Letter from the Chairman
MARK R. STANLEY PRICE

RSG is currently trying to establish captive breeding and re-introduction needs for African fauna. Information has been gathered on status of species from government wildlife authorities, SSC members, SSC Action Plans, NGOs active in the relevant regions, and other interested parties. A comprehensive list of which species are held in US captive breeding institutions, and are part of captive breeding programmes, has been developed, using the International Species Information Systems abstracts. The results of this survey indicate that 43% of African endangered species (mammals, birds, reptiles and amphibians) are represented in ISIS institutions. Some information on this survey is detailed on page 19 in this issue.

RSG has had a variety of re-introduction proposals to review over the last few months, including: oryx in Jordan; Mexican prairie dogs, Mexico; orang utans; white rhinos in Namibia; Ecuador Andean bear and harpy eagles in Ecuador; macaques in Malaysia; sika deer in Vietnam; foxes in the Netherlands; and Alpine chamois in Italy. This gives an indication as to the diversity of data, information, projects, geographical range that RSG members, and others, are working.

The RSG draft guidelines for placement of confiscated live animals are hopefully finally nearing completion. After extensive revision, they were presented to the SSC Steering Committee at its recent meeting, and RSG is waiting for its comments. Thanks go to all those who put so much time and effort into reviewing these.

RSG Project Officer, Micky Soorae, attended the official opening of the houbara bustard release project in Morocco. Individuals, however, were being released into a fenced area where there is already an extant population of houbara.

I believe that it is important for all RE-INTRODUCTION NEWS readers to note that not all the opinions stated in this newsletter are those of RSG, they are often those of the persons writing the articles. RSG is quite concerned about some of the projects outlined in RE-INTRODUCTION NEWS; seemingly with some projects, absolutely no concern has been paid to the genetic origin of individuals. This seems especially true in the section entitled 'Mammals' and with some of the Eastern European projects. RSG cannot condone such projects. However, there is some value in highlighting these projects as an indication as to the extent they are carried out, and to try to highlight some of the problems with them.

Disease, as detailed in Michael Woodford’s article entitled ‘Translocation—the veterinary issues’, and both genetic and behavioural issues are of fundamental concern when dealing with individuals for possible re-introduction. This is outlined in more detail in RSG’s Guidelines for Re-introduction.

We have received an extremely interesting response to the article in RE-INTRODUCTION NEWS 15 entitled ‘Re-introduction summary: European beaver, bison, elk and lynx in Poland’ submitted by Dr. Jan Smielowski. Dr. Henry Okarma of the Mammal Research Institute in Poland outlined his concerns about this project. He identified 3 area of concern:

1. source stock of lynx: sub species being released is different to the sub species found near to the point of release
2. park is too small for a population of lynx
3. intensive use of park - problems with road kills etc.
4. captive born lynx have been used for re-introduction when there are suitable wild born individuals for translocation only 200 km away.

If anybody is interested in seeing a copy of this article, please write to RSG.

I am keen to encourage RE-INTRODUCTION NEWS readers to respond to articles, or to write concerning particular issues. In this way, we can make RE-INTRODUCTION NEWS more interesting and informative.
UPDATES AND ISSUES

Translocation—the veterinary risks

The translocation of wild animals, sometimes bred in captivity on a distant continent, is being carried out on an increasing scale for conservation and welfare reasons all over the world. However when wild animals are translocated from one place to another inherent disease risks become apparent. These risks can be assessed in advance and minimised if timely and appropriate veterinary precautions are taken.

For the purpose of this article ‘translocation’ is taken to mean the intentional release of animals into the wild in an attempt to establish, re-establish or augment a population. This includes releases for welfare reasons.

The veterinary risks for projects involving the movement of wild animals, even over relatively short distances, are varied and often unexpected. This was demonstrated dramatically when an outbreak of bovine tuberculosis occurred in translocated Arabian oryx, Oryx leucoryx, when the stress of relocation precipitated a disease problem which had been unsuspected in the originating herd.

Another case involved the translocation of red lechwe, Kobus leche, from the Kafue Flats in Zambia to a new location in South Africa which was infested by the tick vector of cowdriosis (heartwater), a fatal disease which was enzootic amongst nearby domestic cattle. Many of the translocated lechwe died of heartwater, a disease against which they would have been resistant had they been born in an area where the tick vector and the disease were present and had thus acquired ‘childhood’ immunity.

The unexpected nature of these occurrences is hardly surprising when one considers how little is known about the transmissible diseases which afflict wildlife and how inadequate are the diagnostic facilities and epidemiological tools available to the wildlife veterinarian.

There are many examples of the inadvertent introduction of diseases following upon the translocation of both domestic and wild animals. The consequences of these have been both expensive to control and potentially catastrophic for wildlife populations.

It must be remembered, too, that once introduced into a free-living wild population, the elimination of a disease agent is only rarely possible. A good example of this (although unrelated to translocation) is the introduction by contact with infected, contiguous domestic cattle, of bovine tuberculosis into the Queen Elizabeth National Park, Uganda and more recently into the Kruger National Park, South Africa. However, when eradication is achieved, as it was when the New World screwworm, Cochliomyia hominivorax, was inadvertently introduced into Libya (supposedly along with a consignment of domestic livestock from Central America), the eradication operation took four years and cost in excess of $80 million. In this case, domestic animals were the main species affected and apart from animals in Tripoli Zoo, few free-living wild animals were involved.

Expensive translocation failures have occurred, too, when immunologically naïve animals have been confronted by endemic pathogens in a new and unfamiliar environment (see the case of the Zambian lechwe above). The failure of the Hawaiian goose, Branta sandvicensis, to increase in numbers after translocation back to the Hawaiian islands after captive breeding in England, is said to have been due to its occupancy of only the higher altitudes of its historic range. Breeding had formerly taken place at lower, more suitable altitudes but these are now infested with introduced mosquitoes, vectors of the avian pox virus, to which the goose is very susceptible.

It will be seen from the preceding examples that the veterinary risks that accompany wild animal translocations are considerable and that they may have far reaching and unforeseen consequences for humans, domestic livestock and wildlife.

In a paper presented at the 57th North American Wildlife and Natural Resources Conference in 1992, Davidson and Nettles remarked that the translocation of wildlife never consists of the relocation of a single species. Rather, it always entails the movement of a ‘biological package’ consisting of the animal itself and its fellow travellers. These may include viruses, bacteria, fungi, protozoa, helminths, arthropods and other pathogens.

In response to a growing need to evaluate the disease risks that are associated with wildlife translocation, these two authors developed a prototype for a Disease Risk Assessment System (DRAS) which they have used in USA for the assessment of the potential disease risks of translocating wild-caught raccoons, Procyon lotor; red foxes, Vulpes vulpes; coyotes, Canis latrans; and pen-raised wild turkeys, Meleagris gallopavo; and bobwhite quails, Colinus virginianus.

The DRAS described by Davidson and Nettles has considerable relevance for wildlife translocation projects outside the USA and indeed, their methods could be applied when assessing the disease risks accompanying the disposal of confiscated wildlife. The paper referred to is not well known outside the USA and there now follows a summary of Davidson and Nettles’ DRAS.
with some additions.

The DRAS envisages the evaluation of the disease risk potential of three distinct scenarios.

The first is that, as a result of translocation, an exotic pathogen could be introduced and become established in a new geographic region. The second possibility is that the release of an infected animal could cause an artificial intensification of an enzootic or pre-existing disease. A third scenario is that the translocated animals may succumb to diseases, to which they have no innate or acquired immunity at the release site.

In each case, the DRAS proceeds with a systematic screening by a wildlife veterinarian for the pathogens likely to be affecting the animals destined for translocation. The evaluation of the disease risks posed by any organisms detected during the screening of animals while they are in quarantine is undertaken by the veterinarian. It consists of two stages. The first stage is an evaluation of the ability of the organisms to persist at the release site. This is determined by a study of the epizootiologic requirements of each detected disease or parasite, as reported in the literature.

Organisms are believed to be more likely to become established at a release site if they:

1. Have a widespread geographical distribution;
2. Have a direct transmission cycle or have a widespread distribution of vectors and intermediate hosts;
3. Have a high prevalence and intensity in the translocated species; and
4. Are infective for other animals at the release site.

A subjective category scale, 1 - 4, was devised to rate the probability of disease establishment.

1= Excellent, for those diseases known to be already enzootic at the release site.
2= Possible, for those with direct transmission or those with vectors or intermediate hosts known to be present at the release site.
3= Improbable, for those requiring specific vectors/intermediate hosts which are not present at the release site.
4= Unknown, for those with unknown aetiology.

The next and second stage is an assessment of the pathological capabilities of the various organisms for the animals to be translocated, other wildlife species, domestic livestock and humans. This is based on reports in the scientific literature. The authors established three categories for this assessment.

1= Pathogenic, for those organisms known to produce disease;
2= Non-pathogenic, for those studied fully enough to determine that they never or seldom produce disease and
3= Unknown, for those for which there has been insufficient study to evaluate pathogenicity.

The veterinarian’s final assessment of the risk posed by each pathogen is then based on a combination of its establishment and pathogenicity rating. Pathogens with either a low probability of establishment or a lack of pathogenicity may be considered to pose little risk. Conversely, those which exhibit both a reasonable probability of establishment and pathogenicity in the relocated animals or other potential hosts, may be considered to pose a considerable risk. Risk cannot be predicted for those ranked ‘Unknown’. It is acknowledged that disease risk assessments can never be absolutely predictable because other biological factors in the release area might favour exotic pathogens normally considered harmless, thereby producing unforeseen disease syndromes. Stress, too, may render the translocated animals unusually susceptible to normally harmless organisms.

There are, however, still several problems to be overcome before the provision of adequate and timely health evaluation services is sufficient to ensure that disease incidents resulting from wildlife translocations do not occur. One of these, mentioned before in this article, is the poor availability of diagnostic and laboratory support to provide the required disease evaluation services. Another is the paucity of reliable data on the geographic distribution, host susceptibility and pathogenicity of the various organisms and parasites among wildlife species and populations. Basic information on these subjects is essential for the credibility of DRAS as described here. Unfortunately, it is generally accepted that the diseases of animals that afflict those confined in zoological collections provide a very unreliable guide as to what diseases may be significant in the wild or as to the effects of those diseases on free-living animals (9).

In contrast, the authors assert that, in some cases, if the baseline data is adequate, disease risk evaluations can be made entirely ‘on paper’, without the need for examining the animals at all. They give as an example that enough is known of the life cycle, distribution, prevalence and pathogenicity of the meningeal worm, Parelaphostrongylus tenuis, of the white-tailed deer Cervus virginianus, which causes fatal neurological
disease in other North American cervids (and in some exotic ungulates), to be able to evaluate accurately the risk of the occurrence of this disease as a result of white-tailed deer translocation projects. Finally while the DRAS described here focuses upon the potential for the initiation or spread of disease by translocated animals and the pathogens which may accompany them, another problem exists. This is the concern that the translocated animals themselves may contract enzootic disease at the release site. This concern is particularly relevant when the translocation involves the conservation of endangered or threatened species. In order to carry out a disease risk evaluation at the release site it is necessary to reverse the pre-release procedures described here. Thus the pathological capacities of the various organisms found after an examination of the wild and domestic animal inhabitants of the release site and the presence or absence of vectors and intermediate hosts of infectious diseases likely to affect the incoming translocates, must all be evaluated in a similar way.

In the event, it may be possible to vaccinate animals destined for translocation into an enzootic disease area so as to protect at least the founders of the new or reinforced population. An argument against this might be that vaccinated translocates would then have an advantage over any resident conspecifics. But any advantage thus gained would be to some extent offset by the stresses involved in the translocation.

Recommendations.

1. Disease potentials must always be considered by a wildlife veterinarian when wildlife translocation projects are being planned.

2. A literature review may help in identifying potential disease risks by revealing the epizootiological requirements, pathogenicity, geographic distribution, host specificity, vectors and intermediate hosts of the pathogens discovered during pre-translocation screening.

3. The animals to be translocated must be quarantined for at least 30 days during which screening should be undertaken to identify those pathogens likely to cause disease problems at the release site. Vaccination should be considered.

4. Animals, both wild and domestic, must be examined at the release site to assess the local epizootiological situation and identify any pathogens, their vectors and intermediate hosts, which may threaten the health of incoming, naive translocates.

References.


Contributed by Dr. Michael Woodford, Dr. Vet. Med. FRCVS, Chairman, IUCN/SSC Veterinary Specialist Group, Washington, USA.

Bird Re-introductions and Predators

Several recent instances of predators causing problems with re-introductions of endangered birds have rekindled interest in developing solutions. Depredations by red fox Vulpes vulpes, on captive-bred and released houbara, Chlamydotis undulata, were detailed in RE-INTRODUCTION NEWS 13. Recently, a golden eagle Aquila chrysaetos, evidently killed one of the captive-reared California condors, Gymnogypus californianus, released in northern Arizona. In Hawai’i the critically endangered ‘Alala or Hawaiian crow, Corvus hawaiiensis,
has encountered trouble from another listed species, the Io or Hawaiian hawk, *Buteo solitarius*. Three released ‘Alala appear to have been killed by the hawk in January, 1997, and field investigators have reported serious harassment of the crows by hawks on numerous occasions in the past.

Currently there are only a dozen or fewer ‘wild’ ‘Alala and only two or three potential breeding pairs remaining on the Big Island, whereas the Io is actually common and not biologically endangered. Just within the 2,500 hectare range of the existing ‘Alala there are an estimated 21 Io territories; so, while the ‘Alala must face threats from rats, cats, and mongooses, the hawk looms as an additional predator of concern.

These cases are only some of the most recent instances of a problem that has plagued avian re-introductions since the beginning of serious attempts to establish captive-reared endangered species in the early 1970s. Predation has been an especially severe problem for ‘prey species’ such as upland game birds: masked bobwhite quail, *Colinus virginianus* ridgwayi; cheer pheasant, *Catreus wallichii*; waterfowl: nene, *Branta sandvicensis*; Aleutian Canada goose, *Branta canadensis leucopareia*; and small passerines: Bali mynah, *Leucopsar rothschildi* and San Clemente loggerhead shrike, *Lanius ludovicianus mearnsi*. But, it has even been a problem in the re-introduction of several endangered birds of prey. In North America, the great horned owl, *Bubo virginianus*, and golden eagle, *Aquila chrysaetos*, accounted for the loss of more released peregrine falcons, *Falco peregrinus*, than any other factor, and in Europe the eagle owl, *Bubo bubo*, has been an equally serious cause of losses. In fact, the presence of these large owls has prevented the re-establishment of falcons in some regions. The great horned owl has also been a serious predator on released aplomado falcons, *Falco femoralis*, in south Texas, and goshawks, *Accipiter gentilis*, have apparently worked havoc on released thick-billed parrots, *Rhynchopsitta pachyrhyncha*, in Arizona. As is typical on oceanic islands, exotic predators such as rats, feral cats, and mongooses have impeded restoration efforts for endangered birds on the island of Mauritius. These examples by no means exhaust the list of avian re-introductions that have had to contend with predator problems, but they are perhaps representative of the situations in which predators become a significant factor in the equation for successful species restoration.

There are several ways for re-introduction specialists to deal with predators. One is simply to accept predation as a part of the cost involved and to adjust by increasing the size of the operation until the effects of predation are swamped out by the number of surviving individuals in the released population. This tactic may be less applicable to birds than to some other organisms such as fish, because large numbers are not usually available for release.

Another approach is to select release areas where predators are scarce. When it became clear that great horned owls would be a continuing problem for successful establishment of peregrines in their historical lowland habitat of mixed woods and agriculture along rivers in the eastern USA, the release stations were relocated to higher elevations in the mountains, to urban areas, and to coastal marshes where the owls occur rarely. While this procedure reduces the problem of predation, it has the disadvantage of limiting re-introduction to predator-free areas which may not necessarily be optimal for the re-introduced species in other respects.

Removal of predators from areas where they are causing problems is an old and frequently tried solution. Aside from possible ethical considerations about interfering in the life of one species in order to benefit another, removal often has serious practical drawbacks as well. It can be effective in small, isolated situations, such as on islands, or in continental habitats where the offending predator is neither common nor widely distributed. To date its most successful, and acceptable, application has been directed at exotic predators on small oceanic islands—notably in New Zealand, and on Mauritius where intensive trapping and poisoning of rats, cats, and mongooses have substantially aided in the recovery of the re-introduced Mauritius kestrel, *Falco punctatus*, and pink pigeon, *Columba mayeri*.

Removal has little effect on common, widely distributed, territorial predators such as owls and hawks, which tend to be replaced, as rapidly as they are removed, by ‘surplus’ non-territorial individuals, so-called ‘floaters’. Intensive and continual removal of great horned owls from the environs around release sites for peregrines along the upper Mississippi River in the USA did substantially increase first year survival of the released falcons. But the remaining owls still prevented the peregrines from becoming established breeders at historical eyries in owl-infested habitat along the river, and the peregrines moved into nearby cities.

Two other techniques have received attention in recent years and are currently under consideration for the problem created by the co-occurrence of the ‘Alala and Io in the same habitat. Both are highly manipulative, clinical in approach, labour intensive, and costly. One involves conditioning the ‘Alala prior to release to be more wary of the Io as a predator, by some kind of
negative reinforcement associated with live hawks or taxidermic mounts and recorded hawk calls, possibly in association with wild corvid companions used as guides to show adaptive responses to the naïve 'Alala. The other involves trapping problem Io on territories that occur in 'Alala habitat and subjecting them to 'aversive training' in association with live or dead common crows, *Corvus brachyrhynchos*, before releasing them back to their territories. Presumably such hawks would leave the 'Alala alone and also keep other potential problem hawks out of their territories. Developing these techniques and putting them into practice are likely to be quite expensive, and one has to ask whether the money might be better spent simply to raise and release more 'Alala to get the released population up to some critical size that will allow it to survive and to perpetuate itself in the face of some predation by the Io.

Finally, this entire issue of problem predators and re-introduction is often related to the larger issue of the 'overabundance' of some animals. Endangered species biologists are not used to thinking about overabundance as a problem, but some 'weedy' species of birds need attention. Several species of gulls and geese, and various 'blackbirds', come to mind, but in parts of their ranges so too do such birds as ravens, *Corvus corax*, golden eagles, large owls, goshawks, and, perhaps, even peregrine falcons.

*Contributed by Tom J. Cade, Chair Bird Section, IUCN/SSC Re-introduction Specialist Group.*

**Assessment of Reintroduction as Tool for Recovering Gray Wolves in the Greater Yellowstone Area**

**Introduction**

In 1995, the U.S. Fish and Wildlife Service (USFWS) and the National Park Service (NPS) initiated a programme to recover gray wolves, *Canis lupus*, in the Greater Yellowstone Area, GYA, (i.e. Yellowstone National Park and surrounding National Forests). Even though a naturally occurring population of gray wolves inhabited Montana, the NPS and USFWS determined that wolves would most certainly and cost-effectively return to the GYA if animals were translocated from Canada and released in Yellowstone National Park (YNP).

During March 1995 and April 1996, 31 gray wolves were released in YNP. During April 1995 and 1996 two litters and five litters, respectively, were produced in the wild. By February 1997 the population consisted of 39 wolves in eight packs that should produce this spring. It is entirely conceivable that 75 or more wolves in eight or more packs will inhabit the GYA by February 1998. Given the current size and projected growth of the wolf population it is not necessary to translocate additional wolves from Canada to YNP.

Recovering wolves to the GYA was a controversial and contentious issue. Many individuals opposed recovery and among those that were supportive there was sharp disagreement over how best to proceed. Some felt that the USFWS and the NPS should allow wolves to reclaim the GYA naturally, as they had reclaimed northwestern Montana. Others, including myself, felt that wolves should be translocated from Canada and reintroduced.

While many aspects of the two options are similar, three considerations prompted me to favour reintroduction:

1) it minimizes the time to recovery thus reducing cost,
2) it allows released wolves to be considered members of an experimental-nonessential population thus maximizing management flexibility, and
3) it allows for refinement of management techniques that can be used to recover other endangered species. Below I briefly discuss each point.

**Reasons for re-introducing wolves to Yellowstone National Park**

**Rate of Recovery**

The objective of the gray wolf recovery program in the northern Rocky Mountains is to remove the species from the list of endangered species. Delisting will occur when ten breeding pairs of wolves have produced pups for three consecutive years in the GYA, northwestern Montana, and central Idaho. Because of the size of the naturally occurring population in northwestern Montana it was widely believed that dispersers would eventually settle the GYA (and central Idaho). However, it was recognized that such a process would require many years; delisting was predicted to occur around 2025. Because monitoring and management would be needed during all the years preceding delisting, the estimated cost of recovery via natural recolonization was ten to 15 million dollars.

In addition to substantial cost it is important to recognize that recovery might not ever have occurred via natural recolonization. There are a host of factors that can prevent the growth and persistence of small populations and these factors may have prevented a fully recovered wolf population from arising from wolves dispersing from Montana to the GYA.

In contrast, re-introduction ensured that the GYA would be settled by a relatively large number of wolves in a short period of time. This reduced the predicted time to
recovery to around 2002, overall costs by three to eight million dollars, and the likelihood of various factors hindering or preventing growth of the population. In the uncertain world of endangered species recovery, it is always wise to implement strategies that maximize the likelihood of success while minimizing costs.

**Designation of Wolves as Members of an Experimental-Nonessential Population**

Individuals of an endangered species that are involved in a re-introduction programme can be designated as members of an experimental-nonessential population as per section 10(j) of the Endangered Species Act (ESA). This designation was developed by Congress to promote cooperation among local residents and government agencies that would be affected by conservation efforts that utilized re-introductions to recover endangered species. The designation facilitates cooperation by relaxing the provisions of the ESA through the development of rules that promote local citizen involvement and minimize disruption of local activities. In short, the designation allows re-introduced animals to be managed in a manner that is respectful of the needs and concerns of local citizens. It is much more difficult to manage naturally occurring members of an endangered species in such a manner. For example, wolves in northwestern Montana are managed exclusively by government authorities; local citizen involvement is nil.

I know from 11 years of intimate involvement in wolf recovery that local folks are not so much opposed to wolves but rather skeptical of the government's claims that wolf recovery will not dictate policy to local communities. Primarily because of the inability of the government to keep past promises, local people believe that wolf recovery will negatively affect their lives. For wolf recovery to succeed, we must recognize their concerns, respect their apprehension, and work hard to uphold the promises that were made. If we are able to do those things, with time they will come to view wolf recovery differently. We may never completely win them over, but we can gain their respect which will promote a tolerance for wolves, which will improve wolf survival. Utilization of the experimental-nonessential designation greatly facilitates the development of management protocols that are respectful of local folks.

To illustrate the flexibility of the experimental-nonessential designation, there follows a list of important management protocols that were implemented but which would not have been possible had wolves naturally recolonized the GYA.

- State and tribal wildlife agencies are encouraged to direct wolf recovery efforts outside national parks and national wildlife refuges.
- Landowners and livestock producers may harass wolves on private property or in the vicinity of livestock.
Table 1. Actual outcomes resulting from the Yellowstone wolf restoration program during the first two years compared to predicted outcomes presented in the Environmental Impact Statement.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Predicted Outcome</th>
<th>Actual Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of wolves re-introduced</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>Number of re-introduced wolves that do not contribute to population growth because of stochastic events, conflicts with livestock that led to the wolf's death of placement in captivity, mortality including illegal killing</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>Number of re-introduced wolves surviving at the end of the second year</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>Number of pups born during first two years</td>
<td>0</td>
<td>23</td>
</tr>
<tr>
<td>Number of pups that died</td>
<td>-</td>
<td>54</td>
</tr>
<tr>
<td>Number of wolves at end of second year</td>
<td>16</td>
<td>39</td>
</tr>
<tr>
<td>Number of reproductively active packs at the end of the second year</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Number of ungulates killed annually by a pack of five wolves</td>
<td>60</td>
<td>120</td>
</tr>
<tr>
<td>Number of cattle killed by a population of 21 wolves during first two years</td>
<td>2 to 6</td>
<td>0</td>
</tr>
<tr>
<td>Number of sheep killed by a population of 21 wolves during first two years</td>
<td>18 to 22</td>
<td>10 to 12</td>
</tr>
<tr>
<td>Wolves would travel to areas where circumstances would require that they be returned to wilderness areas or the park</td>
<td>SOME</td>
<td>SOME</td>
</tr>
<tr>
<td>Visitor use of area inhabited by wolves</td>
<td>INCREASE</td>
<td>INCREASE</td>
</tr>
</tbody>
</table>

a The EIS predicted that 33% of the wolves re-introduced in Yellowstone would not contribute to population growth because of stochastic events such as mortality, disappearance, dispersal, etc.

b The EIS predicted that 10% of the wolves that are not subjected to stochastic events could possibly be removed annually because of conflicts with livestock.

c The EIS predicted that 10% of the wolves that are not subjected to stochastic events could possibly die from natural causes, accidents, or illegal killing.

d This number includes pup #46M who was permanently placed in captivity because of capture-related injuries.

e We calculated “actual” number of ungulates killed annually by a pack of five wolves assuming a kill was made every second day.
Livestock producers may kill a wolf caught in the act of killing or wounding livestock on private land. 

Once six or more packs are present, livestock producers legally using public land may be permitted to kill a wolf in the act of killing livestock if authorized agencies have not been able to resolve the conflict.

Wolves may be moved to reduce predation on local ungulate herds, if the action does not hinder wolf recovery.

Land-use restrictions will only be enacted around acclimation pens and perhaps within one mile of active den sites on public land during spring. When six or more pack are present, closures around den sites can only be utilized on national parks and national wildlife refuges.

The experimental-nonessential designation allowed for the development of rules that were a fitting end to the years of hard work spent developing an acceptable strategy for recovering wolves in the GYA. The rules are respectful of the concerns of local citizens, allow for, and actually promote, extensive state and tribal involvement, and ensure that recovery and subsequent delisting are achieved at relatively little cost.

**Application to Efforts to Conserve other Imperilled Species**

During the last century thousands of species have gone extinct as a result of human activities. Unfortunately, the rate of human-induced extinctions continues to rise and during the time it takes you to read this article we will have destroyed at least one other species, maybe more. For every species we destroy, countless others are pushed to the edge of oblivion. For many of these, recovery will only occur through re-introductions that allow individuals to reclaim original ranges. Re-introducing gray wolves to YNP provides opportunities to refine techniques that can be used to ensure the persistence of other imperiled species. Such opportunities would not have arisen if gray wolves had recolonized the GYA through dispersal.

**Summary**

The three considerations mentioned above contributed mightily to the decision to recover gray wolves in the GYA through re-introductions, and the first two years of the effort bear testimony to the wisdom of the decision. The recovery program is progressing much better than expected as wolves are thriving and producing more pups than predicted and livestock losses are considerably lower than predicted (Table 1).

As of February 15, 1997 the GYA supported 39 wolves that existed in eight packs that should produce pups during the spring of 1997. Clearly, if current trends continue, the gray wolf may have been recovered in the GYA ahead of schedule and under budget. Recovering the wolf quickly and responsibly will reduce cost to taxpayers and may foster support for the ESA. It is extremely unlikely that similar claims could be made if wolf recovery in the GYA was dependent upon natural recolonization.

Contributed by Michael K. Phillips, Wolf Restoration Project Leader, Yellowstone Center for Resources, Yellowstone National Park. email: MIKE_PHILLIPS@NPS.GOV

## BIRDS

**Restoration of Endangered Hawaiian Forest Birds**

The phenomenon of island extinctions, historically repeated as a testimony to the expansion of humankind across the oceans, is nowhere more dramatic than throughout the Hawaiian archipelago. An isolated island chain, the Hawaiian Islands enabled nature to display species evolution and diversity unlike any other landmass on earth. However, today many endemic populations are extinct or rapidly declining. Hawaiian forests have become ‘the endangered species capital of the U.S.’ with 70 bird extinctions since the arrival of the Europeans only 200 years ago. This island state is the last stronghold for one-third of America’s endangered birds and plants. Perhaps more alarming is that even populations of the common birds are disappearing.

The decline of Hawaiian plant and animal life has probably resulted from a variety of complex factors including habitat modification resulting from human occupation, introduced exotic plants and predators, and avian disease. Some progress has been made towards preserving and managing endangered forest bird habitat and critically needed research on limiting factors such as mosquito-spread avian disease is underway. However, in spite of these efforts, species continue to decline. If this trend continues, those species reduced to small numbers will also soon be lost. A concerted effort involving habitat management, conservation education and ‘hands-on’ species restoration to include captive propagation and reintroduction has begun, hopefully in time to avert an extinction disaster unlike any other in recent history.

In 1993, the Peregrine Fund, in collaboration with the U.S. Department of the Interior and Hawaii’s Division of Land and Natural Resources began programmes for restoration of native Hawaiian bird species. The
endangered ‘Alala or Hawaiian Crow, *Corvus hawaiiensis*, was the first species to benefit from these efforts. Eggs produced in the wild and in captivity are artificially incubated, the juveniles hand-reared and released to the wild.

**Captive propagation**

In March 1996, the Peregrine Fund completed construction and opened the doors of the Keauhou Bird Conservation Center on the island of Hawai‘i and assumed management of the Maui Bird Conservation Center on Maui. Both facilities are dedicated to conservation education and the restoration of endangered Hawaiian avifauna.

Over the past four years, the Peregrine Fund has established an aggressive programme which has accomplished several milestones, including the development of the technology to incubate and handrear ten species of native Hawaiian songbirds, and to successfully release two species of native passerines. To date, over 102 endemic passerines have been hatched.

Initially, using the more common native Hawaiian species, the Peregrine Fund successfully incubated and reared common ‘Amakihi, *Hemignathus v. virens*, ‘I‘iwi, *Vestiaria coccinea*, ‘Oma‘o or large Hawaiian thrush, *Myadestes obscurus*, and ‘Elepaio, *Chasiempis sandwichensis*. The former two species represent the endemic honeycreeper sub-family, with the latter species representing the families of New World thrush family and Old World flycatcher family respectively. Supported by this successful surrogate experience, the programme has expanded to include six of the endangered native species: the Puauiohi or small Kauai thrush, *Myadestes palmeri*, Palila, *Loxioides bailleui*, Hawai‘i creeper, *Oreomystis mana*, ‘Akohekohe or crested honeycreeper, *Palmeria dolei*, and Maui parrotbill, *Pseudonestor xanthophrys*, in addition to continuing work with the ‘Alala. Each of these species presents a biological challenge, covering the spectrum of life histories from the obligate nectarivore to obligate insectivore.

**Re-introduction of captive-reared birds**

With the wild population of ‘Alala numbering less than ten individuals, the Peregrine Fund began an intensive reintroduction programme in 1993. ‘Alala have now been released into historical habitat in the South Kona District on the island of Hawai‘i. Five, seven and four juveniles were released in 1993, 1994 and 1996 respectively, with ten birds surviving to date (1997). The juveniles are conditioned prior to release for several months in a 15x30m predator-proof, free flight aviary located in the forest. The release birds are supported with the supplementary food for several weeks post release and monitored for weight maintenance. As the birds mature and explore the native food resources, their dependence on supplementary foods decreases to a level of total independence. Reproductive behaviour has been observed in several of the release birds and it is hoped that there will be breeding in spring, 1997.

In 1995, an experimental release of common ‘Amakihi was carried out in lower elevation forest containing predators (rats, cats and mongoose) and mosquito-transmitted avian disease (avian pox and malaria), to develop release techniques for endangered honeycreepers and test the advisability of releasing birds in compromised habitat. Almost all the birds released returned to the release aviary and died due to avian malaria and pox. This experiment showed that although hand-rearing and release techniques are available, restoration of endangered honeycreepers may only be possible at Hawaiian release sites with control of mosquitos and predators.

In 1995 and 1996, the first restoration attempt of a small Hawaiian passerine in a disease-free, predator-controlled habitat was made with the release of captive-reared ‘Oma‘o, into the Pu‘u Wa‘awa’a Reserve; this habitat has been without this species for nearly 100 years. In 1995, two birds were re-introduced as a preliminary test release and in 1996, 23 birds were released in cohorts numbering from two to seven birds. They were acclimated in aviaries built on towers in the lower canopy of the forest for up to two weeks prior to release. Like the ‘Alala, their weights were monitored closely and their supplemented foods were decreased to reflect their improved ability to forage on native foods. Of the 25 released birds, the two released in 1995 currently survive and 21 of the 1996-hatched birds were monitored and known to have survived for at least 30 days post-release (duration of transmitters). Follow-up surveys will establish the flock’s survivorship and the population growth.

The first four years of this programme presents a more optimistic future for the beleaguered avifauna of the Hawaiian islands. As the captive flocks of the endangered species grow, and the techniques for rearing and release are refined, it is hoped that many of the endangered Hawaiian birds will benefit from restoration efforts. However, captive propagation and re-introduction is only one aspect of the ecosystem management tools required in Hawai‘i. Without commensurate action on the part of private land-owners, and local, state and federal agencies, to protect and enhance the native habitat; re-introduction of endangered birds will fail. As Warren B. King wrote:

‘captive breeding and labour-intensive
Manipulative techniques in the wild are futile gestures if we cannot assure the continued existence of sufficiently healthy and capricious habitat to permit the long-term survival of the species. (ICBP - Conservation of Island Birds).

Acknowledgments

Primary collaborators and donors for the Peregrine Fund’s Hawaiian endangered bird programme include: The U.S. Fish and Wildlife Service, Pacific Ecoregion Office; the Biological Resources Division - Hawai‘i Field Station; the Department of Land and Natural Resources; Hawai‘i; Kamehameha Schools Bernice Pauahi Bishop Estate and the Zoological Society of San Diego.

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Contributed by the Peregrine Fund, Keauhou Bird Conservation Center, Maui Bird Conservation Center, Volcano, Hawai‘i.

Vultures in France

Earlier this century, only three species of vultures were still extant in France. The most common was (and is still) the griffon vulture Gyps fulvus, found in the Western Pyrenees. The smaller Egyptian vulture, Neophron percnopterus, was still to be found in the Pyrenees and also in the Alpilles, Provence. In addition, the larger bearded vulture, Tycætus barbatus, was, as it is still, soaring over the Pyrenees and Corsica island.

In 1981, the first griffon vultures were released in the Cévennes, south of the Massif Central, from where the species had been wiped out during the first half of this century. Today, through the release of captive born birds, and through local breeding in the wild, the population has reached more than 200 individuals. There is now confirmation that these birds are mixing with the wild Pyrenees population.

Another project releasing griffon vultures is being carried out in Baronnies in the Alps. The first birds were released at the end of December 1996.

Since 1986, bearded vultures have been re-introduced in the Alps, as part of an international programme between Austria, Switzerland, Italy and France. Although 60 birds are flying again over the Alps, there is, as yet, no sign of breeding as the birds are still young. However, some birds have already paired. The current extant Pyrenean population numbers between 40 to 50.

In 1992, the first black vultures, Aegypius monachus, were released in the Cévennes, in the thriving griffon vultures colony. On 28 August 1996, the first chick to be born in the wild for many years, left its nest. The egg had been laid at the end of March. By the end of 1996, no less than 19 black vultures were flying with the griffon vultures.

Some of the released individuals have been lost to illegal hunting, but generally these releases are proving to be successful.

In the Cévennes, the farmers have an arrangement with the local veterinary services allowing them to place carcasses in ‘control’ areas, where the vultures can feed.

Contributed by François Moutou, WWF-France and Fonds d’Intervention pour la Rapaces, France.

Mammals

Wild dog release in Tsavo National Park, Kenya

A total of six wild dogs (Lycaon pictus) were released at the beginning of May, 1997 into Tsavo West National Park. The group comprised of four females from Laikipia District, central Kenya, and two males from the Mkomazi game reserve in Tanzania. The Mkomazi dogs were both captive-bred, while those from Laikipia were wild bred. There were initially two further males from Mkomazi which were due to be released, but they showed signs of abnormal behaviour; they were used to human presence and it was therefore decided not to release them. The four females were captured on Kisima ranch, Timau, where they had been known to kill sheep. They were thought to be a splinter group of a pack found about 100 miles to the northwest near Mount Maralal.
The six dogs were moved to Tsavo West N.P. and kept in a pre-release enclosure for approximately one month; this provided the opportunity for the animals to form a social group and become accustomed to the site. The enclosure was square in shape with rounded corners, and each side measured approximately 50 feet. The walls were constructed of mesh wire stapled onto poles with a door at one side. There was an artificial den constructed in the middle of the cage. Two males and two females were radio-collared to aid post-release monitoring, which is currently on-going.

Contributed by Pritpal Soorae, Re-introduction Specialist Group, Nairobi, Kenya.

Beaver Re-introduction in Austria

The Austrian beaver population was originally over-exploited 200 years ago. Beavers were hunted for fur, meat and musk. The last one in Austria was killed in 1863 in the Danube estuaries east of Vienna (Mojsva 1897).

Over a hundred years later, based on releases in Germany and Switzerland, Otto Koenig (former director of the Konrad Lorenz Institute) decided to re-introduce the beaver to Austria. Suitability of habitat was tested, and in 1976, an area around the Danube estuaries between Vienna and the Slovakian border was chosen for release (Koenig and Krebs 1979). This was a hundred kilometres of slow running or still waters adjacent to the river, with enough softwood and other vegetation permanently to sustain a growing beaver population. The eastern subspecies Castor fiber oseuropeaus and C. f. belorusus were released for two reasons: the Danube water system is closer connected to the eastern than to western rivers, and they were more easily obtained (mainly from Poland and the former USSR). Between 1976 and 1982, approximately 35 beavers were released, and later another 15 animals followed (mainly C. f. oseuropeaus, C. f. belorusus and hybrids, but also some C. f. fiber and a few C. canadensis). Interestingly, however, it was mainly Canadian and Russian beavers which did not survive the release.

It took until 1985 before the population started really growing (Kollar and Seiter 1990). Then the first animals migrated from the left to the right banks of the Danube (more than 100 km) and built some settlements between Passau and Linz.

In the early 1990’s, beavers from the eastern population reached these western settlements, while some subadults were found all around the capital, Vienna, in the north, some in the south, and most surprising some found their way through the city, travelling more than 30 km through channels (Sieber 1990). During the last 5 years some settlements were established within city limits, partly in suboptimal habitats. They were, however, not only able to survive, but also to reproduce there (Sieber in press).

The numbers of animals had increased sufficiently by 1996 to enable a new re-introduction project to be initiated, with WWF-Austria and WWF-Hungary. Beavers were live trapped in Austria (13 animals up to now) and released in the newly founded Gemenic National Park (Danube, South Hungary); this programme will proceed for another 2 years.

Twenty years on, the current situation can be summarized as followed:

1. The Austrian beaver re-introduction project seems to be very successful (500-700 individuals in about 150 family territories) with connections to central European beaver populations.

2. The beavers did not stay in the estuaries of the bigger rivers (Danube, March, Thaya) but found suitable habitats in smaller creeks, drainage channels and ponds, and even in areas with high human activity.

3. Some conflicts have, however, arisen as a result of beavers using these areas of high human activity, particularly with the forestry and agricultural sectors (problems caused by flooding, digging, tree cutting and feeding on agricultural products).

4. Together with European colleagues working in the same field, the project is trying to develop management strategies for the region which are compatible to both human and beaver populations.

References


Contributed by Dr. Johanna Sieber, Konrad Lorenz Institute for Comparative Ecology, Vienna, Austria.

Restoration of the river beaver in the European North-East

The restoration of the river beaver, Castor fiber L., population in the European northeast, dates back to
between 1938 and 1940, when 17 black beavers from the Voronezh Reservation were released in the Upper Pechora basin. By 1973, there had been 15 different beaver releases in the Vychevga, Sysola, Mezen and Luza river basins. The beavers were mainly from the upper Pechora population as well as from Voronezh and Belorussian populations. The number of beavers which survived transportation and initial release was 266.

By 1996, the beaver populations numbered around 9000 in the subzone of Mid- and Southern Taiga; 1000 in the Upper Pechora; 3000 in the Sysola basin; 3000 in the Middle and Upper Vychevga; 1500 in the Luza basin; 150 in the Mesen basin; and 350 in the Letka basin.

In the Middle and Upper Pechora, in the Northern Taiga and Subarctic Tundra zone, 20 beavers are to be released in the Kozhva river (tributary of the Pechora), in 1997.

*Contributed by V.A. Solovyev, Syktyvkar State University, Syktyvkar, Russia*

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**Cheetah Translocation Project in Lower Zambezi National Park, Zambia**

**Introduction**

The cheetah, *Acinonyx jubatus*, is listed as endangered under CITES Appendix I, categorized as vulnerable by IUCN and as critical by Mace/Lande criteria in the Field Action Plan, (IUCN, 1992). During historic times, its range has declined dramatically, and wild populations are currently estimated at between 12000 and 15000 (Kraus, pers. com.).

The cheetah’s fragmented remnant range is a direct result of human activity, i.e. overhunting, conversion of land to agriculture and livestock farming, and/or gross habitat modification. The cheetah is potentially highly susceptible to both ecological and environmental changes due to its lack of genetic variation (Laurie-Kraus and Kraus, 1993).

The main objectives of this cheetah translocation project were:

1. to evaluate the possibility of establishing a cheetah population in the Lower Zambezi National Park.
2. to study cheetah ecology through monitoring of the translocated animals and to find out the important factors to establish a conservation strategy for cheetahs in Zambia.
3. to study basic translocation techniques.

The pilot project was initiated in August 1994. Due to the encouraging results, the second phase of the project will begin in mid-1997.

**Species distribution**

In Zambia, cheetahs occur in relatively low numbers in Kafue National Park, South Luangwa National Park and Sioma Ngwezi National Park. In Lower Zambezi National Park one or two cheetahs have been sighted on Jeki plain by tour operators during the last four years, but it is not clear as to whether these animals are residents or migrants from e.g. the Luangwa Valley. Although there is no departmental record of cheetahs in the area, it must be remembered that absence of records need not necessarily indicate absence of the animal but may be difficulties in systematic data recording and storage.

Although numbers are scanty, the distribution of the species over the last three decades in Zambia was encouraging.

**Study Area**

The area of the Lower Zambezi National Park is approximately 4092 km². It is located in the south-eastern part of Zambia. It lies between latitudes 15°S and longitude 29°10' and 30°10' east. The park itself is composed of three physiographic regions: the plateau, the escarpment and the valley (Outline Management Plan Lower Zambezi National Park, 1992).

**Methodology**

The translocated animals were wild cheetahs (males), which had been trapped by farmers in Namibia. In Lower Zambezi National Park the three animals were placed in an enclosure of measurements 65m x 65m x 3m for six weeks during which they were provided with shade, water and two fresh impalas per week. The purpose of this was for orientation and acclimatization.

During the six weeks the animals were enclosed, a preliminary study on telemetry was done to:

1. to check on how far the radio signals from the cheetahs' collars could reach. Results from the preliminary study showed that this depended on vegetation or terrain between the collar and the receiver.
2. to get used to the handling of the Yaesu receiver and the antenna. Signals from cheetah radio collars were caught using the Yagi antenna and the Yaesu receiver whereas the location of the animals was checked using the Global Positioning System (GPS).
3. to try and identify the cheetahs individually. On individual identification, special marks were noted like the animal’s tail marks, black ‘tear marks’ and their body sizes. Observations made regarding animal identification, preliminary study on telemetry, the animals’ patterns of movement after their
release and other vital information were all systematically recorded.

Results
The animals were released in October, 1994. They subsequently moved mostly at night, on average covering as much as 8-9 kms. Within a month of their release, the cheetahs had covered about 70 kms in the southwest direction from Jeki Boma. Their unidirectional movements could have been due to instincts as their original homeland (Namibia) is South-west of Lower Zambezi National Park.

About a month after their release, cheetahs one and three were found snared in Baya Baya area which is about 70 kms South-west of Jeki Boma.

It is encouraging to note that the other animal, cheetah two, is still alive and has moved back into the park despite the other two cheetahs being snared. It is able to hunt on its own as per our observations in May, 1995 and also as observed by two Wildlife Police Officers who saw the cheetah on an impala carcass. From our aerial and ground telemetry survey, the animal has already established a home range of approximately 600 km².

Discussion
From the observations made during the monitoring stage, further research needs to be undertaken to look at:
1. why the cheetahs are moving in the single direction;
2. the species’ present status in the area;
3. the social interactions with other predator species and intra-specific interactions;

These will take time to answer. In the meantime, however, the project needs to find additional funding due to a current shortage.

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Acknowledgements: The Cheetah Translocation Project in the Lower Zambezi National Park has been made possible through the initiatives and assistance from the following: the Director (National Parks and Wildlife Service), G and G Safaris, Cheetah Conservation Fund of Namibia, JICA, the Chief Wildlife Research Officer, Mr. H. K. Mwima and the National Parks and Wildlife Service staff involved. Also many thanks to the Chiefness Chiwa and her people and the tour operators for their assistance and cooperation.


Re-introduction of Bison bison bonasus in Belarus

Introduction
In historical times, the bison’s range extended throughout Europe and Asia. By the early 20th Century, bison remained only in forests in Belovezhskaya Pushcha and the North Caucasus. The last wild bison, Bison b. bonasus, was shot in 1919, and the last wild Bison b. caucasicus, in 1927. By 1926, only 52 bison survived; they were in zoos and menageries in Germany, Sweden, England and Poland. Efforts to rescue the bison were initiated in Poland in 1929, and in other countries after the Second World War.

By 1995, the bison’s numbers had risen to 3300 throughout the world, and the status of the species was changed from category one, to two. There are now 238 centres breeding bison, and about 80% of the reserves holding bison are in Russia, Poland, Belarus and Germany. However, in most of these reserves, the bison are in small, isolated herds, and there are signs of inbreeding.

Belarus
In Belarus, a bison re-introduction programme was initiated in 1946: ten bison were released into the Belovezhskaya Pushcha National Park. By 1995, 300 animals were in Pushcha and 130 individuals in other countries. In the mid-1970s, further releases were carried out in Belarus. In 1974 and 1976, seven bison were released into Berezninsky Biosphere Reserve; in 1987-88, eight bison were released into Pripyatsky Reserve; in 1994, 12 into the Volozinsky District, and in 1995 15 into Polissky Radiological Reserve. Re-introduction was a success: by 1996, each bison population numbered 100 individuals. Now, another three areas for release have been selected, Osypovichsky and Grodnensky Forests, and Lyaskovichi. The search for potential new release sites continues.

Areas consisting of continuous forest (15-20,000 ha) with widespread deciduous and sufficient food sources, and with minimum influence from anthropogenic and other
factors, are considered suitable for bison re-introduction. The need to support at least 50-150 individuals is a major consideration when selecting release sites.

Each release site must be equipped with an enclosure (2-3 ha per animal) in which the animals are kept for 4-5 months. This is to enable the bison to acclimatize to the environment. Following release, the bison tend to spend more and more time away from the enclosure, until the winter months when they often return to the enclosure. This is useful, as it enables the project to carry out preventative treatment for helminthoses on the bison.

Bison conservation is both complex and problematical, and includes the three following interconnected aspects: biological (preservation of genetic polymorphism), ecological (the need to create a large population, including an effective breeding population of 500 individuals), economical (considerable cost of bison keeping). With respect to these, a strategy and action plan on bison re-introduction in Belarus has been developed.

A strategy for the metapopulation management of the bison was developed, which included the translocation of individuals between sub-populations to help improve the genetic viability of the various sub-populations.

Contributed by Pietr Kozlo, Institute of Zoology BAS, Minsk, Belarus.

Release of red deer in Belarus

In the 17th Century, the indigenous red deer, Cervus elaphus elaphus, population was extirpated from the greater part of Belarus, and by the end of the 18th Century, it was extinct from the entire country.

Red deer were released in 1865 into the hunting estates of Polish Kings and Russian Tzars - Belovezhskaya Pushcha. Subsequently, between 1892 to 1900, more than 500 individuals from different regions of Central Europe were released: 18 from Germany (estate ‘Pless’); 400 from Polan (estate ‘Spala’), 51 from Silezia, 18 from Bohemia (Chechia); 30 from Austria (Prince Lichtenshtain’s hunting estate). Unfortunately, therefore, the modern Belkovezhskaya population of red deer has a complicated hybrid origin. It is unfortunate, therefore, that this population has provided founder stock for other release projects in Belarus, Ukrain, Latvia and the Russian Federation.

The deer’s re-introduction into the whole territory of Belarus was carried out between 1968-1985. Nearly 1500 individuals were settled in 25 regions. By 1990 the deer’s numbers had increased to between 5300-5500 individuals. The deer from Belovezhskaya Pushcha were used for re-introduction.

In most cases, between 60-80 deer were released within one region, but sometimes between 100-150 or more. There are now sufficiently large populations of red deer: 750-850 in Osipovichskaya; 300-350 in Jurovskaya; 200-250 in Volozhinskaya.

The ultimate aim of the project is for red deer to number 15000-18000 in Belarus.

Contributed by Pietr Kozlo, Institute of Zoology BAS, Minsk, Belarus.

SAUDI ARABIA- AN UPDATE

Arabian oryx: Recent developments in Saudi Arabia

The basis of the Saudi Arabian conservation programme for the Arabian oryx, Oryx leucoryx, is the National Commission for Wildlife Conservation and Development’s (NCWCD) Protected Area System Plan. The ultimate goal of the Saudi Arabian oryx programme is to re-establish self-sustaining, free-ranging populations within the framework of protected areas throughout the historically documented range of the species in the Kingdom. Initial re-introductions of the species in Saudi Arabia in the Mahazat as-Sayd fenced Protected Area have proved to be very successful. With the release of oryx in to the ‘Uruq Bani Ma’arid Protected Area, restoration to the deserts of Saudi Arabia became a reality (RE-INTRODUCTION NEWS 10). This communication summarizes recent developments of the Saudi Arabian oryx programme.

Captive breeding of the Arabian oryx began in the Kingdom of Saudi Arabia in 1986 when 57 animals were transported from the late King Khalid’s collection to the National Wildlife Research Center (NWRC) in Taif. After an outbreak of tuberculosis was brought under control, efforts were directed towards promoting both rapid growth of the herd and improving the genetic representation through the addition of blood lineages from Qatar, Abu Dhabi and Bahrein; these are not represented in the World Herd. On 1 January 1997, the NWRC herd numbered 245 (126 males and 119 females) animals, and in the near future will stabilise at around 260 animals. Captive breeding is now focusing on the production of animals of optimal health and genetic status for re-introduction into the wild. To date, 93 oryx (42 males and 51 females) born at the NWRC have been already re-introduced into two protected areas; Mahazat as-Sayd and ‘Uruq Bani Ma’arid.
The initial re-introduction site for Arabian oryx in Saudi Arabia was Mahazat as-Sayd, a 2,200 km² area of desert steppe habitat near Taif, east of the Asir mountains. The area has been fenced to protect oryx from hunting and to allow the vegetation to recover. Since March 1990, 72 (32 males and 40 females) animals have been released: thirty-four came from the NWRC captive breeding unit and 38 from other private collections (mainly from the Zoological Society of San Diego in the USA and from Shaumari in Jordan). The animals are followed daily by NCWCD ranger staff and monitoring of population dynamics as well as studies on the behavioural ecology and reproductive physiology of the animals are carried out by NWRC scientists. The Mahazat as-Sayd population has increased rapidly (15-20% per year) and was estimated at the beginning of January 1997 to number 270 individuals. No supplementary food or water has been made available to the wild animals, as recovery of vegetation within the reserve has been remarkable, providing considerable optimism for the successful re-establishment of this wild population. A simulation model based on observed rates of productivity and survival indicates that the population will continue to grow at an increasing rate for the next few years, reaching 400 individuals by the year 2000.

The second site of re-introduction is the 'Uruq Bani Ma’arid Protected Area, a 12,500 km² reserve at the western edge of the Rub’al Khali, or Empty Quarter (RE-INTRODUCTION NEWS 10). In February 1997, 17 Arabian oryx, ten males and seven females aged between three months and two and a half years, were transported from the NWRC and released in March and April. These animals will supplement the already established population (RE-INTRODUCTION NEWS 11 and 13). In total, 77 captive-born animals (NWRC) and six wild-born oryx from Mahazat as-Sayd have been released in ‘Uruq Bani Ma’arid since January 1995. It brings the total of released Arabian oryx in ‘Uruq Bani Ma’arid to 83 (40 males and 43 females) individuals. It is remarkable that no deaths related to translocation stress have occurred, although the species is known to be difficult to transport. Fifty-six animals have been fitted with radio-collars and their movements recorded regularly by Mr. Martin Stauss, postgraduate student from the University of Pretoria, RSA.

By the end of 1996, 23 calves, 11 males, nine females and three of unknown sex, had been born to females released during 1995 and 1996. Of the 16 females released in March-April 1995 (first re-introduction) nine had given birth once by the end of 1996 and six twice during the same period. The mean inter-birth interval calculated from seven females was 300 days (SD+/-30.6 days). The mean age at first calving was 895 days (SD+/-107.6 days), and the minimum age at first calving was 726 days old. Despite the likelihood that these data on reproduction are influenced by the stress of adaptation to a new environment, figures are very consistent with data collected from Mahazat as-Sayd and Taif herds.

Seven of the calves are of unknown sire. Six of the 13 males released at the same time reproduced at least once, and four died. Three of these are believed to have died as a result of injuries sustained in a fight with another male. The cause of death of one female was unknown: her calf was rescued by the ranger staff and released the following year. Of the 19 females released in March-April-May 1996 (second re-introduction), seven had already given birth by the end of March 1997. One male released in 1996 died three months after its release, but we were unable to determine the cause of death. Two animals released in 1996 a male and a female, disappeared in the autumn of the same year while heading south-east into the desert. Despite intensive searches by light aircraft and NCWCD ground patrols, they have not been found.

By March 1997 the two wild Arabian oryx herds re-introduced into the Kingdom of Saudi Arabia were estimated to number 380 individuals (270 in Mahazat as-Sayd and 110 in ‘Uruq Bani Ma’arid), while the captive herd at the NWRC, Taif, comprised 245 oryx.

The NWRC is responsible for the captive breeding and re-introduction of Arabian oryx and houbara bustards in the Kingdom of Saudi Arabia, on behalf of the National Commission for Wildlife Conservation and Development (NCWCD).

Contributed by Stéphane Ostrowski and Eric Bedin, National Wildlife Research Center, Taif, Saudi Arabia.

Ostrich Update, Saudi Arabia

Wild Ostriches breed in the Arabian Peninsula for the first time in over 40 years:

In February and March of this year, ostrich chicks hatched within the Acacia savannah of the 2,200 km² Mahazat as-Sayd Protected Area in central Saudi Arabia. These chicks represent the first breeding by free-ranging ostriches in Arabian Peninsula since the last Arabian ostrich Struthio camelus syriacus was shot in northern Saudi Arabia in the 1950s. They also herald a new phase in Saudi Arabia’s ostrich restoration project. The death of the last Arabian ostrich marked the extinction of the subspecies. Unlike other Arabian endemics, such as the Arabian oryx, Oryx leucoryx, the Arabian ostrich was not represented in any captive
collections. As part of the wider programmes for the restoration of wildlife in Saudi Arabia the National Commission for Wildlife Conservation and Development took the decision to introduce the nearest living relative of S. c. syriacus, namely the Sudanese red-necked ostrich, S. c. camelus.

Captive breeding of pure S. c. camelus takes place at the National Wildlife Research Center, near the city of Taif. Releases of captive bred ostriches between June 1994 and December 1996 have resulted in the establishment of 13 adult birds inside the Mahazat as-Sayd Protected Area - site of re-introductions of the houbara bustard, Chlamydotis undulata macqueenii, Arabian oryx, and sand gazelle, Gazella subgutturosa. Good winter rainfall and a flush of new plant growth had enabled these free-ranging ostriches to produce a total of four nests by March 1997. Hatching at two of these nests produced four and nine chicks from clutches of 13 and 33 eggs respectively, thus doubling the Mahazat as-Sayd ostrich population.

With the future of the Mahazat as-Sayd birds more secure and requiring only some input of under-represented genetic lineages, new release sites are being prepared in the extreme north and south of Saudi Arabia, in the large protected areas of Harrat al-Harrah and ‘Urq Bani Ma’arid.

Anyone wishing more information about this or other Arabian re-introduction projects is welcome to contact the NWRC at the following address:

Contributed by Philip Seddon, National Wildlife Research Center, NCWCD, Saudi Arabia

FISH
Conservation of Formosan Salmon, Taiwan

Formosan salmon, Oncorhynchus masou formosanus, a landlocked salmon, is an endangered species in Taiwan. It is the southernmost geographic distribution of the Pacific salmon and originally inhabited the upper reaches of the Tachia River between the altitudes of 1500 and 2000 metres, in Taichung County, Taiwan. In the 1940s, this fish was found in six streams: Chichiawan, Wuling, Yousheng, Suchiehlan, Nanhu, and Hohuan. However, when Central Cross-Island Highway opened and agriculture developed, soil erosion and excessive application of pesticide and fertilizers contributed to the eutrophication and pollution of the river. In addition, forest degradation caused a rise of water temperature. These factors adversely affected the survival of the salmon, which can only live in good water quality with a temperature no more than 17°C. In the 1990s, the salmon remained only in the downstream regions of Wuling Stream and the Chichiawan Stream in Wuling area.

In light of this situation, the fish was protected as an endangered species under the Wildlife Conservation Law promulgated in 1989. However, the Wuling area also suffers from heavy overuse because the area has been developed as a farm. Apart from the strong environmental impact caused by agriculture, the population of the endangered salmon is threatened by the many sand dams along streams. Therefore, to save the endemic subspecies, Wuling has been gazetted as part of Shei-pa National Park. Within the area, the streams with the salmon were especially designated as the Formosan Salmon Ecological Protection Area after the establishment of Shei-pa National Park headquarters in 1992.

Cooperation with experts in aquatic ecology
1. Base line studies
To protect the fish, understanding their life cycle, habitat, population, and so on are crucial. Some related studies have been conducted by the Council of Agriculture and base line studies have continued intensively after the establishment of Shei-pa National Park. During the last four years, five major projects have been accomplished.

a. A survey of Formosan salmon population and research of habitat by improvement;
b. A survey of fauna and population size of aquatic insects in Chichiawan Stream;
c. Investigation of river water quality and its monitoring planning in Wu-Lin Area;
d. A study of Formosan salmon recovery;
e. The Ultrastructure of Formosan landlocked salmon spermatozoon.

2. Strategies for recovery
Strategies for recovery include habitat improvement, artificial propagation, waste water, and garbage control. Because of agriculture and recreation activities such as farms and hotels managed by the Wuling Farm, the runoff from Wuling Farm contains residual pesticides, fertilizers, and waste water. Moreover, forest degradation is occurring due to farm development. All of this impacts on the survival of the fish. Therefore, both temporary and permanent solutions are being implemented.

a. Habitat improvement
It is most important that the forest is restored. After
evaluation by a plant ecologist, land released by the farm was planted with broadleaf trees which are native to the Wuling area. Furthermore, the farm will gradually release more land to be planted over and converted into recreational farm under an agreement between Shei-pa National Park Headquarters and Wuling Farm.

The river bank of Chichiwan Stream has either become silted up or washed out due to natural forces or agricultural activities. Sand deposits ruin the salmon's habitat since they need deep pools to live in, so a shelter was built for the salmon to escape from flood rush by cleaning the sand deposit along the river bank.

b. Artificial propagation
It is necessary to conduct artificial propagation because of the rapid decrease in the salmon population. In 1994, the first year that Shei-pa National Park started the strategy for fish recovery, 268 fry were successfully propagated from three pairs of breeding fish. In 1995, about 400 fry were artificially reproduced from eggs of two female fish. These fry were all released into Wuling Stream and Chichiwan Stream.

c. Pollution control
Pesticide and fertilizer control is one of the most urgent issues. Several related research institutions have been invited to do long term soil monitoring at Wuling Farm. At the same time, workshops to teach farmers how to use pesticides and fertilizers in environmentally safe ways are held periodically.

A sewage treatment system and incinerator are being constructed for treating wastewater and rubbish, respectively, from Wuling Area. These two systems will help ensure that the environmental impact of agriculture, tourism and other human related activities are minimized.

**Artificial Propagation of Formosan Salmon**

Efforts to improve the techniques for artificially propagating Formosan salmon were initiated in Shei-pa National Park in September 1994. The first aim was to establish a cultivation technique for fry.

In October 1995, another effort at artificial propagation was undertaken. The aim of this study was to establish the egg hatching equipment and to verify the cultivation technique for larvae.

In 1996, the typhoon 'Herb' destroyed several habitats of Formosan salmon, mainly on the upstream of Chichawan Stream, causing the fish populations to decrease from 1800 to 1100. On account of that, Shei-pa National Park restarted artificial propagation in October, 1996. The hatching rate was 90%; 815 fry surviving from larvae with a survival rate of 70%. The fry with a length of 3.5 cm were released into Wulin Stream, Chichawan Stream, and Shichaihan Stream.

**RE-INTRODUCTION BRIEFS**

The goals of the condor recovery programme include the establishment of at least three separate California condor Gymnogyps californianus, populations that would include at least 150 individuals and at least 15 breeding pairs, prior to considering the downlisting of the condor from 'endangered' to 'threatened' status. One of these populations is the captive population; another is the population which is being established in the species' recent historic range in central California. The third population is to be in northern Arizona, in the hopes that the birds will repopulate the Grand Canyon, where they had been so numerous. Six young Californian condors were released in northern Arizona in December 1996, the first of the species to be seen in the state for more than 70 years, and are the first of many (possibly more than 100) to be released in this area. Releases will continue on an annual basis until a viable population is established. The released birds are equipped with radio transmitters, allowing the field team to track their movements. This will provide information on favoured habitat and causes of condor deaths.

The US Fish and Wildlife Service carried out an extensive environmental impact analysis on the proposed Mexican gray wolf, Canis lupus baileyi, in the southwestern USA. The wolf is believed to be extinct in the wild, but there are 140 wolves in captivity. There are now plans to release two or three breeding pairs at two sites in New Mexico, with the aim of establishing a wild population of 100 wolves. However, proposals to re-establish the species have been opposed by local ranchers, politicians and Apache Native Americans despite the fact that the re-introduced population would be considered a non-essential experimental population.

The Department of Construction, Taiwan, plans to carry out a firefly re-introduction programme in six national parks. This will be in addition to habitat restoration. Artificial light has greatly affected the mating behaviour of the firefly, and this will be a major consideration during the re-introduction. The first re-introduction will take place in Yushan National Park, and the whole programme is planned over a three year period.

**Re-introduction of Formosan Salmon**

In January 1995, 268 fry were re-introduced into Wulin Stream. In December 1995 and January 1996, a further 300 fry were released into Wulin and Chichawan Streams.

*Contributed by Hsiang-Chien Wu, Shei-pa National Park, Taichung Hsien, Taiwan.*
In April 1996, 19 woodland caribou, *Rangifer tarandus caribou*, were translocated from British Columbia, Canada, to the Selkirk Mountains of northeast Washington as part of a recovery effort for this endangered species. It is aimed at improving the number and distribution of woodland caribou within the Selkirk Ecosystem Recovery Area, which encompasses northeast Washington, northwest Idaho, and southeast Columbia. Since their release in April, the caribou have travelled throughout the recovery area, some joining the caribou that were still extant in the area. There has been at least one birth, and two deaths, probably as a result of predation. This translocation is the first phase of a three year project. An estimated 20-24 caribou will be introduced in each of the next two years.

Fourteen whooping crane, *Grus americana*, eggs were collected in Canada’s Wood Buffalo National Park in May 1996. This year, the collection was limited to whooper pairs not represented or poorly represented in captive breeding flocks. This is the last egg collection for several years because captive propagation centers are at capacity and are able to produce the number of young cranes needed for the continuing whooper re-introduction project in Florida.

Three to five month old Malleefowl, *Leipoa ocellata*, failed to survive beyond 104 days when experimentally released into the Yathong Nature Reserve, NSW, Australia. The principal cause of mortality was predation by the introduced red fox. It accounted for at least 50% and possibly as much as 92%. Malleefowl released into the reserve fared better; three of them survived beyond 15 months. Foxes, habitat clearance and fragmentation, habitat degeneration and changes to fire regimes are considered the major causes of the overall decline of this species.

**Update and summary of the red wolf re-introduction:**

- **Summary of the red wolf (Canis rufus) re-introduction project (September 1987 - 30 April 1997) in northeastern Carolina, USA (from US Department of the Interior, Fish and Wildlife Service):**

  - current population: there are 51 to 80 wolves in the free-ranging population (includes wolves which the project has lost contact with and wild-born wolves not yet captured).
  - reproduction: there has been a minimum of 121 pups born in the wild since September 1987. Currently, 88% of the wolves free-ranging in northeastern North Carolina were born in the wild.
  - releases: 71 captive-born wolves have been released since September 1987.

- captures: there have been 343 captures of 154 wolves since September 1987.
- monitoring: there have been 1,115 radio telemetry flights resulting in over 12,000 wolf locations.
- sightings: there have been 484 reported wolf sightings since September 1987.
- complaints: there have been 52 complaints filed since September 1987, but only 26 of these actually involved wolves. Of this number, 20 complaints were simply that wolves were present where they were not wanted; the other 6 complaints were reported problems. Only one of these could be verified as an actual depredation.

**RSG Survey: Initial Results**

Initial results of RSG’s survey on endangered African faunal species represented in captivity in ISIS institutions in the US and worldwide, as a comparison to endangered African faunal species potentially in need of captive breeding and re-introduction.

**Insectivores:** no insectivores are represented in captivity. These tend to be rare species that occur in specialized habitats.

**Chiroptera:** 40% are represented in captivity. The groups indicated in this category are the fruit bats, flying foxes and a sheath-tailed bat.

**Primates:** 35% are represented in captivity. Groups include the potto, galagos, and monkeys.

**Large herbivores:** 70% are represented in captivity. Groups include: dungs, manatee, elephant, equids, rhino, hippo, antelopes, gazelles and duikers.

**Rodents:** 0% are represented in captivity. Groups include: squirrels and elephant shrew.

**Birds:** 17% are represented in captivity. Groups include: aquatic birds, eagles, pigeons, pipits, flycatchers, sunbirds, weavers amongst others.

**Reptiles:** 82% are represented in captivity. Many of the species are very rare, and there is significant number of recovery plans, often involving captive breeding. The species in captivity are mainly from Madagascar, Mauritius and South Africa. Groups include: boas, lizards, tortoises and geckos.

**Amphibians:** 0% are represented in captivity. The list of endangered species represents mostly South African species; generally very little is known about amphibians continent-wide.

*Anyone interested in reviewing this report please contact RSG.*
NEW LITERATURE


RSG apologises to the Black Hill Flora Centre in South Australia for a mistake in its article printed in RE-INTRODUCTION NEWS 13:

Their article entitled ‘Herbivore grazing: an important consideration in plant translocations’ was submitted by Dr. Manfred Jusaitis and Birgitte Sorensen.

Veterinary technician and primate behavioural specialist keen to work as volunteers on a re-introduction programme. Please contact RSG, or Deborah Goin and Laszlo Paule directly on: cbsga@aol.com/fax: 1-770-908-2252.

French trainee veterinarian keen to volunteer on a re-introduction project July-September 1997. Contact RSG, or contact Eliza Gajewski directly: Foyer Louis Coudeyre, Ch. 26, 43100 Fontannes, France.

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