional antenna and exact positions were pinpointed using a directional antenna. If otters could not be located from the ground an airplane was used. The usual range of the transmitters was 500 – 2,000 metres but reduced to <100 metres when staying in holts or diving underwater. In the airplane this range increased to 3 – 9 km. Radio-tracking was done between May 1989 and February 1994 and otters were observed on 64% of all possible radio-tracking days. Two people worked in shifts round the clock tracking otters. The survival rate of otters was estimated for the first 12 months after release and calculations of the survival rate of released otters were carried out by using the Kaplan-Meier estimation with staggered entry. In this analysis missing animals do not change the survival rate but increase the variance of the survival.

Survey

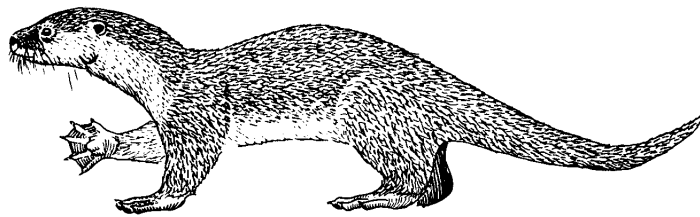
Several surveys have been carried out in the study area between 1983 and 1996 which was before, during and after the otter

release period between 1987 - 1993. Otter surveys are focused on signs of otter such as feces and footprints. In the study area these surveys were carried out from August to the beginning of October on bare ground season without snow. During the survey information about presence of otter, mink *Mustela vison* and beaver *Castor fiber* was recorded including other environmental parameters.

Results and Discussion

Survival rate

The survival rate of the 36 radio equipped animals was 54%. There was a significant difference in the survival rate between the group of wild-caught otters and the group of captive-bred otters. Wild-caught otters had a survival rate of 79% and captive-bred 42%. Among the captive-bred otters, the survival rate of offspring from one breeding female was 71%, from the other 21%. There was a significant difference between the offspring from the two breeding females ($Z = 4.00$, d.f. = 1, $p < 0.05$). Thus, the difference in survival rate among captive-bred otters was most likely due to the handling after separation from the mother before release and that a longer separation-release period caused stress and a reduction in the survival rate of this group. A shorter separation-release period was equal to the survival rate of wild-caught otters and was comparable to the survival rate in wild otter populations of the same age group. As an example is the otter population in Shetland, UK which had a survival rate of approximately 80 – 85%.



European Otter *Lutra lutra* © Joseph A. Davies / CITES Secretariat

Fate of released otters

Out of 36 otters released, a total of 14 individuals were radio tracked more than one year and radio contact was lost with 8 animals, in one case because of radio failure and 14 otters died. Loss of radio contact could be attributed to wide ranging movements out of the area.

Establishment

Out of 36 released otters, 16 were recorded to have established home ranges, and these mainly occurred in unoccupied areas. In one case 2 males established a home range within an area occupied by a female. Otters released in occupied areas usually established their home ranges in the first vacant adjacent area suitable for otters. During the period between July and December the first year after release, the home range size of established otters did not differ between males ($n = 6$, 35.7 km) and females ($n = 7$, 44.0 km). During the first six months of the following year (January to June) males expanded their home ranges ($n = 6$, 63.4 km), while no such expansion was observed among the females ($n = 7$, 49.8 km). Thus, females had the same home range size both before and during the breeding season, indicating that they have feeding home ranges. The home range expansion among the males could indicate search behavior for mates.

Conclusions

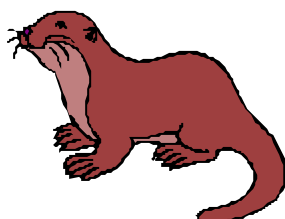
From a conservation perspective, what are the conclusions based on the results from the otter re-stocking project in Sweden?

⇒ Individuals released in areas occupied by conspecifics often traveled more widely than animals released in unoccupied areas.

- ⇒ Otters released in occupied areas appeared to move to the first suitable vacant area for establishment but established home ranges adjacent to those of resident otters. In some cases there were individuals who moved away from the release site and were lost from radio contact. The survey in 1996 indicated that areas empty of otters had been recolonized and it could be these particular individuals.
- ⇒ It is evident from the movement and establishment pattern of released female otters that competition for prey and suitable habitat is more important in females when compared to sub-adult males. In males, competition for mates was more important than prey availability and suitable habitat. This choice in females is probably due to the importance to raise young than looking for mates.
- ⇒ Interactions with conspecifics and habitat quality appear to be important factors in the movement and establishment patterns of released animals. Consequently, the knowledge of otter presence in a potential area earmarked for otter releases is of fundamental importance. It is also important to ensure that the habitat quality, in terms of fish production, shelter, etc., is high.
- ⇒ Otter releases should be carried out in the following manner: If no otters are present in an area, the releases should concentrate on areas where the habitat quality is high. If otters are already present in the release area, then it is important to avoid intra-specific aggression from local otters, which can result in stress and death amongst the released otters. In such a situation the otters should be released on the peripheral area of the existing population. My recommendation is to release the otters approximately 10 km from areas occupied by other otters.

Finally, from a conservation perspective, re-stocking or re-introduction is clearly possible to augment a population provided that environmental and habitat factors that caused the original decline of the population have been identified and removed. However, radio tracking is not enough to get satisfactory information about the development of a population in an area. Therefore it is necessary to augment this data with consecutive surveys of otter signs in the area. This was done in 1996 and the conclusion of the results from the otter survey is that the otter population has shown a positive development. There has been an expansion of established areas, a density increase and a connection between the fragmented populations in the study area and the area north of the study area.

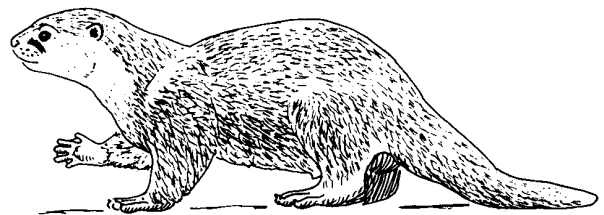
Contributed by Thomas Sjöäsen, Department of Zoology, Stockholm University, Stockholm, Sweden.



ORIENTAL SMALL-CLAWED OTTER

Reconditioning process of captive-bred oriental small-clawed otters prior to re-introduction to a mangrove habitat in Singapore

Five (3:2) captive bred small-clawed otters *Aonyx cinerea* were selected from a breeding colony of 28 otters in the Night Safari, Singapore, for re-introduction to the Sungei Buloh Nature Park (a protected mangrove habitat in Singapore). The 5 specimens included, "Rhemus" a 9 year old alpha male, "Terra" a nine year old alpha female and a pair of sub-adults born in 1996. The last young male was born in January 1999 during the acclimatization period, a month prior to transfer to Sungei Buloh. The otters were initially housed in a pit-type sterile enclosure in



Oriental small-clawed Otter Aonyx cinerea © Joseph A. Davies / CITES

the Night Safari holding area, but through the evolution of the "open natural" concept of Night Safari, they were provided with a natural ground habitat with a stream flowing through it (though the stream had a man-made cemented finish). Part of the acclimatization to natural conditions took place in this exhibit. When the final decision was made to re-introduce these otters to the mangrove habitat, a proper "next - to - nature" type rehabilitation enclosure was erected at the Night Safari, in a secluded area, to truly acclimatize them (following the soft release guidelines). This enclosure measured about 130m² and accommodated 2 large natural ponds which were thickly planted with aquatic and marginal plants and dense ground cover. A large number of branches and logs were also placed to increase the area and provide sites for nesting.

Exposing the otters to live prey was the main focus of the acclimatization process. The zoo diet of thawed fishes was continued for the first month and this was supplemented with live snails collected from the Night Safari area. They initially explored these moving snails and as they grew bolder they took a few bites at opening the shell. Eventually they relished them and actively spent time cracking open the shells and taking large bites of the soft-bodied mollusks. The following week live prawns and crabs were tried and they were taken with relish and ease. Successively live fishes were offered by releasing them into the ponds and these were comparatively more difficult to hunt. It was interesting to note that when all the various live prey items were presented together, they ingeniously selected the easy prey and lastly swam deep into the pond for the fish. Thawed fish were completely phased out after the first month and the rest of the eleven months they were hunting exclusively for live prey.

The next part of the otter rehabilitation training involved complete psychological exclusion of the otter keepers as food presenters. The mesh fencing was screened with a black cover to block the view of humans. Food was presented discretely by throwing it in or placing it silently. Sounds associated with people such as

giggling, keys in a bunch or moving vehicles were minimized.

Sunglei Buloh Nature Park which was chosen as the eventual release site is made up of 87 hectares of mangroves and mudflats. Various species of migratory birds use this area as a stopover site. Two large rivers the Sungei Buloh Besar and the Sunglei Buloh Kechil, flow alongside the park and contain a rich source of food for otters, i.e., mudskippers, crabs, shellfish, prawns and fishes. Surveys on the wildlife of this sanctuary are regularly conducted by Mr. Subaraj Rajathurai of the Singapore Nature Society, who is also a member of the Singapore Native Fauna Re-introduction Committee. The society conducted a preliminary study of this site, for the release, and recommended that this species would enrich the fauna of the habitat. Oriental small-clawed otters were once present in large numbers in Singapore but they become extinct due to developmental impact.

Following this, our first "trial re-introduction" of small-clawed otters into our nature reserve, the Singapore Native Fauna Re-introduction Group (SNFRP) is seeking to perfect soft-release methodologies. We would like to seek the advice of RSG members who have had previous experience in radio-tracking of otters in the wild to give us some advice and guidance to initiate such post-release monitoring processes.

Contributed by Vasantha Neugogoda, Coordinator and Usha Mathew, Secretary, Singapore Native Fauna Re-introduction Group, Singapore Zoological Gardens, Singapore. E-mail: singzoo@pacific.net.sg

URSIDS

BROWN BEAR

Translocation of the brown bear in the Italian Central Alps

The range of the Brown Bear *Ursus arctos* in Italy is limited to a core population in the central Apennines and a residual population, of a few individuals, in the Adamello Brenta Natural Park (Central Alps). Individuals are also occasionally recorded from the eastern Alps and are probably strays from Slovenia and Austria. A translocation project, proposed by the Adamello-Brenta Natural Park administration, aims to re-establish a viable population of bears in the Central Alps, and has been funded by the European Community through a "LIFE" program. The project is being carried out in co-operation with the Province of Trento and with the authorities of Slovenia, where bears will be captured. There is a very useful co-operation with Austrian and French colleagues who have carried out similar brown bear translocation projects.

Our institute, the Italian government agency for the management and conservation of wildlife, produced a feasibility study for the translocation which aimed to:-

⇒ verify that there was no possibility to recover the residual population without a translocation;

- ⇒ assess that the region can sustain a viable population of bears;
- ⇒ assess if conflicts that arise between bears and human activities are sustainable;
- ⇒ identify the main factors that could negatively affect the establishment of a population in the area.

We censused the residual population through a DNA analysis of feces and hair samples and the results of this analysis confirm that only 3 individuals still inhabit the area. Therefore there is no real possibility for the local population to recover without the arrival of new individuals either through natural immigration and/or translocation. Since no reproduction has occurred in this area during the last 8 years, we assume that the remaining individuals are probably not reproductively active, and the population can be considered functionally extinct.

Data which listed the presence of bears in the Alps was processed using logistic regression analysis and this was used to create a habitat suitability model. This data was collected over the last 20 years and defines the habitat characteristics which include human disturbance indexes. We identified 1,700 km² of suitable area for a bear population, and we estimated that this area can sustain about 35 – 50 bears. Recent research carried out in Scandinavia suggests that this number can be considered above a Minimum Viable Population.

The direct costs and potential impact on human activities, for the period of time required to establish a total population of 50 individuals, was estimated in conjunction with private professional analysts. The potential impact caused by bears on economic activities was also estimated on the basis of data gathered in similar translocation projects in Austria and France. A probabilistic prediction of the impact of problem bears was also investigated. The cost of the project is potentially very high and will depend strictly on the frequency of problem bears causing severe damage to livestock. This also includes the direct cost of poaching and/or indirect impact of human pressure on bear population increase.

Human dimension aspects were considered carefully, because human pressure represents the main limiting factor for the future population dynamics in the central Alps which has a high tourist presence. A survey on the attitudes of the local population towards the Brown Bear translocation was carried out through 1,500 telephone interviews which indicated that 75% of the residents had a positive opinion of the project. This positive opinion rose to over 80% when it was stated that bears will be constantly monitored and problem individuals will be removed or destroyed. In this respect, an emergency team has been created, training rangers to aversion and trapping techniques. A Bear Project Committee was established, inviting main stakeholders including representatives of the main hunters' associations, agriculture organizations, environmentalists and bee-keepers. The group will be constantly informed on the results of the monitoring activities which will allow the possibility of updating the program in respect to the different groups' observations.

Finally, a key aspect of the project was the organizational logistics as the area covered by the translocation overlaps the territory of 5 provinces and 3 Parks. There is a limiting factor in the competency among the different administrations and this can limit rapid decision making which is a priority. Therefore, a committee composed of a few experts and managers was established and decision making authority delegated to this group.

On the basis of these results, the project was approved by the Italian Ministry of Environment and by all competent authorities allowing an initial release of 3 bears and a total of at least 9 individuals by 2002. A male was released on 26th May 1999 (3.5 years old, 99 Kg) and a female released 4 days later (3 years, 55 kg). Initial post-release monitoring data is very encouraging and bears are continuously monitored at 2 hour intervals and tend to avoid inhabited areas. Hunters are co-operating with the monitoring in order to encourage wider participation and transparency of data collected.

The main lesson we learned from the project is that when working on large carnivore conservation programs the human related aspects are a priority. This requires new initiatives and ideas to ensure good probability of success and it is necessary to involve all interested parties toward achieving the common goal. In this process government agencies, the scientific community, non-governmental organizations, local and regional authorities play a major role and members of the public can influence the program through their participation. Public involvement must be initiated at the earliest possible stage before even defining the objectives of the program. Furthermore, there is a need to develop and apply effective and reliable tools for interacting with the human dimension to understand the key beliefs of citizens, design of public campaigns and methods to evaluate the results achieved through these campaigns.

Contributed P. Genovesi, E. Dupré, L. Pedrotti - Istituto Nazionale per la Fauna Selvatica, Ozzano Emilia (BO), Italy. E-mail: infspapk@iperbole.bologna.it

BLACK BEAR

Black bear re-introduction techniques in Kentucky and Tennessee, USA

In 1995 we began a study to experimentally re-introduce black bears *Ursus americanus* to the Big South Fork area of Kentucky and Tennessee, USA. Big South Fork area is approximately 81,000 ha in size and is comprised mostly of National Park Service and USDA Forest Service lands. Big South Fork area is within the historic range of the black bear, but bears were extirpated from the area by the turn of the century. Black bears have a powerful homing instinct and are capable of travelling long distances. Consequently, successful translocation into unoccupied areas cannot occur without the implementation of sound techniques that limit the homing ability of bears.

We tested 2 techniques designed to limit post-release movements of translocated bears. The first technique involved removing parturient bears or females with cubs from their winter dens in the Great Smoky Mountains National Park and transporting them 160 km to Big South Fork area where we placed them in natural den sites we had chosen. The premise is that the maternal behavior associated with giving birth and rearing of cubs would prevent homing by these female bears. The second technique involved trapping bears during the summer from Great Smoky Mountains National Park and transporting them to Big South Fork area. With this technique, the bears were held in acclimation pens at a remote site at Big South Fork area for 2 weeks. After acclimation,

the door to the pen was opened to allow the bear to go free. Food was left at the release site for 3-4 days post release to increase site affinity.

We compared the 2 techniques in terms of survival, site fidelity, and post-release movements. Eight adult females that were pregnant or with newborn cubs were translocated using the winter technique and 6 adult females were moved with the summer technique. Survival was greater for winter-released bears (0.833) than summer-released bears (0.300) during the first year of after release. Only 1 winter-released bear died during the study. This death was caused by a uterine infection and was not associated with the translocation process. In contrast, 3 of the 6 summer-released bears died. All 3 deaths were road mortalities associated with extensive post-release movements. Movement patterns after release also differed depending on the release method. Six of the 7 remaining winter-released bears established home ranges within the release area, whereas only 2 summer-released bears stayed at Big South Fork area.

During winter 1998-99 we confirmed natural reproduction of bears in Big South Fork area. One bear gave birth to 2 cubs; the other gave birth to 3 cubs. Because adult males were never translocated, the sire(s) is thought to be a cub from 1995-96 or 1996-97 releases, or perhaps a transient male. Currently there are approximately 20 to 25 bears at Big South Fork area.

Our population growth projections suggest that the current complement of bears at Big South Fork area will not be sufficient to establish a long-term viable population; additional releases will be necessary. We conclude that the winter translocation technique should be used for subsequent translocations. This technique has clear advantages over the summer technique in terms of survival and site fidelity. With the winter-release method, managers should expect some translocated bears to move significant distances following den emergence but these movements should generally become more localized in a period of several months.

Rick Eastridge, Department of Forestry, Wildlife & Fisheries, University of Tennessee, Knoxville, TN, USA & Joseph D. Clark (E-mail: jclark1@utk.edu), Southern Appalachian Field Laboratory, Biological Resources Division, USGS, Knoxville, TN, USA.

DOLPHINS

BOTTLENOSE DOLPHINS

Experimental return to the wild of two bottlenose dolphins, Florida, USA

In the first scientific experiment of its kind, two young male bottlenose dolphins *Tursiops truncatus* were captured in Tampa Bay, Florida, USA and then returned to the wild at the same locale in October 1990, after two years in captivity. From a conservation biology perspective, cetaceans warrant consideration for re-introductions for two reasons. First, several species of small cetaceans, including the baiji *Lipotes vexillifer* and the vaquita *Phocoena sinus* are facing imminent extinction. Second, large-scale mortalities of dolphins and porpoises are occurring with increasing frequency around the world resulting in the depletion of

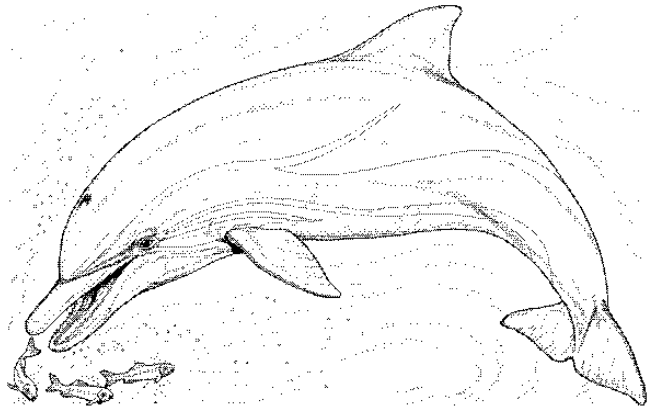
populations. It has been suggested that returning captive members of non-endangered cetacean species (e.g., bottlenose dolphins *Tursiops truncatus*), to the wild could be a means of developing and testing methodology for re-introducing endangered cetacean species involved in captive breeding programs.

The criteria for selection of the dolphin subjects and the release site were determined prior to the capture of the animals. The criteria were determined to maximize the probability of a successful return. We selected subadult males already independent of their mothers and therefore capable of fending for themselves -- this presumably indicated they were capable of prey capture, and they were sufficiently familiar with the local predators, environmental conditions, and the social structures of dolphin schools they might encounter. Males tend to form strong pair bonds and sometimes leave the home range area for periods of time so their return a few years later as a functional social unit would approximate a natural pattern. Finally, young animals were selected because their behavioral flexibility might facilitate the animals' reacclimatization to life in the wild.

Tampa Bay, an estuarine environment on the west coast of Florida, was selected as the site for the experiment for several reasons. Dolphins in this region have demonstrated a high degree of residency, which would help define the subsequent release site and facilitate follow-up monitoring. It would also help to define the host population so baseline studies could be conducted before the return of the subjects. Return to an established home range should also provide the dolphins with familiar habitat, resources, predators, and social system and avoid enforced genetic mixing. Southeastern Tampa Bay has high quality dolphin habitat being largely undeveloped with adequate resources and modest human activity and impact.

Two subadult male dolphins were collected from Tampa Bay in July 1988 and held in a captive facility while being used in echolocation research for approximately two years. In preparation for their return to the wild they were freeze-branded for identification purposes, placed in a sea-pen near the release site to reacclimatize to the local waters and to relearn how to capture live prey, and given thorough veterinary examinations to ensure a healthy, disease-free return to the wild.

On October 6th, 1990 they were transported by boat 41 km to the release site (during transport a radio-transmitter was placed on one dolphin). Initially upon release both dolphins swam up on a sand bar and needed human assistance to be pushed off. They then began to swim and explore the release site. During the first month the dolphins remained together and after that gradually separated and established typical social association patterns with the other resident dolphins. Intensive monitoring continued for the first year after release and then opportunistically since then. To date we have had 69 sightings of one dolphin through April 1999 and 32 sightings of the other dolphin through September 1993. Observations of each dolphin have shown them to be fully integrated into the local dolphin societies. They displayed typical behavioral, ranging, and social association patterns. Their body condition has been excellent at each observation. They have not



Bottlenose dolphin *Tursiops truncatus*

been observed interacting with humans.

The apparent success of this experiment cannot necessarily be generalized to all potential candidates for return to the wild, but the results, conclusions and suggestions can be used to guide future experiments. Our project was conducted under strictly controlled circumstances, and involved young animals that were held in captivity for a modest period of time. Other dolphin release projects involving less controlled circumstances, captive-born dolphins, and dolphins that have been in captivity for longer periods of time have proven less successful. Thus dolphin releases should be considered experimental.

- ⇒ Return dolphins to the waters from which they were originally collected or their stock originated to avoid enforced genetic mixing and provide familiarity with habitat and social structure features.
- ⇒ Release dolphins as functional social units based on similar natural combinations of age and sex classes.
- ⇒ Establish a "half-way house" at or near the release site (use soft - release approach).
- ⇒ Obtain background information on home ranges and social patterns of resident dolphins prior to the release. This will facilitate selection of appropriate monitoring methodology and logistics.
- ⇒ Efforts should be made to match blubber thickness and water temperature regimes between the captive facility and the re-adaptation site well in advance of the transfer. Body condition should be monitored prior to release and compared to residents.
- ⇒ Efforts should be made to learn about the local dolphin prey, and to locate sources of fresh and live prey for re-adaptation.
- ⇒ Plans should be made, and funding and permits secured, well in advance for monitoring the re-assimilation of the animals. There should be a contingency plan for re-capture during the first few weeks if it appears that an animal is not thriving, and for another release attempt or placement of the animal after recapture.

Contributed by Kimbrough Bassos-Hull and Randy Wells, Chicago Zoological Society's Sarasota Dolphin Research Program, Sarasota, Florida, USA. Email: kbhull@mote.org



CHECK THE FOLLOWING WEBSITES FOR MORE INFORMATION ON RSG:

<http://www.iucn.org/themes/ssc/programs/rsg.htm>
<http://www.massey.ac.nz/~DArmstro/rsg.htm>





RSG BULLETIN BOARD

FALCONS & CONDORS

The Turner Endangered Species Fund and the Peregrine Fund have joined forces to restore Apolmado falcons and California condors in New Mexico, USA. Re-introduction should begin in 2000.

ASIATIC & AFRICAN WILD ASSES

Denzau, G. & H., 1999 Wildesel (in German), Jan Thorbecke Verlag Stuttgart, ISBN 3-7995-9081-1 (A monograph on Asiatic and African Wild Asses, which contains e.g. maps and details of the former distribution of these equids. It reviews also major re-introduction projects of *Equus hemionus kulan* in Turkmenistan and Kazakhstan as well as of *Equus hemionus onager* in Israel).

HELP SAVE BIRDS FROM EXTINCTION

BirdLife International wants to ensure that by next year there is widely available information on all bird species considered to be in danger of extinction and which will be published in a book *Threatened Birds of the World*. They are looking for sponsors who would be willing to sponsor a species of their choice.

This is a great opportunity to help the bird of your choice. For further details contact: Naomi Hawkins, BirdLife International, Wellbrook Court, Girton Road, Cambridge, CB3 0NA, UK. Tel: +44-1223-277318, Fax: +44-1223-277200, E-mail: naomi.hawkins@birdlife.org.uk

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