No. 25 April 2006

RE-INTRODUCTION NEWS

Newsletter of the Re-introduction
Specialist Group of IUCN's
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RSG Organizational Structure:

RSG MISSION:

To combat the ongoing and massive loss of biodiversity by using re-introduction as a responsible tool for the management and restoration of biodiversity through actively developing and promoting sound inter-disciplinary scientific information, policy, and practice to establish viable wild populations in their natural habitats.

Cover Photos:
Clockwise from top-right:
- Darting an otter, Spain @ Deli Saavedra
- Tracking bear in South Korea @ Sang-Hoon Han
- Gharial in India @ R. J. Rao
- Releasing muskoxen in Russia @ T. P. Sipko
- Samurac fish breeding facility in Spain @ Juan Antonio Gomez
- Released moose in Russia @ T. P. Sipko

Center of page:
- Gray wolf in Yellowstone National Park, USA @ Doug Smith/NPS

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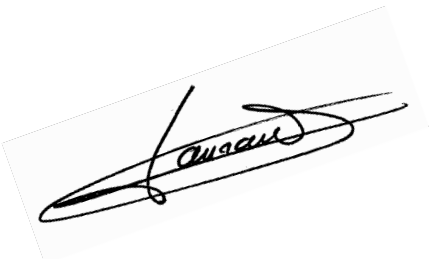
Letter from the Chairman — Dr. Frédéric J. Launay

After an extensive period, the Re-introduction Specialist Group has finally reconstituted its membership! It was a long process but hopefully the new structure and membership will make RSG even more active and relevant. The RSG has a somewhat complex organization. The structure has been discussed several times amongst its member and it was finally agreed in 2001 than the best structure would be a mixture of taxa and geographical organizational layers. A Secretariat composed of the Chair and a part-time Program Officer is running and coordinating the activities of the group. The secretariat is hosted and totally funded (salaries and operational costs) since 2000 by the Environment Agency in Abu Dhabi, United Arab Emirates. The actual structure of the group is the following and several nominations will take place soon to fill the vacancies:
Chair: Frédéric Launay, Vice-chair: vacant, Reptiles and Amphibian Section Chair: Pritpal Soorae, Bird Section Chair: Phil Seddon, Fish Section Chair: Heather Koldowey, Ungulate Section Chair: vacant, Plants Section Chair: vacant, Invertebrates Section Chair: vacant, North America Regional Chair: Devra Kleiman, Oceania Regional Chair: Doug Armstrong, South Asia Regional Chair: Sanjay Molur & Sally Walker, East Asia Regional Chair: vacant, Europe & North Asia Regional Chair: Mike Jordan, Meso & South America Regional Chair: vacant & Africa Regional Chair: vacant.

We are actively looking to fill the vacancies and members are cordially invited to suggest candidates to fill these. However valid and efficient this structure is, it is still too "reactive" in my mind and does not allows the group to take more initiatives. An attempt will therefore be made from 2006, to create and activate various thematic task forces around issues such as: *Science & Re-introduction*: developing the science behind the reintroduction processes, including developing analytical tools. *Guidelines and policies*: developing and formulating guidelines and policies around re-introduction issues. *Training and capacity building*: developing training and capacity building modules and training tools for re-introduction practitioners and/or stakeholders. *Database*: developing re-introduction projects and practitioners databases that include analytical modules. In addition two "governance" task forces should be created in order to better market the RSG. These are: *Communication & Awareness*: developing a communication strategy for RSG activities as well as for the issues surrounding re-introduction processes. *Fund-raising and Marketing*: developing and implementing a fund raising and marketing strategy for RSG and its activities.

The membership of the group has usually been around 300 members since its creation in 1988. This large membership, whilst useful in some instances, was also a burden and was adding unnecessary costs on the group activities and operation. In 2004, it was therefore decided to review the group membership and attempt to balance the need to have active members with the need to increase the awareness on re-introduction amongst a large number of people. The membership, after this exercise, stands now at 134 members, representing all the continents. Still North America and Western Europe provide the majority of our members. This is an issue the secretariat will look into seriously. More members from other regions will be actively recruited. A number of exciting tasks are ahead of us, and I am very confident that with this new membership and structure, RSG will rise to the challenge.



Update on Galliforme re-introduction guidelines

The intention of these guidelines is to provide a practical reference for those who are considering galliforme re-introductions for conservation reasons (game management will not be included). It will unavoidably restate the IUCN Guidelines for Re-introduction, but will place them in the context of galliformes, providing general examples, links and contacts whilst acknowledging their particular life history traits that need considered and may have an influence on success (basic groupings of pheasants; megapodes; grouse; partridges, quails, francolins, snowcocks, guineafowl and turkeys; and cracids). Because we want it to get up and running as soon as possible, it will be based on the web in the first instance, thereby providing easy links to IUCN and the specific conservation action plans, and also providing a basic base to build upon once feedback is received. Ideally there will be a full literature review and bibliography available, as well as information on the various projects underway worldwide.

Currently efforts are being made to concentrate efforts on collating all information relating to galliforme re-introductions, with particular reference to methodology, although any information on any project is helpful. The main difficulty is that most information is not widely published, and it would therefore be hugely useful and much appreciated if any of the RSG members/newsletter readers could forward any literature that might be of value (small paragraphs or large reports) to Anna Fraser at <*annampfraser@hotmail.com*>. We will have at least a basic first draft available for comments soon.

Contributed by Anna Fraser, Coordinator WPA Galliforme Re-introduction Guidelines Initiative.
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Letter

Controversy over saving the last Asiatic lions

The article (*Reintroduction News, April 2005*) by R. J. Rao and Faiyaz A. Khudsar describes the project on Asiatic lion translocation in India, but does not touch on the controversies which are blocking implementation of the ultimate aim i.e. establishment of a secure second population in Palpur Kuno reserve in Madhya Pradesh (MP), as a precaution against a calamity wiping out the subspecies. The last wild Asiatic lions are confined to the Gir reserve in Gujarat State in western India. According to a 2005 census report there are now 359 lions. This represents a conservation success, since a century ago estimates were as low as 20 because of over-hunting. The ruler of the princely Junagadh State, where the survivors were living, banned hunting, with support from the British government in India, and, despite ups and downs, the population has grown. Unfortunately, the Gujarat State government has repeatedly declared that it will not allow any lions to be taken out of the State, where they are considered a State treasure. On 5th September 2004, the Press Trust of India (PTI) reported that

Asiatic lion (*Panthera leo persica*) stalking
© Peter Jackson

translocation of some lions to Palpur Kuno reserve would take place by the end of the year. But a few days earlier, The Times of India had reported that the government of Gujarat had turned down a central government request for two or three prides of lions. Gujarat's Forest Minister, Mangubhai Patel, said: "There is no need to shift lions from Gir. We will ensure their survival here." There has been no indication since then of any chance in the policy. The Chief Conservator of Forests (Wildlife) of MP, R.L. Saxena, said that the Gujarat government had been asked for a pride consisting of 8-15 lions (2-5 males, 4-5 females, plus cubs). This would be the first of two prides planned for translocation under the project and it was expected to arrive by the end of 2004, or by early 2005, he added.

The proposal for a second home was made by the Indian government in the early 1990s on the recommendation of the Wildlife Institute of India. The Gir reserve is considered to be over-crowded with over 300 lions; 50 have already migrated from the reserve in recent years and settled in surrounding areas. Furthermore, the Gir lions have been found to be closely genetically related as a result of inbreeding arising from their decline and a later population crash in the late 19th Century. That raises the risk that an epidemic could wipe out the last wild Asiatic lions, which once ranged from Greece to India. Such an epidemic (of Canine Distemper Virus CDV) killed about one-third of the 3,000 African lions in the Serengeti in the early 1990s. The 345 km^2 Palpur-Kuno reserve, near Shivpuri in northern Madhya Pradesh, was chosen as a suitable habitat for a second Asiatic lion population after a survey of what remains of its historical range. The PTI report quoted MP's Chief Conservator as saying that the initial stages of the project had been completed within the stipulated time; over 1,565 families from 34 villages in Palpur-Kuno had been re-located at a cost of about Rupees 20 million (nearly US$ 2 million) in order to accommodate the lions. In Gujarat, the government has proposed establishing new reserves for Gir lions within Saurashtra, the region where the Gir reserve exists, but scientists say that lions in such reserves would not be isolated from the Gir population, and complete separation is essential to protect the lions from any disease outbreak spreading from one area to the other. Palpur-Kuno lies nearly 1,000 km east of the Gir, and the area between has many obstacles to migration, such as cities and towns, industries and desert.

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INVERTEBRATES

Translocation and genetics of the giant Gippsland earthworm in Victoria, Australia

The giant Gippsland earthworm (*Megascolides australis*) is one of the largest terrestrial invertebrate species known in the world, with an average length of 1 m and a diameter of 2 cm, specimens up to 3.6 m long have been documented (Taylor *et al.*, 1998 & Yen *et al.*, 1990). The species is endemic to a small region known as south and west Gippsland in the southern state of Victoria, Australia. Within this area, suitable habitat is extremely patchy as a consequence of clearance of most of the native vegetation and conversion of the land to pasture since the late 1800s (Taylor *et al.*, 1998 & Yen *et al.*, 1990). The earthworm is considered very rare in both abundance and distribution, with the average density of adults within populations being estimated at only 2 per m^3 and populations thought to be declining (Taylor *et al.*, 1998). The species is therefore listed as Vulnerable by the IUCN and under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. It is also listed as Threatened under Victorian legislation, the Flora and Fauna Guarantee Act 1988. Processes such as cultivation of the soil, earthworks, application of pesticides, urbanisation and alteration of drainage patterns pose significant threats to the survival of the giant Gippsland earthworm and extinction of populations is likely to result if such processes persist (Taylor *et al.*, 1998).

Extensive road works throughout the Gippsland region, involving the realignment of a major highway, were recently proposed and it was noted that any populations of giant Gippsland earthworm throughout this area would be destroyed if such disturbance were to proceed (Van Praagh *et al.*, 2002 cited in Yen 2005). Preliminary surveys revealed a significantly large population at Loch Hill, near the township of Loch, one of the areas where the proposed road works were to occur. It was decided that translocation of as many individuals from the existing population as possible was the most appropriate measure to mitigate the detrimental impacts of the construction (Yen, 2005). Various methods of extracting the earthworms from the soil, holding conditions and receptor site preparation were tested during the pre-translocation phase of the project. The giant Gippsland earthworm is a very fragile organism and spends its entire life underground at depths of around 2 m, making collection efforts especially difficult (Taylor *et al.*, 1998 & Yen, 2005). The most successful method of collecting individuals involved softening the soil with water, then exposing areas of the hillside with an excavator and shovels and carefully removing the earthworms by hand. Individuals were stored under cool temperatures in plastic trays containing moist soil and a hessian covering until relocating them to the nearby recipient site at the end of each day. Receptor sites were chosen on the basis of proximity to the original Loch Hill population, geomorphology, absence of other giant Gippsland earthworm, and accessibility of sites (Yen, 2005). Successful trial translocations were conducted by moving earthworms to nearby pits dug approximately 1 m x 30 cm

Giant Gippsland earthworm (*Megascolides australis*)
© Dr. Dave Runciman, La Trobe University

x 20 cm deep, moistening the soil with water, placing one individual in each pit, gently filling the pit with loose soil and monitoring the animals' health for several months thereafter (Yen, 2005).

Translocation of the Loch Hill population began in October 2005 and continued over an eight-week period with the help of many keen conservationists. Utilising the methods previously outlined, it was decided that a total of 800-1,000 giant Gippsland earthworms should be translocated. Post-translocation monitoring will be conducted over the next five years, starting in January 2006, using a ground-penetrating radar and small-scale excavation to determine the level of activity at the recipient sites (Yen, 2005). Over 600 earthworms were safely relocated by the end of the project but due to the earthworms' fragility and limited accessibility, mortality was unfortunately a common occurrence throughout the collecting period. This however presented a unique opportunity to gather genetic data on this species, of which nothing was previously known and will provide important information for the future ongoing management of giant Gippsland earthworm.

Preliminary genetic data were collected from fifty individuals during the pre-translocation phase and genetic diversity assessed by analysing two regions of the mitochondrial genome. The Loch Hill population was found to be moderately diverse and it was concluded that this population has probably been large and stable

Release site of the Giant Gippsland earthworm
© Dr. Dave Runciman, La Trobe University

for hundreds of millennia and it would therefore be ideal to translocate as many individuals as possible to maintain most of the genetic diversity (Runciman *et al.*, 2005). Relationships with other members of the Megascolecidae family, to which the giant Gippsland earthworm belongs, were also assessed using these molecular data.

Phase two of the project (translocation and associated research) involves the collection of more individuals, further analyses of mitochondrial DNA and the development and screening of nuclear markers (Runciman *et al.*, 2005 & Yen 2005). I am currently undertaking this research, as part of an honours project, and have thus far discovered fixed differences in the DNA sequence of a mitochondrial gene between individuals from Loch Hill and individuals collected from a population several kilometres away at Bena. Therefore, it appears that by translocating individuals from the Loch Hill population a distinct portion of the species' genetic diversity has been retained. Further analyses of other populations are however needed to confirm this result. Given the moderate variation found in the mitochondrial genome, nuclear diversity is expected to be high and nuclear markers are currently being screened to assess this. If these markers are found to be adequately variable they may also allow the identification of individuals (from blood samples), enhancing post-translocation monitoring (Runciman *et al.*, 2005 & Yen, 2005). Due to the earthworms' poor dispersal ability and specific habitat requirements we expect populations to show significant divergence due to low levels of gene flow, meaning populations may need to be considered as separate management units. Genetic analyses will also provide insight into the population structure and biological traits, such as reproductive mode, of the giant Gippsland earthworm. This information will offer an invaluable understanding of a rarely studied animal, aiding in the future management and conservation of not only the translocated population but the species as a whole.

Acknowledgements
Special thanks to Dr Alan Yen, translocation project manager and invertebrate biologist, and Dr Beverley Van Praagh, giant Gippsland earthworm expert (and invertebrate ecologist), for their exceptional organisation of the translocation and the many hours of their time devoted to making this project a success. Congratulations to everyone who was part of the translocation team, whose dedication throughout many hours of tedious earthworm extraction made possible the survival of this population of threatened species. Lastly, a huge thanks to my supervisors Dr. Dave Runciman and Dr. Neil Murray of La Trobe University who have provided me with much needed guidance and encouragement throughout my project.

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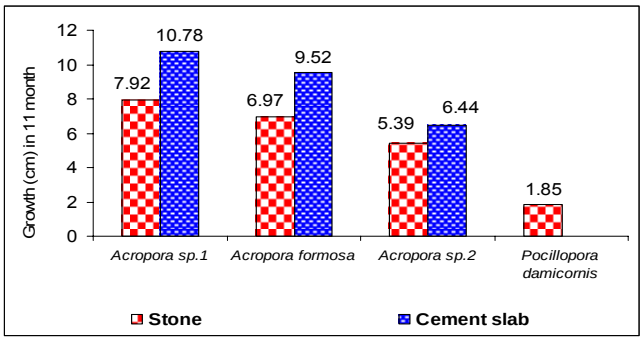
Coral transplantation in Lakshwadeep Atoll, Indian Ocean

Decline in coral reef spread and loss of species from localized sites are well-documented phenomena during the last two decades from almost all reefs in the world. Until 1998, the causes for this were man-made activities such as mining, souvenir collection, pollution, dredging, etc.. The massive bleaching in 1998 and the subsequent high mortality, with a recurrence albeit at low intensities, has only added to this decline. Our observations in the atoll reefs of Lakshadweep since the 1980s reflect this. Massive souvenir trade decimated all *Acropora* and *Pocillopra* species from the lagoons and mining (and later, bleaching) reduced the overall live coral cover to as low as 20% in some reefs. Assisted recovery is possible in several ways: breeding of corals in laboratory and rearing of planulae to stages where they can be settled in the reef, electrochemical enhancement of calcium precipitation in corals, provision of additional substrates for settling of planulae and transplantation of corals are some of the methods practiced worldwide. Among them, transplantation of branches or pieces of corals from actively growing sites to denuded areas has been the most successful thanks to the simplicity of the method and its cost-effectiveness.

We experimented with this in the Kavaratti lagoon in Lakshadweep. Candidate genera were *Acropora* and *Pocillopora*. We used 2 x 2 m iron frames with 30 cm high

Coral reef transplantation on frame

Fig. 1. Growth on stone vs. cement slab



supports and covered with a metal screen. The frames were deployed first at 3 m depth in the lagoon where coral life was totally absent. Slabs of concrete and coral stones (12 x 12 cm) were used as bases for transplantation. The coral pieces were tied to the bases with thin nylon string and the slabs in turn were secured to the metal screen. Securing the corals to the slabs and the slabs to the frame was done underwater by SCUBA divers in order to minimize stress to the corals.

The experimental transplantation was done in November 2004 and the corals were monitored since then at monthly intervals. During each visit, the length of the transplant was measured. In addition, notes were made of the increase in other life forms, like fishes and benthos (holothurians, crabs, snails). In each visit, the frames were cleared of the debris and algal matter. Besides the formation of several branches, the growth, in terms of linear increment, was of the order of 5-10 cm in *Acropora* and 2 cm in *Pocillopora*, with no significant differences between those secured on concrete and coral stone slabs (Fig. 1). There was also no mortality of corals at all during the one year which includes a 4-month monsoon period known for rough sea conditions and low light transparency, which might partly be due to the care exercised in handling the fragments. What is of further interest is the increase in other biodiversity in the site – several species of fishes besides holothurians, cowries and snails were seen at the transplantation site.

We are planning to extend the transplantation to large areas in the Kavaratti lagoon as well as to other atolls in Lakshadweep. Besides increasing live coral cover, this could also serve tourists who neither swim nor dive and yet would like to see coral environs at shallow waters. As this technique does not demand high skills, we intend to develop this into a community venture, generating modest income for local islanders as well as instilling in them a sense of commitment to coral reef conservation.

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Update on the West Indian top shell re-introduction in Bermuda

This article reviews the long-term prognosis of the West Indian top shell (*Cittarium pica*) re-introduction undertaken in Bermuda in the early 1980's. This re-introduction from East cay in the Turks islands in 1982 was undertaken to replace a native population that was evidently exterminated by over-harvesting as a food resource sometime after human settlement and before the 19th Century (Bickley and Rand, 1982 & Wingate, 1989 & 1990). The rationale for that re-introduction was that advances in the standard of living, precluding the need for subsistence harvesting, combined with improved conservation legislation, should give the species a better chance of surviving a second time around.

This project was reviewed in a previous RSG newsletter, Wingate (1994). A survey conducted by myself in 1989 revealed that the population had firmly established and was extending its range rapidly on Bermuda, but it also included mention that illegal harvesting had begun and was already impacting on the population in some areas. In response to this the Bermuda government added the Top shell to a list of Protected Species in November 1989 under the provisions of the Fisheries (protected species) Order 1978 of the Bermuda Fisheries Act 1972. A comprehensive survey, carried out by Madeiros (2000) revealed that the top shell had finally spread to all parts of Bermuda's coastline where suitable habitat was available and was patchily common in some areas. There were even reports of small sub-colonies in the sub-optimal habitat of sheltered harbors. But it also revealed a marked reduction of harvestable age (medium to large) shells in areas where they had previously become abundant, most notably on coastal parklands where people have unrestricted access to the foreshore. The cause of this was confirmed to be illegal harvesting, most of it incidental for use as bait for fishing, but in some cases for use as food and in at least one instance for commercial exploitation as a specialty food item in a local restaurant. Annual surveys have been continued by the new Conservation Services Department since then, but the situation has not changed significantly. Illegal harvesting continues despite passage of the protective legislation and despite the erection of signs in certain key areas illustrating the shell and advising the public that it is a protected species with a maximum fine of US$ 5,000 possible for illegal collecting.

The delayed onset of this illegal harvesting suggests that Bermudians, at least, were initially unaware that the top shell was a commercially harvestable species. However, with the globalization of Bermuda's now predominantly off-shore tax exempt business, banking and re-insurance

Adult West Indian top-shells clustered in the intertidal zone of Bermuda with chitons
© David Wingate

economy there is a growing population of immigrant labour to fill menial jobs in the service industries. Some of these limited term contract workers are from countries where subsistence harvesting is still the norm, but it becomes a recreational pastime for them on Bermuda. Language barriers and lack of familiarity with local customs and legislation is an additional problem. In a few easily accessible locations the top shell has been virtually eliminated again, (supporting my hypothesis that the original population could have been exterminated by human over-harvesting), but fortunately there are enough private landowners who protect their fore-shore rigorously and some areas of the coast are too inaccessible to be attractive for recreational harvesting anyway. It is in these areas that the top shell remains relatively common. Thus, even though the human harvesting at present remains illegal, rather than managed under a license and quota system, the restored top shell population would appear to meet the criteria for a sustainably harvestable resource, which was one of the objectives of the restoration.

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American burying beetle – PHVA workshop

The Conservation Breeding Specialist Group (CBSG) conducted a Population and Habitat Viability Assessment (PHVA) workshop for the American burying beetle (*Nicrophorus americanus* Olivier) in St. Louis, Missouri, USA on 14th-17th November 2005. The federally endangered American burying beetle (ABB) is the largest member of the family *Silphidae* in North America. Easily recognized by their shiny black bodies and red to orange markings on both their elytra and pronotum, this species offers its young extended parental care, an unusual behavioral trait in beetles. After ABBs find an appropriate-sized carcass, intense inter- and intra-species competition occurs (Kozol, 1990). Together, a victorious pair cooperatively prepares the carcass for burial by removing fur or feathers and coating it with oral and anal secretions that retard bacterial and fungal growth. The female beetle

American burying beetle (*Nicrophorus americanus* Olivier)
© Michael Amaral

lays eggs in a brood chamber near the preserved carcass. After the eggs hatch, the parents move the first instar (stage) larvae to the carcass, where the larvae solicit feeding by stroking the mandibles of the parents. Both parents remain with the carcass and larvae, feeding their offspring with regurgitated meat until the larvae are capable of feeding themselves. Eventually, large third instar larvae burrow a short distance from the now-diminished carcass and form a pupation cell. Teneral (new adults) then emerge from pupation within 30-45 days (Prospero, 1999).

The ABB was once abundant in most eastern and central states as well as the southern borders of eastern Canadian provinces. It was found in Jasper County, Missouri as recently as 1980 (USFWS, 1991). At the time it was placed on the U.S. federal endangered species list in 1989, the only known populations occurred on Block Island in Rhode Island and in Latimer County, Oklahoma. However, since then, field surveys have discovered populations in five other states: Arkansas, Kansas, Nebraska, Oklahoma and South Dakota. (Backlund and Marone, 1997 & Bedick *et al.*, 1999). In 2005, the ABB was also apparently discovered in northeastern Texas, but further verification of this record is pending.

The decline of the ABB has been underway for nearly a century. The once widespread population was fragmented and greatly diminished by the 1920's (Ratcliffe, 1996). The prevailing theory for this decline points to habitat loss and fragmentation leading to a corresponding decrease in suitable carrion. As more and more land was converted for agricultural use, the changed habitat favored scavenging mammal and bird species that compete with carrion beetles for resources. For example, passenger pigeons and prairie chickens, ideal carrion size for the beetle, disappeared. Turkey and waterfowl populations declined (Simpson, 1991). Small rodents adapted well to the new habitats and some species flourished. However, most small mammals are too small for the ABB, which requires an 80–200 g carcass to maximize its reproductive potential. The cutting of forests and tilling and pasturing of the prairies led to more edge habitat, ideal for predators and scavengers that directly compete with the beetles for carrion.

Since listing, the ABB has been successfully reared at several universities and zoos. Captive reared and direct-translocated ABBs have been released at three sites in attempts to re-establish populations in the wild. Releases of only 211 ABBs on Penikese Island, Massachusetts, from 1990-1993, resulted in a small population that persisted until 2002, about 9 generations. However, no ABBs were documented on the island from 2003-2005. A much more ambitious re-introduction effort on Nantucket Island involved the release of nearly 3,000 ABBs during a 12-year period, 1994-2005 (McKenna-Foster *et al.*, 2005). The success of this effort is still being evaluated. Lastly, about 830 ABBs have been released on public land in southeastern Ohio during the years 1998-2000 and 2003-2005. This is the first mainland attempt to restore the species to its former range and thus far, post-release monitoring surveys have caught relatively few ABBs.

The ABB Conservation Center of Saint Louis Zoo's Wild Care Institute, comprised of 12 Conservation Centers around the world where threatened animals and their ecosystems are receiving a focused approach to help in their survival, invited the CBSG to conduct a PHVA for the American Burying Beetle.

The PHVA Workshop involved stakeholders from eight states and the United Kingdom, including representatives from federal and state wildlife agencies, zoological institutions and the timber industry. The goals of the Workshop were to:

- encourage communication and collaboration with government and non-government conservation programs;
- develop a risk analysis and simulation population model for the ABB beetle;
- formulate practical, scientific management of the ABB throughout its range; and
- suggest research priorities linked to conservation and recovery of the ABB.

The PHVA Workshop began with participant introductions and a series of presentations to ensure that everyone was starting from the same place and familiar with the process and available scientific information. Next, issues and needs related to the long term survival of the ABB were identified and organized into topics for further working group discussions. After significant problem analysis and data compilation and review, the groups prepared an 'issue statement' for each issue, prioritized these statements and brainstormed potential solutions to address high priority concerns. In addition, the groups were asked to identify those solutions with the potential to impact any of the population model input parameters. The participants worked in plenary to discuss values for life history parameters and to estimate population size and carrying capacity for the various wild ABB populations. The resulting Vortex model was used to identify key factors affecting ABB populations, such as overwinter mortality, that were then used by the working groups to identify effective management actions. Specific models were developed for each geographic population that assessed the current status as well as potential future habitat losses, and a re-introduction model examined the impact of the number of beetles released, the number of years of release, and the effect of provisioning released pairs. This information was used to develop alternative management scenarios and later to modify the recommendations. The penultimate step in the workshop process involved the development and prioritization of recommendations for implementation of preferred solutions. Recommendation presentations were shared with the entire group and detailed, concrete action steps for implementation of their priority recommendations were developed.

Finally, the recommendations were prioritized by the entire workshop. This was a powerful exercise in which workshop participants clearly articulated their highest priority actions, the need for life history research, surveys, and improved communication among stakeholders. The top priority recommendations are detailed in the PHVA report available from the CBSG Office. Each recommendation includes a timeline for completion and lists the parties responsible for their implementation.

Contributed by Onnie Byers, CBSG Executive Director, USA (e-mail: *onnie@cbsg.org*) & Michael Amaral, Sr. Endangered Species Specialist New England Field Office U.S. Fish and Wildlife Service, USA.

FISH

Re-introduction of the Samaruc fish in Valencia, Spain

Samaruc (*Valencia hispanica*) is a Ciprinodontiformes fish endemic to the Valencia region of eastern Spain. Their populations which are restricted to a few wetlands have experienced a strong decline during the last few decades. It is also considered as one of the most threatened species of European fauna and is included in all the international lists of endangered species (IUCN, Habitat Directive, etc.). The Spanish National Act of Threatened Species includes samaruc within the most restrictive category of protection: "Threatened with extinction". The environmental agency of the regional government of Valencia (i.e. Generalitat Valenciana) has been working in the restoration of this threatened species for more than one decade. During these years its tasks have been supported by the European Union through a LIFE project entitled "Creation of a network of reserve areas for samaruc in the region of Valencia". Most conservation efforts have focused at minimizing the factors traditionally considered as the cause of the decline of the natural populations of samaruc: the destruction of its habitat and the introduction of exotic species.

Habitat Destruction

Samaruc used to be present in all coastal wetlands in the provinces of Castellón and Valencia up until the mid-20th Century and by the 1990's its distribution had been reduced to only six small sites. As a first step towards slowing down the loss of the small number of local populations, all wetlands where the species was present were protected and, in some instances, restoration tasks were performed to enlarge the carrying capacity of some sites, to ensure their correct future functioning. In addition, with the aim of increasing the number of sites where the species was present, some formerly desiccated wetlands were restored partially and transformed in semi-natural reserves for the species, all of them within the distribution range of the species. That way a network of reserves for

Samaruc (*Valencia hispanica*)
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the species was created within the region, which is currently still being enlarged as proper sites become available. All these wetland conservation-management measures have made possible that nowadays all natural populations of the species are located within protected sites and also that its reduced distribution range increases as the number of preserves increases too.

Introduction of Exotic Species

Another important factor of historical decline of autochthonous populations of samaruc is the introduction of exotic species, either intentionally or unintentionally, over the last 100 years and have had a negative influence on the conservation of samaruc. These species are the black-bass (*Micropterus salmoides*), sun perch (*Lepomis gibbosus*), carp (*Cyprinus carpio*) and goldfish (*Carassius auratus*) among others. More specifically, the introduction of *Gambusia holbrooki* to fight malaria during the 20th Century has been one of the main factors of threat to the species, and still remains so. To try and determine the ecological relationships between samaruc and *Gambusia*, several studies were carried out (Lobón-Cerviá, 1998) where behavioural interactions as well as the foraging ecology of both species were studied. Results of the study confirmed the predatory capabilities of Gambusia on eggs and neonates of samaruc, suggesting that the negative interaction between both species took place through predation. This predatory capacity and the ovoviviparous nature of the species, together with the fact that the alien species has successfully adapted to all wetlands within the region, suggests that preventing the interspecific competition was one of the most important challenges for the conservation of *Valencia hispanica*. It was also found impossible to eradicate Gambusia from the wetlands therefore some other alternative strategies have been implemented to improve the growth of samaruc populations.

Captive Breeding and Re-introduction

Based on the criteria for the conservation of the genetic content of each one of the minimum conservation units previously established by Fernández-Pedrosa (1997), captive breeding programs have been carried out for each one of the remaining populations of samaruc in the region. In order to achieve this goal, the breeding facilities of the Centre for Fish Research located in the village of El Palmar (Valencia) were duly adapted by the regional environmental agency (i.e. Conselleria de Territorio y Vivienda). So far more than 230,000 individuals have been breed in the centre. All these individuals have been used to reinforce small populations and to create new populations in the reserve areas, always keeping in mind genetic criteria of the conservation units, that is, in each preserve individuals from the closest natural local population have been re-introduced. Regarding the results of the captive breeding and re-introduction program, we have confirmed the stabilization of most natural populations. Some of the new reserves created, now show viable populations, capable of long-term persistence without further re-introductions. In some sites however, further work is needed to remove the negative effect of *Gambusia* and other alien species and hence further population re-inforcement is still needed.

Awareness Campaigns

Since the beginning of the project it was clear for us that the success of the project was dependent on public support especially from those sectors directly involved or affected by management actions (Risueño, 2000). Therefore the project has been constatntly highlighted in the media educating the public of this project within their region. Specific awareness campaigns addressed to students have received special support. The creation of a network of reserves for this endangered fish species was broadcasted through the edition of specific educational material. Emphasis was placed on the participation of schools from those villages most directly affected by the conservation of the species or those closely located to restoration areas. We have achieved, through all these awareness campaigns, that a little-known fish species has become a conservation icon in the region. Moreover, people have made the link between samaruc and wetlands so that any disturbance caused to wetlands is rapidly associated to disturbances on the fish.

Conclusion

The assessment of the success of the project has to be based on the present situation of the species as compared to the situation more than a decade ago. As already stated, one of the main achievements of the project has been the creation of a centre for fish research, solely dedicated to conservation matters related to autochthonous aquatic flora and fauna, most of them endangered species. This centre has developed very successful captive breeding procedures for samaruc and hence the species has overcome its past risk of extinction.

Samaruc release site

On the other hand, based on the previous creation of a network of reserves for the species, the restoration of a number of freshwater springs and small wetlands has been implemented. These sites, thanks to the high quality of the water, have become a sanctuary for aquatic birds and endemic flora species. In all cases, these restoration activities have contributed to the increase in the number of sites where the species is present, widening its distribution range.

However, the project has not achieved all its goals mainly because of the difficulty of removing exotic fauna. Despite some natural local populations have increased their numbers owing to our re-inforcement campaigns, most local populations have remained stable during the last years, with low population densities and a constant state of competition with alien fish species. Survival of the species in these sites is therefore not guaranteed and dependence on captive breeding is still strong.

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AMPHIBIANS

Relocation of California red-legged frogs, California, USA

Graniterock has operated the Wilder Sand Quarry since 1998 under the terms and conditions of their Habitat Conservation Plan (HCP) and Incidental Take Permit (# PRT-842273) from the U.S. Fish and Wildlife Service (USFWS) regarding measures to avoid and minimize take of the California red-legged frogs (*Rana draytonii*). One measure (Section 3.1 of the HCP) requires pre-construction surveys for the frog prior to sediment removal from operational basins, and that any frogs present be relocated to other non-operational ponds onsite. Dana Bland was authorized by the USFWS via email from David Pereksta on 16th October 2003 to conduct a radio-tracking study of a small number of frogs for a short period of time to document their movements after relocation from sediment basins prior to scheduled sediment removal activities. This study was authorized under Dana Bland's 10(a)(1)(A) permit (# TE-798017-5). This report documents the results of that study.

Methods

Graniterock scheduled sediment removal from Ponds 23 and 98-2 to begin in October 2003. Dana Bland and assistants conducted nighttime surveys prior to beginning of schedule sediment removal to capture, radio-tag and relocate California red-legged frogs at Ponds 23 and 98-2. Frogs were captured by hand or with a dip net, measured, weighed, fitted with a radio transmitter, and released at one of the ponds in the Habitat Conservation Area (HCA). Only frogs measuring greater than 70 mm snout-urostyle length were fitted with transmitters. Radio-tagged frogs were tracked three times per week for approximately two months. Their movements were plotted on an aerial photo of the site. Frogs were recaptured at least once to check the fit of the radio transmitter belt, weighed and re-released at the point of capture. One frog was relocated a second time after it moved back to Pond 23 during the time sediment excavation was occurring. The radio transmitters were removed from the frogs at the end of the study. The radio-tracking technique developed by Galen Rathbun was used for this study (Rathbun, 1996). Small, lightweight radio transmitters with whip antennae (Model BD-2G) were custom made for this study by Holohil Systems Ltd. The transmitters were fixed to a size #3 aluminum clasp with two-part epoxy. The clasp with transmitter was attached to belt made of size #3 aluminum beads, each fitted to the individual frog's waist. The belt and clasp were spray painted black to reduce their visibility to predators. The transmitted frogs were tracked using a model R-1000 telemetry radio receiver from Comunications Specialists, Inc. with H-style antenna from Telonics, Inc. When frogs were originally fitted with transmitters, and when they were recaptured to check them, the following data was collected on each frog: transmitter number, snout-urostyle length (mm), weight (g), sex, location of captured frog, notes on frog health. During each tracking session, the following data was collected: date, time, weather, transmitter number, observed (Yes or No), exact location, additional notes as needed.

California red-legged frogs (*Rana draytonii*)
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Results

A total of nine California red-legged frogs were captured at Ponds 23 and 98-2, fitted with radio transmitters, and relocated to Ponds 3 and 98-3 in the Habitat Conservation Area on Graniterock's Wilder Sand Quarry on 23rd October and 9th November 2003. Frogs at or less than 70

mm snouth-urostyle were not fitted with radio transmitters, but were captured and relocated to Pond 3 prior to sediment excavation. Five of the nine (55%) frogs fitted with radio transmitters moved away from the pond to which they were relocated. Two of the nine (22%) frogs moved back to the area (or close proximity) from which they were originally captured. The remaining four of the nine frogs (45%) remained at the pond where they were relocated for at least one month.

Discussion

The majority of the relocated frogs (55%) did not stay at the pond where they were relocated. Two of the nine frogs (22%) were tracked returning to or near their original capture point. The remaining four frogs (45%) stayed at their relocation pond for a period of one to two months of tracking. The three frogs that left their relocation ponds and traveled to Old Dairy Gulch were found in very dense cover vegetation at the western edge of the gulch. These frogs may also have attempted to return to or near their pond of origin if tracked over a longer period of time. However, the purpose of this study was to track short-term movements of frogs relocated from an active work site.

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Pool frog release in Norfolk, UK in 2005 – were *IUCN Guidelines for Re-introduction* properly followed?

We are concerned that the UK government may have acted contrary to established procedures and international protocols in releasing an amphibian species and its associated micro fauna. *IUCN Guidelines for Re-introduction* (IUCN, 1995) have been considered with respect to the release to the wild of the pool frog (*Rana lessonae*) in Norfolk, United Kingdom. The release is reported to have been carried out in August 2005 by English Nature and The Herpetological Conservation Trust and further releases are planned in 2006.

In May 2005 a paper in the journal Biodiversity and Conservation, concluded that evidence points towards pool frog being a recent native species, but relied on an unpublished method of identifying sub-fossil hip bones, to determine past occurrence, rather the accepted method of using skulls. Leading experts including the world authority cited in the crucial paper have questioned the conclusions drawn from the unproven method. Further, a government agency review of historic accounts of 19th Century green frog populations (debated heatedly yet inconclusively in the 19th Century by British zoologists) has been shown to be questionable in its assessment of supporting arguments for the nativeness claim. Confidence for a pool frog release appears to have developed with interpretations of genetic studies that show UK specimens from extinct colonies to be similar to those in Scandinavia, one of the possible sources of either natural origin or artificial introduction to the UK. Pool frog releases took place just a few weeks after publication of the paper, and too fast to allow alternative interpretations of the science to be published. The following comments are just a few examples of the concerns and follow main headings from the IUCN Guidelines for Re-introduction:

Multidisciplinary Approach

- Re-introductions require a multidisciplinary approach involving a team of persons drawn from a variety of backgrounds. The group established for the Pool frog program comprised almost entirely people promoting the nativeness of pool frogs rather than those who remained unconvinced by the evidence. In doing this it is believed that the approach to the work has been biased and unbalanced. Further, the government agency concerned has refused to take account of representations (that pointed out the equivocal nature of the conclusions drawn from government funded studies) unless published in peer reviewed journals, a very questionable approach, given the time constraints.

Pre-Project Activities

- IUCN Guidelines for Re-introduction indicates that an assessment should be made of the taxonomic status of individuals to be re-introduced. This has not been done. The origin of Swedish frogs and their relationship to other frogs in Scandinavia and the Baltic region is not documented and the possibility of the Swedish or Norwegian colonies being themselves introductions is not properly considered. The Swedish island distribution may arise from human introduction in a country with old traditions for moving amphibians. There are also suggestions of genetic links between UK populations and other parts of continental Europe, which have not been investigated.
- A government funded investigation of historical information about the loss and fate of individuals from the re-introduction area was undertaken by a non-specialist and the report is full of mistakes and ambiguities.
- Detailed studies should be made of the status and biology of wild populations (if they exist) to determine the species' critical needs. For animals, this would include descriptions of habitat preferences, intraspecific variation and adaptations to local ecological conditions, social behavior, group composition, home range size, shelter and food requirements, foraging and feeding behavior, predators and diseases. There is no available document looking at these factors in Swedish frogs, just a very general report produced on the day of the frog release.
- Evaluation of the re-introduction site by those releasing frogs and the basis of government permission to release frogs was that the release location is of a type where the species cannot expand its range and will not disperse into the surrounding countryside. This seems counterproductive but in any case a separate review suggests that frogs could spread out, although those releasing frogs do not accept this.
- Prospective release stock must be subjected to a thorough veterinary screening process before shipment from original source. It is understood that the advisors to the project carried out extensive checks to identify pathogens but the frogs were released before the recommended two-year study period could be

completed, due to funding not being available to continue. A range of host parasites and other fauna and flora living in the frogs that were collected in the source country of Sweden may also be damaging pathogens or parasites to native fauna.

Socio-economic and Legal Requirements

- IUCN Guidelines for Re-introduction indicates that thorough assessment of attitudes of local people to the proposed program should be carried out and that it be fully understood, accepted and supported by local communities. Socio-economic studies should be made to assess impacts, costs and benefits of the re-introduction program to local human populations. No such studies have been done. Although it is understood that the government forestry body has given permission, local landowners whose land may be subject to constraints, designations and restrictions to land use following the release have not been consulted and the project has not consulted regional and local interests adequately. This is contrary to the requirement of the UK's national legislation to give public consultation on the proposed release of species, at which time the questionable native status would have been aired.

We believe that pool frog is not clearly shown to be a past native to the country and worthy of re-introduction and associated expenditure of conservation funds. This analysis suggests IUCN guidelines have been breached on numerous grounds and the IUCN via its RSG is invited to carry out an independent examination of this case and to provide a report with recommendations as a matter of some urgency.

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REPTILES

Release of headstarted iguanas in Anegada, British Virgin Islands

Anegada is the second largest island in the British Virgin Islands (BVI) (39 km^2). Unlike other large islands on the Puerto Rican Bank, which are mountainous (up to 523 m in the BVI), composed of volcanic and metamorphic substrates, and semi-mesic, Anegada is flat and low lying (8.5 m max.), composed entirely of sedimentary substrates (limestone and sand), and more xeric. This unique environment is home to the endemic Anegada iguana (*Cyclura pinguis*). The Anegada iguana is currently listed as "critically endangered" on the IUCN Red List. The population has suffered an estimated 80% numerical decline since the late 1960s (Carey, 1975 & Mitchell, 1999). Today the remaining population is estimated between 200 and 400 individuals and habitat destruction due to human development and over browsing by free-ranging livestock (cattle, donkey, and goats) is a major threat to the iguanas. However, the primary threat to the survival of the Anegada iguana is the large feral cat (*Felis catus*) population on the island. Each year this introduced predator kills most hatchling iguanas within months of emerging, resulting in very little recruitment. Consequently, the Anegada iguana population is made up almost entirely of older adults, with other age classes virtually absent.

To offset the high juvenile mortality, the British Virgin Islands National Parks Trust (BVINPT) and the IUCN Iguana Specialist Group (ISG) initiated a headstart program in 1997 with the introduction of three hatchling iguanas into a captive facility on Anegada. The program is designed to bolster the wild population until the feral cat problem can be mitigated. Each year during the summer nesting season (June and July), the core iguana area (3 km^2) is surveyed to locate nests. Fencing barriers are constructed around individual nests to protect them from livestock and contain hatchlings as they emerge in September and October. Hatchlings are then collected and taken to the headstart facility, where they are raised in a protective environment by BVINPT staff until they reach a larger and presumably less vulnerable size. To date, over 140 hatchling iguanas have been introduced into the headstart facility. By 2003, iguanas in the headstart facility began reaching sizes we felt were large enough for survival with feral cats. However, although headstarting is used as a conservation strategy for several species of West Indian iguanas, few studies have evaluated the technique and little information is available on the survival, behavior, and adaptability of captive-reared iguanas repatriated to the wild (Alberts *et al.*, 2004 & Wilson *et al.*, 2004). To optimize the headstarting process (i.e. maximize post-release survival rates and minimize time in captivity) we have been releasing a broad size range of headstarted iguanas to determine how body size correlates with post-release success. Because we are also interested in the effect of habitat type on survival rates, we conduct releases in two very different habitats that support sizeable adult populations. Our studies are also allowing us to investigate the iguana carrying capacity of habitats compromised by feral livestock, and how iguanas raised in captivity adapt to living in the wild.

Methodology

Twenty-four headstarted iguanas were returned to the wild in October for each of three consecutive years (2003-2005). The size range of animals released in 2003, 2004, and 2005 were 750–2,050 g, 600–1,540 g and 415–1,055 g, respectively. Released iguanas were selected based on health screening conducted by the veterinary staff of the Fort Worth and Bronx Zoos. Health screening consisted of physical exams, blood chemistry analyses, and fecal analyses, and followed the guidelines for pre-release screening adopted by the Iguana Specialist Group (ISG). Each year, twelve iguanas with similar size distributions and equal sex ratios were released in each of two habitats in the core iguana area: coastal sand scrub at Bones Bight, and rocky woodland at Middle Cay. All 72 animals were fitted with radio-transmitters prior to release. Fifty-six of these animals had a radio-transmitter surgically implanted in the coelomic cavity. One of three internal transmitter models was used, depending on each iguana's body size, and transmitters never exceeded 2% of the body mass. The three models, manufactured by Holohil Systems, Ltd., were the AI-2T (16 g), SI-2 (9.3 g) and SB-2T (5g). For the 2005 release, only the eight smallest animals (ranging in size from 450–621 g) received internal transmitters. The 16 remaining iguanas were fitted with external transmitters (Holohil model RI-2CT) attached to the nuchal crest with nylon coated stainless steel wire and crimping tubes. All transmitters were temperature sensitive and battery-life ranged from 1-2 years depending on size and model.

All animals were manually tracked for the first 30 days after release. Post-release monitoring trips lasting two to three weeks were made at 60 days, 120 days, 180 days, 270 days and 360 days during the first year for a total of 125 days of monitoring. Animals with two-year transmitters were also tracked at 420 days, 510 days, 630 days and 720 days for a total of 204 days of monitoring. During field trips, animal locations were recorded daily by direct observation using a handheld YAGI antenna, TX1001 receiver, and a Trimble GPS. In addition, 45 minute, continuous-sampling, focal-animal observations were conducted on several individuals each day to gather information on different behaviors. Attempts were made to capture animals once every other trip to collect data on growth, external parasites, and body condition. Animals with working transmitters will continue to be monitored until October of 2006, when transmitter batteries are predicted to fail.

Results

This is an ongoing project and the information presented here is only an overview of results to date. Data will continue to be collected through October 2006. Of the twenty-four animals released in 2003, 19 were still alive after two years representing a 79% survival rate. The five mortalities occurred at two days, 60 days, six months (3rd and 4th mortality), and 22 months after release. The first mortality was due to complications from the transmitter implant surgery. Cause of death could not be determined for any of the remaining losses due to the poor condition of the carcasses. There are currently 21 animals still alive from the 2004 release, representing an 87% survival rate. Individual mortalities occurred at 60 days, five months, and eight months post release. Only one carcass was

Anegada iguana (*Cyclura pinguis*)
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located, and it was heavily scavenged so cause of death could not be determined. There is no correlation between body size and survival for either of the first two release groups. Surviving animals from the 2003 and 2004 release groups are thriving and continue to grow. One individual increased in mass by 1.5 kg 18 months after release. The iguanas have established home ranges and are showing retreat site fidelity. Most animals have not traveled far from their release site. Mean distance between release sites and home range centers is 94 m. However, one male established a home range approximately 400 m from his release site. The longest distance moved by any animal in a 24-hour period is 286 m.

The third release occurred in October 2005. Only one follow up trip has been conducted to date. However, two mortalities occurred between 30 and 60 days after release. In both instances, cause of death could not be determined. Because the deceased iguanas were two of our smallest animals, the project may be reaching its goal of determining the minimum size iguana that can survive in the wild with feral cats. Animals will continue to be monitored through October 2006. The ISG is pleased with the success of the Anegada headstart program, with 62 of 72 released iguanas surviving. In 2006, Island Conservation will join the project to coordinate the introduced mammal eradication program, and a Species Recovery Plan for the Anegada iguana will be published to guide the diverse conservation efforts needed to save this important Caribbean Iguana.

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Gharial re-introduction in Chambal River, India: a success story

Restoration of single species of plants and animals is becoming more frequent around the world. Conservation practice aims to restore communities to their former level of diversity. Conservation planning seeks to identify such diverse communities and protect them. As this form of ecological management is increasingly common, it is a priority for the scientists to develop guidelines so that re-introductions are both justifiable and likely to succeed, and that the conservation world can learn from each initiative, whether successful or not. In India under the Crocodile Project, captive reared crocodiles have been both re-introduced in areas where they had been extirpated locally and also used for supplementation of relict populations (Singh, 1985). The supplementation exercise for crocodiles has been most successful in India. In addition many State Governments have initiated special Endangered species projects in several protected areas. Madhya Pradesh is area-wise the biggest state of India, well forested and with a rich history of wildlife conservation. In the early 1970's the national movement for conservation of flora and fauna started in the state and there are 11 national parks, 35 sanctuaries and 1 biosphere reserve covering an area of 16,877.42 km^2. In the north is the Gwalior region, which comprises Gwalior, Bhind, Morena, Shivpuri and Datia districts covering 3,356,000 ha. The Madhya Pradesh Government has undertaken rehabilitation programs for the highly endangered crocodile species - the gharial (*Gavialis gangeticus*) under the Crocodile Project that started country-wide during 1975. Three important crocodile habitats were identified and given protection by declaring them as sanctuaries they are the National Chambal Sanctuary on Chambal River, Ken Gharial Sanctuary on Ken River and Son Gharial Sanctuary on Son River.

National Chambal Sanctuary

The Chambal River is perennial, having its origin in Vindhyan Range near Mhow district of Madhya Pradesh. The river is a good habitat for large number of aquatic animals including a variety of fishes, crocodiles, turtles, migratory birds, aquatic mammals like dolphin and otter. To protect the gharial and other aquatic animals the Chambal River was declared as National Chambal Sanctuary, which is managed by the Forest Departments (wildlife wing) of Rajasthan, Madhya Pradesh and Uttar Pradesh. Stopping of fishing activity, maintaining full protection from poaching, extending protection to the habitat and rehabilitation of gharial under `grow and release' scheme are the management strategies adopted in the National Chambal Sanctuary. Rehabilitation of gharial has been taken up in the sanctuary from 1978. Gharial eggs are being collected from the Chambal River for artificial hatching at Deori Gharial Rearing Centre (DGRC) (Fig. 1). Rehabilitation of Gharial has been taken up in the National Chambal Sanctuary from 1978. Around 2,000 captive reared gharial have been released in the Chambal River by Madhya Pradesh and Uttar Pradesh Forest Departments. To avoid any possible migration of gharial to outside the Sanctuary area, most of the releases were done in the up-stream of the Chambal River near Pali, Baroli and Rameswar ghat where river Banas joins Chambal River. Captive reared muggers were also released in the Chambal River. In addition to release of crocodiles in the Chambal River captive reared gharial have also been released in Ken and Son Gharial Sanctuaries of Madhya Pradesh. In addition to crocodiles, turtles, dolphins, otters and migratory birds also received protection in the Sanctuary. Although due to financial crisis and ignorance, the re-introduction of gharial was ceased for a period of 10 years from 1993-2003, gharial captive rearing program was again started at the Gharial rearing centre, Morena, Madhya Pradesh from 2003 (Rao, 2004). A total of 35 captive reared gharials were released by the Madhya Pradesh Forest Department during December 2005 and February 2006 and 112 gharials by the Uttar Pradesh Forest Department during January 2006 in the Chambal River. Monitoring the released

Fig. 1. Captive Gharial (*Gavialis gangeticus*) hatchlings at Deori Gharial Rearing Centre, Morena, India
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gharial is currently in progress.

Research

Management oriented research studies were undertaken in the National Chambal Sanctuary by the Wildlife Institute of India, Dehradun; Jiwaji University, Gwalior and Aligarh Muslim University, Aligarh. All these studies helped the administration of the National Chambal Sanctuary to take up various actions for management of the Sanctuary for conservation of wildlife.

Wildlife Monitoring

The State Governments of Madhya Pradesh, Rajasthan and Uttar Pradesh are taking conservation management programs of the Chambal Sanctuary. The Forest Departments monitor the populations of endangered species in the Sanctuary regularly. As borders between States are political and not ecological, habitats in the Sanctuary are subject to different, or even conflicting, management and land use practices. Senior Forest Officers of all three States are in-charge of their respective projects. Range Officers, Research Assistants, Field Assistants, Forest guards and boat men are looking after the protection in the field. Every year the Forest Department of Madhya Pradesh conducts surveys to monitor the populations of endangered species including migratory birds. The Gharial population is declining in Chambal River. Information accumulating through last few years has raised the possibility that the gharial population in the National Chambal Sanctuary, India, may be in the process of a catastrophic decline. Monitoring of released gharial is being carried out in the sanctuary including annual surveys for population counts and identification of new nesting sites. Recent surveys revealed less than 800 gharials and around 85 wild-laid nests. The total natural recruitment of gharial at the hatching stage in the Chambal River is about 2,500. However, survival rate of hatchling in nature is estimated to be 6.5%. This warns a need for greater protection of gharial in the Chambal River. The survival rate of released gharial is also not encouraging as there are unofficial reports of gharial mortality due to illegal fishing activity in the sanctuary.

Conclusion

According to Kleiman (1989) 'success cannot always be measured by counting the number of surviving animals. If a species survival depends on habitat preservation and re-introduction results in a broader conservation program including greater habitat protection, then the re-introduction could be judged a success even if every re-introduced individual dies soon after release'. Monitoring of the released gharial shows a positive trend on the survival of the re-introduced gharial in a protected area of around 400 km of river. If the specific goals of a conservation-oriented re-introduction and the criteria by which success is evaluated depend both on the species' status in the wild and in captivity and the political and social conditions in the region surrounding the release site, then the gharial re-introduction in the Chambal region is a great success for:

1. conservation of species,
2. protection of habitat, and,
3. providing awareness among locals and political personnel for wildlife conservation programs in India.

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Experimental release of the Madagascar side-necked turtle "rere" in Ankarafantsika National Park, Madagascar

The rere (*Erymnochelys madagascariensis*) is the only freshwater chelonian endemic to Madagascar, represents a monotypic genus and subfamily (Erymnochelinae) and is the only Old World representative of the family Podocnemidae. Adults can reach a maximum carapace length of 50 cm. It inhabits lakes, rivers and some marshes throughout western Madagascar, from the Mangoky River in the south to the Sambirano River in the north, up to a maximum altitude of 500 m. Populations are in steep decline throughout the species' range, and some have disappeared from many sites where they were abundant (Kuchling & Mittermeier, 1993 & Velosoa, 2001). The main cause of decline is capture (nets, traps and diving) for local consumption. Collection of nesting females has a particularly heavy impact on the populations, since large females represent the vast majority of the reproductive potential in each population. Habitat degradation has also occurred but is considered to be a less important threat (Kuchling & Garcia, 2003).

Durrell Wildlife Conservation Trust has led surveys and outreach work throughout the range of this species since

Close up of a rere (*Erymnochelys madagascariensis*)
© Gerald Kuchling

1998 while also aiming to conserve and reinforce turtle populations at Ankarafantsika National Park; one of only two protected areas containing significant rere populations. Despite their protected status, turtle populations within the park are severely depleted and increased protection of these sites combined with release of juveniles to restore populations were identified as priority strategies to conserve the species here. Six adult males and three adult females were captured in the Ankarafantsika National Park in 1998 and kept at the Ampijoroa Breeding Station (ABS) with the aim of releasing 2-3 year old juveniles into depleted lakes within the park (Kuchling, 2000). Only two hatchlings have been bred so far at Ampijoroa, but a total of 222 hatchlings from wild nests around Lac Antsilomba were taken into the ABS for head-starting from 1999 to 2003. The project aimed to free juvenile rere in Lac Ankomakoma, a lake of approximately 10 ha in the south western end of the park, to understand the potential for success of establishing head-started or captive-bred juvenile rere, to speed up recovery of the remnant rere populations inside the park. Additionally, the project would seek to improve conservation of wetland habitats associated with the species through collaboration with villagers and National Park authorities and thus encourage the long-term protection of endemic Malagasy fauna and their habitats at the local, national, and international levels.

Pre-release Preparation and Release

Lac Ankomakoma held a significant population of rere in the near past, but was severely depleted at the time of the release. Only 17 individuals were captured in 600 trap-days between December 2001 and February 2003, of which only 2 were adult (both males). This decline is largely attributable to the impact of rod fishing and collection of eggs and nesting females by people camping around the lake to collect raffia. Since 1998, settlement, cultivation, raffia collection and camping at the lake have been prohibited. Furthermore, the lake is considered sacred and net fishing and use of boats are forbidden by tradition. In 2003, camping, raffia collecting and rod fishing still occurred sporadically, but there were no longer crops grown or large numbers of cattle brought for pasture around the lake. Secondary forest was regenerating on these areas. Workshops were held in August and November 2002 and in July 2003 with representatives of relevant government departments, local authorities and local communities to discuss the project and encourage their support. An association ('*Tamingan'i Doanibe*') was created that includes representatives of all 10 villages that have traditionally used Lac Ankomakoma, in addition to the village downstream near to Lac Antsilomba where the hatchlings were collected. The association aims to conserve both the natural and cultural value of Lac Ankomakoma through implementation of a *'dina'* or local convention.

Captive rere were kept in ponds isolated from other tortoises and turtles in the ABS. Blood and faecal samples taken from juveniles for release, and juveniles from Lac Antsilomba for comparison, showed that wild and captive populations had similar profiles for haematology, blood biochemistry, faecal bacteriology and parasitology. A total of 158 wild-caught juvenile turtles, aged 3-5 years weighing an average of 395 g (185–740 g), were released in Lac Ankomakoma on 26th March 2004. It was known from endoscopies that 108 of the released turtles (68%) were female. Representatives of central and local Government, as well as traditional leaders and representatives from all 11 member villages of the association, witnessed the release. A traditional ceremony, *joro,* was held to request a blessing from the ancestors at which papers confirming legal recognition of the association and of its locally defined rules (*dina)* protecting the lake and the rere were publicised.

A rere (*Erymnochelys madagascariensis*) being shown to local people prior to release in its natural habitat
© Joanna Durbin

Post-Release Monitoring

Monitoring of released turtles was based on mark-recapture through the use of baited floating net traps set around the edges of the lake (Kuchling, 2003). Tracking by telemetry was not possible because boats and diving in the lake are prohibited by local custom. Trapping was undertaken in April and October-November 2004, and also in February and November-December 2005, because turtles are most active in the hotter and wetter months (October to March) (see table 1). Since any turtle captured must have been alive up to that date, the capture data show a minimum population known-to-be-alive (KTBA) of 43 individuals (27% of released turtles) eight months after release and of 32 individuals (20%) one year after release. These KTBA estimates underestimate the actual size of the release population, in particular for the most recent year because only the small proportion trapped at the latest session are confirmed to be alive, whereas earlier KTBA estimates benefit from cumulative data from subsequent trapping sessions. The low recapture rates encountered do not allow reliable population estimation through modelling to be undertaken. With additional trapping sessions in future years it may be possible to use population modelling methods (e.g. Manly and Parr method or Jolly-Seber method) to provide more realistic estimate of numbers. All turtles captured were weighed, examined externally for lesions and ectoparasites, and faecal and blood samples were taken for comparison with pre-release and other wild populations. No released animals showed signs of ill-health.

Dispersal of the released turtles can occur via the single small river draining the Lac Ankomakoma release site.

Table 1. Results of rere trapping at Lac Ankomakoma							
Trapping period	Trap days	Captures		Recaptures		Number of released turtles known to be alive (KTBA)	Released turtles KTBA as a percentage of total number released
		Wild	Released	Wild	Released		
Dec 2001	60	4	-	-	-	-	-
Mar 2002	254	5	-	2	-	-	-
Nov 2002	54	4	-		-	-	-
Feb 2003	231	8	-	2	-	-	-
Nov 2003	204	18	-	7	-	-	-
Feb 2004	192	14	-	14	-	-	-
Mar 2004	-	-	-	-	-	158	-
Apr 2004	64	4	4	4	-	46	29
Nov 2004	189	18	23	11	1	43	27
Feb 2005	240	15	21	12	8	32	20
Nov 2005	228	27	21	18	14	21	13
Total		117	69	70	23		

This was monitored by placing nets across the river and flushing turtles into the net at 50–100 m intervals in May 2004 and April-May 2005 on the river and by requesting reports of turtles found by local people. So far, no released turtles have been found outside the release site. Post-release trapping has also provided additional information on the resident rere population at Lac Ankomakoma. A total of 47 turtles have been captured since December 2001, of which five were adults (2:3) and two sub-adults (1-1.5 kg). Of 27 individuals captured in November 2005, ten were small juveniles (under 100 g), indicating that this population is reproducing successfully. Close collaboration has been maintained between the village association and park authorities, for example by periodic joint missions to monitor resource use around the lake. There has been no sign of raffia cutting and camping or of fishing at the lake since the release. Increased protection of the lake has enabled the vegetation around the lake to continue regenerating and may have been the reason for a pair of the critically endangered Madagascar fish eagle (*Haliaeetus vociferoides*) to start nesting there. Further monitoring is required over a longer time period to evaluate the direct contribution that released captive-reared rere will make to the depleted wild populations. An important outcome of the release has been the increased surveillance and protection of the lake and the existing rere population.

Acknowledgements

The Rere Project is a collaboration between Durrell Wildlife Conservation Trust the General Direction of Waters and Forests of the Government of Madagascar and the National Association of Management of Protected Areas (ANGAP). We are very grateful to the local authorities and local people of the Ankarafantsika area for their collaboration, to Gerald Kuchling of the University of Western Australia for initiating the project and for his continued advice, and also to Conservation International, Harcroft Foundation, Kreditanstalt für Wiederaufbau and Liz Claiborne Art Ortenberg Foundation for funding.

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MAMMALS

Re-introductions of black rhino in KwaZulu-Natal, South Africa

There were more than 65,000 wild black rhino in Africa in the mid-20th Century. Then a devastating poaching wave swept down the continent in the 1970s and 1980s. More than 95% of the black rhinos in Africa were wiped out by poachers. Demand for rhino horn in the Middle and Far East, made easier by economic and political instability in some African countries, drove the slaughter. By 1992, there were only 2,500 black rhino left, mostly in heavily protected reserves. Since then, black rhino numbers have been inching back up, thanks to intensive protection efforts in state and private sectors. By 2004, there were an estimated 3,600 black rhino in the wild, almost all of these in South Africa, Namibia, Kenya and Zimbabwe. But there is no room for complacency. The demand for rhino horn continues and many of the political and economic conditions that threaten black rhino-poverty, corruption, instability, land-hunger–still exist. High security is one

critical element of black rhino conservation. The other is biological management focused on growing the overall population as fast as possible. Rapid population growth can mean the difference between survival and extinction. Faster growth provides a bigger buffer against poaching or natural disaster and minimizes genetic loss. As with investing money, small differences in growth rate of the overall black rhino population make a big difference over time.

One project which aims to help increase overall black rhino population growth rate is the WWF/Ezemvelo KZN Wildlife Black Rhino Range Expansion Project in KwaZulu-Natal, South Africa. South Africa has approximately 38% of the existing black rhino population and approximately 500 of these are found in KwaZulu-Natal. Ezemvelo KZN Wildlife, the province's formal conservation authority, has a world-class track record of innovative and successful rhino conservation. Formerly known as the Natal Parks Board, the organization was responsible for bringing the white rhino back from the brink of extinction in one of the great success stories of 20th Century conservation.

Now, they are carrying that proud history forward with black rhino. Ezemvelo KZN Wildlife have very successfully protected their black rhino, but the organization's protected areas have finite borders and black rhino are already bumping up against the edges. There is a concern that this could lead to an overshoot of ecological carrying capacity, as well as a density-related decline in population growth rate. So, in partnership with WWF, they have embarked on the Black Rhino Range Expansion Project which aims to increase land available for black rhino conservation, thus reducing pressure on existing reserves and providing new territory in which the animals can rapidly increase in number. Relatively large founder populations established on land with a high carrying capacity for black rhino seem to experience high population growth rate. There are four subspecies of black rhino. The focus of the Black Rhino Range Expansion Project is on *Diceros bicornis minor*, found mainly in South Africa and Zimbabwe. Initially the Project focused on KwaZulu-Natal but the potential exists to look further afield.

Approach

The Project team is funded by WWF and works closely with Ezemvelo KZN Wildlife. The Project forms strategic partnerships with landowners–whether private, state, or communal–who hold large areas (ideally at least 20,000 ha with an ecological carrying capacity of more than 50 black rhino) within the historic range of the black rhino. Once the partnership agreements are signed and sealed, then founder populations of up to 20 black rhino are released on to the new site. This is thought to be optimal for rapid population growth. Because of the large area of land required, the project site can be made up by partnerships between adjacent landowners who are prepared to drop their internal fences. The project began in July 2003 and has so far released a founder population of black rhino on to two new sites. In two years the Project has catalyzed the creation of about 40,000 ha of barrier-free land for black rhino in its historic habitat in KwaZulu-Natal with more areas lining up as potential future sites. This is good for black rhino but also for many other

Black rhino (*Diceros bicornis*) translocation
© WWF

species which benefit from the ecologically-rational use of land. Much of the land was already under conservation but in relatively small pieces divided by internal fences. The courageous decisions of landowners who have committed themselves to creating these large areas have benefited black rhino and many other species that live alongside them. Potential partner sites throughout the province were assessed and those that met the stringent criteria were short-listed. (See selection criteria below). The successful sites are recommended by the Project leader, after consultation with the Management and Steering committees of the Project, and the final choice is made by the Board of Ezemvelo KZN Wildlife Board. The first site was Mun-ya-Wana Game Reserve in northern KwaZulu-Natal which consists of four adjoining properties (Phinda, Bumbeni, Zuka and Phumalanga) which dropped the fences between them in order to create a barrier-free area of just less than 20,000 ha for black rhino. Mun-ya-Wana borders Ezemvelo KZN Wildlife's Mkhuze Game Reserve and the contract signed regarding black rhino included a clause that efforts to remove the dividing fence be concluded within a reasonable time-frame. A founder population of the 15 black rhino was released on to the new site in October 2004.

The second site, also in northern KwaZulu-Natal, is Zululand Rhino Reserve. This site covers 24,000 ha of savannah bushveld made up of 20 neighboring properties whose owners removed their internal fences in order to create a significant, barrier-free haven for endangered species, including black rhino. In October 2005, a total of 21 black rhino were released on to the site. Work has already begun on potential site three and beyond. The focus here is not only on privately-owned land but on community-owned land. In South Africa much land under conservation has been subject to land claims by formerly dispossessed communities. The Project is working with successful land claimants to help them maintain economically successful conservation areas. The model works as follows - a founder population of black rhino and management guidelines are made available by Ezemvelo KZN Wildlife, while the other partners provide the land and ensure high levels of security and management. Landowners are custodians of the initial founder population, which remains the property of Ezemvelo KZN Wildlife. However, half of the progeny will be owned by

the landowners and half by Ezemvelo KZN Wildlife.

Selection criteria for Project Partners:

- The land must provide suitable black rhino habitat within the historical range of *Diceros bicornis minor (*initially within KwaZulu-Natal, although the potential exists to expand the project area at a later date). There must be no black rhino of another sub-species on the property.
- The area should ideally have an ecological carrying capacity of more than 50 black rhino, and can be made up by partnerships between adjacent landowners who are prepared to drop fences.
- There should be no barriers to free movement of the black rhino population within the area.
- The land must have security of land tenure and good security prospects.
- The landowners must show a demonstrable capacity and commitment to manage and protect a black rhino population. They must also make tangible contributions in cash or kind towards the custodianship of the black rhino.
- The landowners or partners must agree to enter into legally binding long-term management agreements with Ezemvelo KZN Wildlife.
- Properties where the current land use is wildlife based, current poaching levels are low, fencing is adequate, and with a link to an existing black rhino area have an advantage, as do those offering economic potential to local communities.

Project Modules

The Project has two modules 1) one which focuses on finding new areas, and, 2) the other which helps protect existing source populations through funding, for example, ear-notching programs to improve monitoring of black rhino; purchase of equipment; training for field staff.

Discussion/ Lessons learned

Both translocations have been successful so far. The decision to release black rhino without using accepted best practice of holding bomas at the receiving end was very successful. There have been no losses through fighting, accident or any other cause and the first calf has been born on Munyawana Game Reserve (although in this instance the mother was already pregnant when relocated. The first calves conceived on the project sites can only be expected in early 2006). Both sites have a dedicated monitor who sees each black rhino at least once every two days.

It is too early to detect any real increase in the growth rate of the black rhino populations in KZN, the main objective of this project. However, we are hopeful that the project will have been a success because the black rhino in the Ezemvelo KZN Wildlife game reserves had reached saturation point with limited prospects for a healthy growth rate (a decline had already been detected). Removing 5 to 7% of those populations will have relieved population pressures on those reserves (with the hope that those populations will grow at that removal rate) and the animals removed were used as founders for the two new populations. Land was brought into formal conservation activity by the innovative use of partnership schemes whereby landowners not normally associated with formal conservation could participate in this one, with clear financial promise at the end of the day.

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The release of Apennine chamois in Central Italy: 20 years later

Late in the 19th Century, a zoologist noticed the pelt of an unknown chamois in a friend's house: the Apennine subspecies (*Rupicapra pyrenaica ornata* NEUMANN, 1899), of chamois was born, thus. Its very distinctive whitish large throat, shoulder and rump patches in the winter coat, beside many other differences, make it immediately recognisable, with its Iberian smaller cousins (*R.p. parva*, Cantabrics; *R.p. pyrenaica*, Pyrenees), from all other chamois *R. rupicapra* who have just very small throat and rump patches. While its geographic neighbour, the Alpine chamois (*R.r. rupicapra*) is probably the most abundant wild ungulate in the Alps with its 400,000 head, the Apennine chamois (presently, 1,100 head) is rated as endangered by the IUCN. Red List (2004), is in Annexes 2 and 4 of the EU-Habitat Directive 92/43 and it is in Appendix I of the CITES, 1979. By the Italian law (N. 157/92), this chamois is amongst the "particularly protected" taxa. In the early 20th Century, only one remnant small population of Apennine chamois (no more than a few tens of individuals) remained in a royal hunting reserve, which in 1922 became the Abruzzo National Park. After almost half a century at low to very low numbers, in 1970s the chamois in the Abruzzo National Park started recovering, presently being about 600 head, with a relatively modest yearly increase rate of 7%- which is surprising, as there are suitable areas not yet colonised in the Park.

Apennine Chamois (*Rupicapra pyrenaica ornata)*
© Giovanni Cappelli

About twenty years ago, the release of these chamois in other areas of the Central Apennines was planned on behalf of the Abruzzo National Park Agency, the Italian Alpine Club, and the WWF-Italy. In 1991 a first group of 15 individuals was liberated in the Majella massif, now Majella National Park. In 1992-93, 16 chamois were released in Gran

Sasso National Park. Other individuals reinforced the newly forming populations between 1994 and 1997, for a total of 20 chamois in Majella and 10 in Gran Sasso (where 9 more individuals were liberated in 1999-2001). Five other chamois were released in Majella, in 2005. Both populations are thriving: about 200 head, in Gran Sasso, whereas over 300 head have been counted in Majella, in 2005. This success is all the more surprising, because the wolf, a natural predator of chamois, is well established in both areas and as the genetic variability of these goat-antelopes is extremely poor, after several centuries of survival at low numbers. The release of other reproducers in suitable mountains of the Apennines is being planned (Sibillini National Park, Sirente-Velino Regional Park) for the near future. Only the liberation of these chamois in Gran Sasso can be called an actual "re-introduction", as the last Apennine chamois got extinct there in 1892. In all other areas, there is no recent record of this ungulate, although well preserved fossil *R. p. ornata* have been found in the Sibillini mountains: releases of Apennine chamois in these areas should thus be considered as "benign introductions". The conservation and management of the Apennine chamois have been the subject of two E.U. Life Nature funds (1999–2001 & 2002-2005) in the new areas of release (Gran Sasso, Majella), although several aspects of the conservation biology of these chamois in the source population of the Abruzzo National Park would have also deserved attention. In 2002, an Action Plan to save these chamois was prepared by a group of experts, under the aegis of the Italian Institute for Wildlife Management, on behalf of the Italian Ministry of the Environment. Let us hope that facts will soon materialise, from the words written in this Action Plan.

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Re-introduction of Arabian Oryx in Dubai Desert Conservation Reserve, Dubai, UAE.

The Arabian oryx (*Oryx leucoryx*) is a very significant species amongst the Arabian fauna as it is the biggest antelope in Arabia and is an essential part of the indigenous heritage and culture. This species was extirpated from the wild during the early 1970s. Numerous efforts have been initiated in Arabia to restore this species such as in Mahazat as-Sayd (MAS) in Saudi Arabia (Greth & Schwede, 1993 & Mesochina, 2003) and Uruq Bani Ma'arid (UBM) (Ostrowski, 2001 & Bedin, 2003) in addition to the Jiddat Al-Harasis re-introduction in Oman (Jungius, 1978) the UAE deserts were also part of the historical range of this species. With the growing awareness of conservation and ecological restoration in Dubai, an initiative was taken to set aside an area for conservation and which was designated as a nature reserve. An initial area of 25 Km² was fenced out and cleared from livestock and other activities in late 1999 and termed the Al Maha Reserve (AMR), subsequently in 2003 the area was scaled up to 225 Km² forming the Dubai Desert Conservation Reserve (DDCR) which is a system of sand dunes impregnated with few gravel plains (24° 49.5'N 55° 40.5'E). Biodiversity restoration and re-introductions of the indigenous species are the main objectives of the reserve. Currently re-introducing the Arabian oryx (among other species) is the main ongoing conservation activity in the DDCR. Although the area is not big compared to the large home-range of the Arabian oryx, this process of restoring the species to its habitat is an achievement as the species is still conservation dependant for its survival throughout its range. A conservative opinion would rather rephrase it as a semi-wild population but I think that it is of more value to the overall species survival specially bearing in mind the fact those large undeveloped natural habitats available to be set aside as conservation areas are indeed rare commodities in UAE and the Arabian Peninsula in general.

Re-introduction Process

This process started with two groups with the first of 38 animals being released to the AMR in February 1999. These animals were placed in a pre-release boma and then released to the AMR which comprises the core conservation area. These animals were donated by a royal private collector and unfortunately their origin could not be traced. However, the offspring of this group showed some patterns of losing their natural colouration and had relatively pale frontal spots and white legs. Thus, it was decided to mix these animals with new blood to enhance the genetic variability of the herd. In November 1999, about 79 animals from Whitesands Missile Base, USA were brought in to the reserve and were directly released into the reserve and there was no information available about their sex ratios. Arabian oryx in AMR are of free-ranging status with feeding supplements in the form of small amounts of grass and alfalfa pellets provided on selected feeding spots. Water is also supplied in semi-natural water holes.

By the end of 2003, the Arabian oryx population had reached 194 as determined by total counts, and in the same year the reserve was scaled up to encompass 225 km^2 of dune desert as a fenced area but maintaining the inner AMR within its original fence. During 2004, two translocations were carried out to move two groups of Arabian oryx from the AMR to the bigger perimeter of the DDCR. A group of 23 Arabian oryx were transferred from the Al Maha herd into a boma by luring the animals using feed into the collection boma. During the morning of 14th March 2004 an operation of moving the animals to the larger fenced area of the DDCR was started and a total of 23 animals (8:14:1) were targeted for translocation. A small trailer was available for the operation so the animals were moved in three stages. The calf was moved separately so as not to be injured in the trailer or be crushed by the adult animals. Animals were translocated to their pre-release boma in a site chosen in the north of the DDCR. Animals stayed in this boma for about a week, provided with the usual diet of hay and pellets and water provided in a trough and after which the gates were opened to allow the animals to move into the DDCR.

The Arabian oryx started wandering over large distances during the first week after release and six individuals were spotted at a distance of 17 km from the release site. Later the animals split into smaller groups and currently only 10 animals of this initial group seem to keep together while the others are in smaller dynamic groups. In the second translocation that took place in April 2005, a group of 40

Arabian oryx were moved out of the AMR and into the DDCR in a site of a natural ghaff (*Prosopis cineraria*) forest. Animals started wandering around the site but tended to return back to the release site. In the long-term these animal inhabited the Ghaf forest as it provided generous amount of shade through the day and good forage in the near-by vegetation. Calving was observed to occur after the translocation in both groups indicating good adaptability and potential establishment of the population.

Population Parameters

The population has been monitored since 2002 and the population size was estimated using direct total count drives. The current population comprises 241 Arabian oryx which represents 200% growth over six years since the first release. This means that the population has been experiencing an estimated annual increase of 26.8% between 2002 to 2005 assuming linear growth. Recruitment and mortality was also assessed by counting newly born calves on weekly basis including mortalities. There was a considerable decrease in annual recruitment during 2005 when it dropped below 10% and annual mortality was under 5% in most cases during 2002–2005, except for 2004 when it reached 7.4%. Currently the population is maintaining normal structure and sex ratios and average sex ratios for males, females and juveniles obtained from total counts during 2005 are 40.07%, 46.66% and 13.27% respectively. Survival rates reported were satisfactory and mean adult survival rate of 94.80% is recorded through the period 2002-2005, with a maximum of 98.21% during 2005 and the lowest was 89.52% during 2004. Calves' survival rate during their first year was higher scoring a mean of 97.22% and the lowest calves' survival rate was also recorded during 2004 at 94.29%. The future trend of the population is expected to continue increasing but it is still uncertain whether it will maintain the current rate or decrease. It is noticed that the recruitment percentage is decreasing with an increasing population size, suggesting that there is some density induced effect. It is premature to make such a conclusion but it is possible that a growing numbers of younger males are in strong competition with older established males who control available females and thus depriving the young males from the chance to reproduce. This should be taken into consideration when planning future translocations.

The re-introduced Arabian oryx population in the DDCR seems to be very valuable as a source of knowledge towards the overall survival of the species and the DDCR population seems to follow different dynamics compared to those of MAS and UBM in Saudi Arabia. The population of UBM suffered a decline that started in 2000 and continued to prevail until 2004 when the population decreased from about 220 and down to less than 150. This decline is attributed to higher mortality rates as response to environmental stress due to unfavorable conditions (Chassot *et al.*, 2005). Also, in MAS a simulation study conducted by Treydte *et al.*(2001) showed that the optimum strategy for species survival should involve culling individuals to maintain them at/or below 70% carrying capacity of the reserve. The DDCR population is similar to those in MAS and UBM but still increasing and with a potential to keep growing. This suggests that there are differences in the prevailing conditions in the different sites that control the population dynamics. Although the DDCR is much smaller in surface area compared to UBM and MAS, it provides more resources to accommodate the Arabian oryx population. A vegetation rehabilitation program is running side by side with the oryx re-introduction and more than 6,000 indigenous trees were planted in various parts of the reserves during 1999 which now provides a necessary food resource and shade that is crucial to the oryx well being and survival.

Thus DDCR re-introduction is unique, compared to other re-introduction projects carried out previously, in two aspects. First, the initially introduced herds are relatively larger in number compared to those initially introduced in MAS (17 in 1989), UBM (17 in 1997) or in Yalooni in Oman. Secondly, the parallel habitat rehabilitation going jointly with the re-introduction gives a wider safety margin for the species survival and increases the carrying capacity of the reserve 4 to 5 folds.

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Poaching of re-introduced Arabian oryx in Oman: will accession to CITES help?

The success of the re-introduction of Arabian oryx (*Oryx leucoryx*) in Oman has been a remarkable event in conservation biology (Stanley Price, 1989). By 1996, some 400 oryx were freely roaming the Arabian Oryx Sanctuary, a UNESCO World Heritage Site, in the central desert of Oman. Unfortunately, oryx poaching for live trade outside the country caused a catastrophic decline in the re-introduced oryx population (Spalton *et al.*, 1999). By November 2005, the oryx population in the wild was estimated at 94 individuals (95% confidence interval=78-119), of which just four were females. This sex biased offtake is explained by the high demand for breeding females for privately-owned collections. Fortunately, in August 1998, 39 oryx, mostly females were translocated from the wild to breed in captivity at Jaaluni, which is the field station of the oryx project. By the end of

November 2005, the captive oryx numbered 134, of which 66% were females.

Despite the several security measures that Oman government has made during the last nine years to halt poaching in the Oryx Sanctuary, including the establishment of a special security force, poaching still exists and has made the oryx re-introduction to be a substantially challenging issue between conservationists and poachers. In 2001, several meetings involving all government bodies concerned with biodiversity conservation were held to discuss all relevant biodiversity issues in the country. The outcome of these meetings was the production of the National Biodiversity Strategy and Action Plan, which structures all the environmental actions/options needed to promote conservation efforts in Oman (Ministry of Regional Municipality, Environment and Water Resources, 2001). In one of the strategy conservation options to halt oryx poaching was the accession of Oman to the CITES Convention. This paper provides a descriptive analysis and recommendations of scientific and economic grounds to this option.

In situ Protection of Arabian Oryx

The Arabian Oryx Sanctuary is 24,636 km² and was officially gazetted as a protected area (IUCN Category II) in 1994. Anti-poaching efforts in the sanctuary have been largely carried out by the oryx project rangers. Since 2005, the oryx project operates with eight rangers (two patrols of four men for each duty shift) to secure the oryx population in the wild, which makes each patrol responsible for guarding approximately 12,300 km² of the sanctuary. This limited policing associated with open accessibility of the sanctuary to the public has resulted in an unpleasant ramification for the oryx re-introduction project. Moreover, wildlife laws in Oman especially on the elusive “shooting action” and the necessity for finding "hard evidences" to convict poachers has resulted in a considerable gap between law authorities (e.g. law courts), who never experience wildlife on the ground, and law practitioners (e.g. oryx rangers). Equally, legislations are relatively a constant factor as they do not cover all the variations associated with oryx price in the market including the supply/demand factor.

Oryx and CITES

Since 1975, the Arabian oryx has been listed in CITES Appendix I, where its trade may affect its survival in the wild. In the context of the oryx issue in Oman, financing the CITES regulations mainly through well-policing Oman terrestrial borders with concerned neighboring countries means that the Oman government has to invest huge resources on this as the countries international border stretches for hundreds of kilometers. Hence, from a cost-benefit point view, it would be more feasible for Oman to invest these resources on *in situ* protection to promote the current low detection level of poaching incidents in the Arabian Oryx Sanctuary than on securing borders. Moreover, *in situ* investment can also treat other environmental issues in the sanctuary including off-road driving and overgrazing, which are also primary threats to wild oryx.

On the other hand, the Arabian Oryx Sanctuary is inhabited by local people, who have been largely

Ranger patrol in Arabian Oryx Sanctuary
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depending on its resources including wildlife for a long time, and although the oryx became extinct once in their area, this was caused by hunting parties from outside the country that roamed the central desert of Oman during the 1960s and 1970s in search for oryx and other species for private collections. Being born in the Western world, CITES does not provide locals with enough options to fulfill their growing livelihood needs. The CITES debate on elephant and rhinoceroses conservation in Africa is a clear example of the treaties pitfalls as it has not provided the conservation society with a clear-cut answer on this issue.

Well-regulated Trade of Arabian Oryx in Arabia

Oman’s wildlife conservation approach is mainly based on ecological perspectives (i.e. hands-off) and does not yet recognize the economic potential of consumptive use of wildlife (e.g. legal commercial sale) as a source of national income. However, considering the growing economic needs of local people in the Arabian Oryx Sanctuary associated with the uncertainty of future resource availability that is mainly determined by oil production and pricing, wildlife consumptive use can provide the oryx project with considerable income for the security and management measures of the Oryx Sanctuary, as well as show the government the economic importance of protecting oryx in their natural habitats. More importantly, it is anticipated that legal and sustainable trade will decrease the oryx price in illegal markets as it will render buyers to purchase oryx legally rather than being involved in criminal activities through illegal trade. On the other hand, the latest population estimates of Arabian oryx in Arabia are alarming as 73% (more than 2,800 oryx) of the oryx population is held in captivity (Ostrowski & Anajariyah, 2003). Moreover, the conservation purposes of some of the captive oryx herds are questionable. As a result, it is the time to investigate the question “can well-regulated trade of Arabian oryx in the region contribute to their future survival in the wild?” Considering the sensitivity of this proposal, the status of oryx re-introduction can be summarized by “*use it or lose it*". Unfortunately, a few oryx re-introduction publications investigate the conservation management issues of re-introduction (e.g. Stanley Price, 1989).

Regional Collaboration

Since 1999, Oman has addressed its oryx plight to other conservation organizations in the in the Gulf region. The establishment of the Coordination Committee for Conservation of Arabian oryx, secretariat based in UAE, in 2000 was one of the results of this regional collaboration. Moreover, the government of Oman has been starting to establish collaborative committees with its neighboring countries in the region to discuss all relevant aspects of mutual concern. If oryx conservationists can introduce the oryx poaching and trade issues in these committees, then the oryx poaching can be further investigated by top politicians for action.

Conclusion

The plight of oryx in Oman has been accelerated by two key factors including *in situ* protection measures and the growing needs of local people to have high standard of living. Both these factors are at the heart of conservation challenges at both national and global levels. Unfortunately, local needs are out of the concern of CITES Appendix I, where total protection of endangered species is prioritized. Increasing rangers force, as well as promoting law enforcement is a key measure to enhance *in situ* oryx conservation. Currently, the Oman government is establishing a special wildlife anti-poaching unit at the Arabian Oryx Sanctuary and the unit soldiers were selected from different local communities of central Oman. It is planned that the anti-poaching strategy of this unit to be based on both ground and air surveillance. The feasibility of initiating legal controlled trade of Arabian oryx in the region is a management option that needs to be reviewed in a scientific and socio-economic context. Regional collaboration should also be viewed as a key requirement to openly discuss, as well as address oryx trade issues to political decision-makers.

Views expressed in this article are of the author's and may not necessary be those of the Office of the Adviser for Conservation of the Environment or the Arabian Oryx Project.

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Re-introduction of muskoxen in Northern Russia

A considerable part of the territory of Russia faces the Polar Ocean and these large territories have a severe climate with long periods of low temperatures. The task of re-introducing muskoxen (*Ovibos moschatus*), which are well adapted to this habitat, seemed challenging for biologists in Russia. According to Vereshagin & Barishnikov (1985), this species has inhabited the Taimyr Peninsula only relatively recently, where remains of muskoxen of 2–4,000 years old have been discovered. Re-introduction of muskoxen will help in the restoration of the biological diversity of the Northern ecosystems. Also re-introducing a mega-herbivore will boost the utilization of vegetation of this region and hopefully restore the vegetation communities to their previous state. Also, the re-introduced muskoxen shall become a dependable food resource for the residents of Northern Russia as research shows the ecosystem is capable of sustaining over 2 million muskoxen. The Polar Ocean shoreline was chosen as a re-introduction site for the muskoxen and according to the re-introduction plan, a chain of herds, located within 600-700 km from each other is planned to be established. A young male muskoxen bull is capable of migrating 800 km (Yakushkin, 1998) and genetic exchange between these herds will be possible in forming a larger area occupied by the muskoxen.

Initial re-introductions of muskoxen took place in 1974 and 1975 when 10 and 20 animals were translocated from Banks Island (Canada) and Nunivak Island (Alaska, USA) respectively, to the Eastern part of Taimyr Peninsula. The population fanned out successfully, spreading to the north, east and south (Putorana Plato) of the Peninsula and there were 2,500 individuals in 2002 (Sipko *et al.*, 2003). In 2005 the numbers increased to 4,000. By 1975, 20 muskoxen from Nunivak Island (Alsaka, USA) were delivered to the Vrangel Island where the population increased slowly, as a significant amount of the animals did not survive the initial period of acclimatization. By 2003, the number of individuals on the Island rose to 750 individuals (Gruzdev *et al.*, 2003) and have presently stabilized to about 800-850 individuals.

Approach

Further individuals for re-introduction were received from

Muskoxen (*Ovibos moschatus*)
© T. P. Sipko

donor populations on Vrangel Island and Taimyr Peninsula. Age limits for animals were approximately 0.3–3.5 years old, though most of the animals captured were 0.5 years old. Vrangel Island is a nature preserve and vehicles with low-pressure tires and snowmobiles were used for the capture. After the animals are surrounded by people with dogs, selected individuals were sedated with a syringe fired from an air-gun. Sedated individuals were separated from the main herd, and placed into cases for transportation to the enclosures. Helicopters were used for transportation of the animals from the Island to the enclosures near the airport on the mainland. Before loading on the plane the animals were put in individual transportation boxes. Upon arrival, the individuals were either delivered to the site of re-introduction, or to the enclosures for temporary holding. On Taimyr Island, a helicopter was used to locate and transport the muskoxen and the method of capture and transport was the same as on Vrangel Island.

Discussion

The first stage of re-introduction of muskoxen to Northern Russia, starting in the 1970's proved to be successful and set the precedent for future re-introduction efforts (Sipko & Gruzdev *et al.*, 2003). Permanent surveillance of the re-introduced muskoxen is hampered by large distances between the different release sites. Counts performed in Yakutia in 2005, recorded 347 muskoxen (total for four release sites) and the numbers of individuals have more than tripled in 10 years. The Bulun area population has split into two with one part of the population moving 120 km west to the delta of the Lena river, where they currently remain. The fastest growth of muskoxen has been observed in the Allaikhov area, where 18 calves have been born in three years. Complicated working conditions and long distances mean a longer transportation time for these animals and therefore requires skilled specialists to accompany them along the way. Additional to the animals captured for re-introduction an additional 81 muskoxen were captured for domestication experiments and for zoological parks. The experience of the capture team is seen as necessary to keep mortality within 10–15%.

The project has shown that individuals from Taimyr Peninsula have adapted to the habitat in Central Siberia compared to those from Vrangel Island, eastern Russia. There are plans for the release of muskoxen to the mountain systems of Northern Asia, which are currently under development.

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Re-introduction of moose into Kamchatka, Russia

Kamchatka Peninsula has been developed by the Russians since the 17th Century and there are no records of moose on the peninsula. The wildlife of Kamchatka is low in diversity when compared to the mainland and both lynx *(Felis lynx)* and squirrel *(Sciurus vulgaris)* appeared only in the 20th Century (Valentsev & Mosolov, 2004). Though there is some archeological data of evidence that in the 11th–16th Centuries moose were present in the south and east of the peninsula (Vereschsgin & Nikolaev, 1979). It was in this data that our interest lay for the re-introduction of the moose (*Alces alces buturlini*) to Kamchatka.

The moose is known to inhabit the north-eastern part of mainland Russia, but in past centuries these animals were rather scarce. Growth of moose populations in this region dates back to the middle of the 20th Century and by that time spatial redistribution of the aboriginal population had already been accomplished, they concentrated in small settlements leaving vast territories without any hunting pressure. This whole region was also involved in a wolf extermination campaign widely using toxic chemicals and as a result the moose population in mountain taiga portion of the river Penzhina basin had reached 2,000 individuals by 1974 (Fil, 1975). This was considered as a suitable donor population for our re-introduction project. The peninsula was explored and its inner part, i.e. the Kamchatka river valley was considered as a suitable habitat for moose. On the west, south and east the territory was surrounded by mountain ridges that protected it from heavy snow, and this was a good feature for feeding moose. Also it became evident that the southern areas of Kamchatka region were inaccessible for moose because of mountains, deep snow and an ever growing poaching pressure, although food resources were considered adequate. The only problem was snow cover depth which for this species is critical at 120 cm. Additional studies showed that the height of the snow cover was not uniform due to strong winds and numerous rivers did not freeze due to frequent thaws and volcanic heat. Therefore it was positively assumed that the moose would be able to adapt to the conditions of the southern areas of the peninsula.

Approach

The project was divided into two stages, each having its own unique features. The first stage, in 1977-1988, included capturing of 63 individuals in the area of river Penzhina tributaries (Pavlov, 1999). They were transported to the inner part of the peninsula, i.e. river Kamchatka valley and as a result a stable population formed and a part of which even migrated to the western

Moose (*Alces alces buturlini*)
© T. P. Sipko

coast of Kamchatka. According to a 2004 census, the moose population in the central Kamchatka numbered about 1698–1775 animals (Sipko *et al.*, 2004). Moose were caught in the valley of river Belaya, Penzhina's tributary, and individuals trapped were nine months old. At first with the help of helicopter they were driven away to a treeless area and then tranquilized with immobilizing drugs shot from a helicopter. The motionless animals were transported by helicopter to an open-air cage, where they stayed for 5-7 days to recuperate. After that the moose were once more immobilized, put into individual cages and delivered to the release site by helicopter. The transportation time was about nine hours and at the site animals were kept in an open-air cage for 15 days and then released into the natural environment. In cases where the depth of the snow cover was 60–70 cm, the moose were released immediately. In 1979 the first calf was recorded in this new habitat.

During the second phase, the moose in the new population established in the inner part of the peninsula, were captured. In April and March 2004–2005, a total of 26 animals were trapped, transported, and released and most of them were about 11 months old, and four were two-year olds. Trapping took place in the Kamchatka river basin of the where tall trees prevented a helicopter being used to its fullest extent. Moose detected from the helicopter were driven to a clearing in the wood, where the helicopter could land and afterwards a snowmobile was unloaded and used to chase and immobilize the moose. Once captured, they were tied, put on a sledge and placed into individual boxes where they were kept for one to three hours until their respiratory function and motor activity fully recovered. Only after that they were loaded into the helicopter and transported to the release site which took about five to six hours. The moose were released into the wild in the south of the peninsula, in the valley of Golygina and Udochka rivers. As a rule they were left on thermal grounds (areas warmed up by volcanic heat – usually they have no snow cover all through the winter) and in Autumn 2005 there was a moose-cow recorded with a calf.

Discussion

In the winter of 2004-2005, snow cover in Kamchatka was extremely high and for the first time during the whole period of observation it exceeded 150 cm. and this was of considerable concern, as the future of the released moose seemed very uncertain. Despite these extreme conditions the re-introduced animals over-wintered and only one was killed by a bear in the spring. Therefore it may be concluded that re-introduction of moose into the peninsula is going on successfully and this project as a whole is important for the development of tourism and hunting in the region.

The moose inhabiting the peninsula are very large in size, they are the largest among all Eurasian specimens, this being a characteristic feature of the local population. Slaughter weight of a big bull is 600–750 kg, outside spread of the antlers about 161.5–175 cm (n=6), the greatest reaching 181 cm-this specimen was killed in 2002 in Ust-Kamchatskyi district. Eleven month old calves weigh between 220–325 kg (n=10). The bulk of these animals was the reason for some problems during their immobilization as the dose of the injection was increased, and this caused considerable difficulties in restoration of the animals from drug-induced shock. Besides, the moose were too heavy to reload and as a rule larger animals especially moose are difficult to transport by helicopter and it takes a lot of time and effort to restore their normal physical condition.

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Re-introduction of European bison in Central Russia

The total number of European bison in the world has not been increasing during the last 15 years, and numbers about 3,000 individuals, found in small groups in numerous captive centers and free-roaming populations. Each separate population usually has five to seven ancestors from 12 individuals that are founders of all contemporary bison (Belousova, 1993). They have very high inbreeding coefficients that are 44% in the Lowland line and 26% in the Lowland-Caucasian line (Olech, 1998). Recent studies have shown that inbreeding has

taken place during a longer period and the real inbreeding coefficient of bison is actually higher (Sipko, 2002). As a result, symptoms of inbreeding depression are already being observed (Sipko, 2002). It is necessary to have an effective size of 500 individuals to save the species from extinction and guarantee its survival and to preserve its genetic polymorphism (Soule,1987). The effective population size basically depends on the abundance of mature and sexually active animals and their sex ratio and level of inbreeding. It is usually about 25-35% of the total number of the bison population, thus creating a population of 1,500-2,000 individuals can ensure the survival of the species. There are risks from epidemics and other unforeseen events thus the need for two geographically separate populations. There are suitable territories for such a population only in Russia. After extensive research the following territories which fulfill the biological conditions of European bison, are seen to be appropriate and have long-term protection. They are the 1) Bryansk-Oryol-Kaluga region in the European part of Russia within the Central Russian sub-province of the European broadleaf forest region, 2) the Ust-Kubenskoye Hunting Facility (260 km^2) is the second territory and is situated approximately 400 km north from Moscow in the Vologda region (Vologodskai oblast).

Approach

Animals for re-introduction have been taken from breeding centers of Russia and West Europe. Their gene pools are different because bison from Russia and West Europe have been isolated from each other for almost 100 years. Using non-related bison for breeding is important to have a genetically diverse population. Animals for re-introduction have been transported in boxes and usually released 1-2 months after capture. The transportation of bison for long distances in individual boxes has had good results in Russia compared to transporting several animals in large boxes. The European method of having several animals in large boxes has caused mortality and injuries.

Discussion

The bison population which is created in the Orlovskoye Polesie National Park territory has the biggest genetic potential compared to other bison groups in the world. This population is in the stage of intensive growth and 20 calves were born in 2005. Animals move to areas adjacent to the park and regularly appear in the Kaluzhskie Zaseki State Nature Reserve. There are three separate herds of bison forming the population and it is necessary to release additional bison in the shortest possible time to get an optimal number of animals. The release of bison in the Bryansky Les State Nature Reserve was unsuccessful and the last individuals have been translocated. Their long migrations and crossing of the Russia-Ukraine state border resulted in poaching was the main reason of decline. There is also a need to find new bison to supplement the Ust-Kubenskoye Hunting Facility' population. The region situated between the Volga and the Oka rivers has a large population density of bison and this area has a lot of industrial works and road networks with very intensive traffic. This lowland area has small sites of coniferous forest land namely Vilikoozerskoe Hunting Facility, Muromskijj sanctuary and Sknjatinskoe Hunting Facility. These areas do not have

European Bison (*Bison bonasus*)
© T. P. Sipko

enough space for further increase of bison numbers and a low population growth and numerous cases of bison death have been observed and additional re-inforcements of bison in these areas is pointless. The supplementation of bison to the Bukovina population in East Carpathian from Netherlands for restoration of bison number is not appropriate, as males, which have lived on plains, cannot compete with local bulls born in the mountain conditions, during the rutting season. There is a low rate of bison increase amongst captive collections worldwide and the European bison pedigree book (2002) notes that 172 bison were born whilst 112 bison died. Therefore there is a lack of animals for creation of viable long-term populations (Sipko *et al.*, 2004).

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Re-introduction of gray wolves to Yellowstone National Park, USA

Yellowstone National Park (YNP) was established in 1872 as the world's first national park. At that time, wolves (*Canis lupus*) were present but it was government policy to eradicate them to protect ungulates and other "game" animals. By 1926 the last wolf had been killed in YNP, and the area outside the park by the mid-1930s. Other than occasional unverified sightings, there were no wolves present from 1926 through 1995. In 1995 and 1996, the U.S. Fish and Wildlife Service (USFWS) in conjunction with the National Park Service (NPS), both arms of the government that had conducted the eradication, re-introduced 41 wolves from Canada and northwestern Montana. From the beginning wolf re-introduction was controversial. Wolf killing in the western United States was within the memory of many people and their immediate offspring. Western culture and economy were oriented toward resource extraction including livestock production and hunting and was strongly anti-wolf. Comments like, "We killed them for a reason, were my grandparents wrong?" were common. Coupled with a general animosity toward the government, this created a volatile, often hostile feeling toward the program. Local people, who would live near wolves once they were re-introduced, resented people living far away in cities lobbying and funding re-introduction, noting that the city dwellers would not have to deal with the wolves once they were restored. This urban/rural dichotomy still exists and has not been adequately addressed or reconciled. The result has been a strongly polarized public with both sides well funded and politically connected.

This controversy was not unpredicted. The USFWS and NPS conducted unprecedented public outreach and communication: Public meetings in towns around the area, press releases in newspapers, magazines, television and radio occurred for years. Several preliminary studies and an Environmental Impact Statement were also published. Despite this when wolf re-introduction occurred many people claimed they were not informed, and that the government said that the wolves would be restricted to YNP; a main point of public outreach was that the wolves would roam freely past the boundaries of the park. Wolf re-introductions and translocations had occurred elsewhere prior to Yellowstone. Alaska, Michigan, North Carolina, Montana and Minnesota were some areas wolves had been either re-introduced or moved. Each effort produced mixed results, but a conclusion was that acclimating, or holding the wolves on site in pens, prior to release increased the chances that wolves would remain in the release area. Hence, our design in Yellowstone included re-introduction after a period of acclimation in specially constructed pens on site.

Methods

Fourteen free-ranging wolves in 1995 and 17 in 1996 were captured in Alberta and British Columbia, Canada, respectively, via helicopter darting. Ten orphaned wolf pups, their parents were killed due to conflicts with livestock, from northwestern Montana were also re-introduced in 1997 (only two of these pups survived past nine months after release and cause of death was control

Gray Wolf (*Canis lupus*) pack attacking bison in Pelican Valley February 2005
© Doug Smith / NPS

due to conflicts with livestock or vehicle strikes). We selected these areas because prey and topography was most similar to Yellowstone National Park and central Idaho (another re-introduction area). Wolves were held in approximately one acre pens for ten weeks before release. Ten foot high pens were constructed out of chain link fencing that had no corners, a two-foot overhang, and a four-foot ground apron. The overhang and apron were to prevent climbing and digging. Pens were located approximately 1-2 kms from a paved road that allowed year-round access. Wolves were fed twice a week eviscerated road-killed elk (*Cervus elaphus*), bison *(Bison bison*), deer (*Odocoileus hemionus*), and moose (*Alces alces*). Mule drawn sleighs or snowmobiles were used to transport carcasses to the pens. Feeding trips were short and wolf exposure to humans limited. Security guards secured a perimeter around the pen of varying proximity due to geography but far enough so as not to disturb the wolves, but close enough to guard against any poaching attempts. Pens were continuously monitored by security guards.

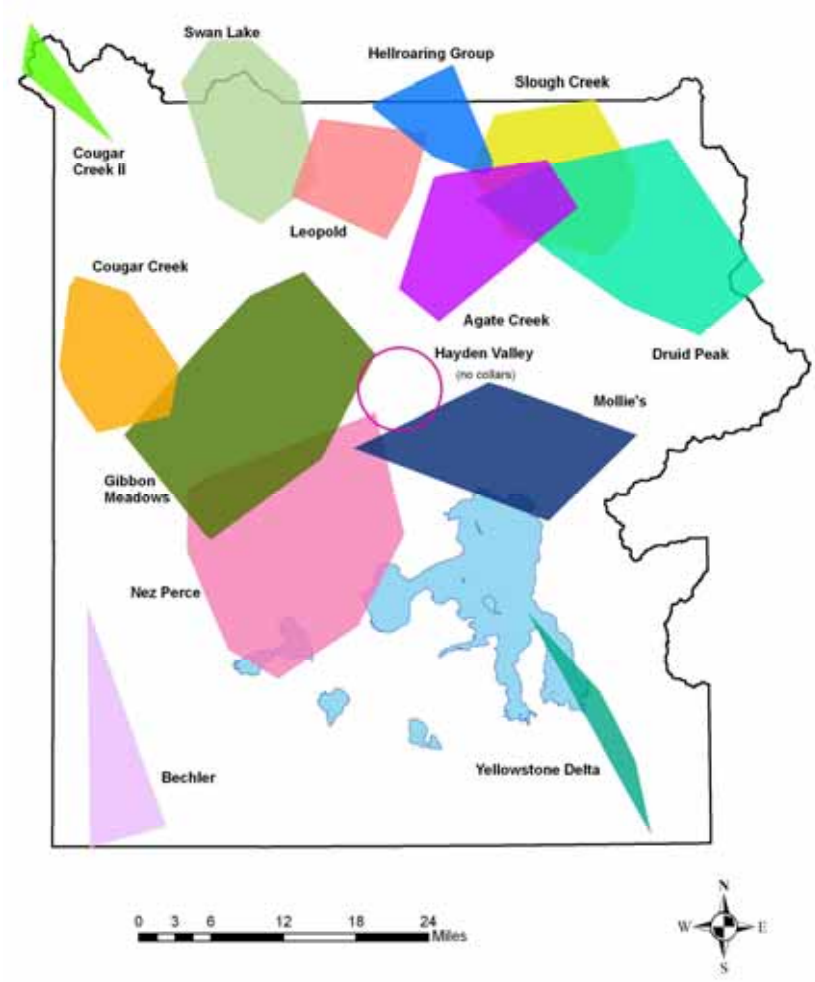
Wolves were placed each year in pens in January just prior to the breeding season and released directly from pens ("soft" release) in late March or early April. All wolves were radio collared to monitor wolf assimilation into the new environment, allow proactive management, and conduct long-term studies. Wolves were captured in packs in Canada to re-introduce family groups, not individuals. We were not able to capture entire packs, but subsets of them. Besides restricting movement post-release, acclimation was also intended to maintain social bonds between pack members post-release which have been found to dissolve due to the stress of capture, handling, and relocation. In several cases we were not able to capture multiple members of the same group, so we created packs inside the acclimation pen. Pairings of same sexed adults were avoided, but females with pups of either sex introduced to an adult male in a pen were successful. Release from pens was achieved first by opening the gate through which we accessed the pen, but we found that most wolves avoided the gate. Removal of several pen sections was necessary to encourage the wolves to leave, and even then departure from pens was not immediate except in one case.

Results

We released seven groups of wolves (41 individuals) after ten weeks of acclimation; an eighth group was acclimated seven months. In five cases (Nez Perce, Sawtooth, and Lone Star releases excepting) family ties were maintained and the wolves traveled and remained together post-release. The Nez Perce pack, a complete pack with breeders and pups, split up upon release and did not reunite. The Sawtooth group, which comprised two (a sibling adult male and female) Nez Perce (recaptured after unsuccessful initial release) and ten Montana wolf pups introduced to each other in the pen, also did not stay together post release after seven months of acclimation. The Lone Star pair failed because the female was scalded in a hot spring and died as a result of her burns; the male later successfully paired and produced young in the wild. One successful release (Soda Butte pack) resulted in capture and re-release because the pack had settled on a ranch north of YNP and was not welcomed there. This pack was successfully re-released in the extreme southern end of YNP.

Wolf packs quickly settled and showed territorial behavior within months after release (Figure 1 territory map). Two aggressive interactions were recorded between wolves released in 1995 and 1996. Wolves from 1995 (Rose Creek and Crystal Creek packs) had successfully established territories and newly released, wandering 1996 wolves (Druid Peak pack) encountered 1995 territorial wolves. In both cases wolves were killed, in one case it was a yearling male wolf that had no impact on the resident pack (Rose Creek pack). In the second case (Crystal Creek pack) the breeding (alpha) male was killed, a litter of pups was lost, and the breeding (alpha) female was injured. Only two Crystal Creek wolves survived this attack and they abandoned their territory leaving it to the invading Druid Peak pack who resided there until they were displaced by another pack (Slough Creek pack) in 2005. No other re-introduction related encounters were documented.

Figure 1. 2005 YNP wolf pack territories



Once territories became established, wolf packs produced pups, which in turn dispersed and resulted in naturally forming packs. Wolf population growth the first five years was rapid averaging 40-50%/year and 10-15%/year the next five years. From the initial 40 released wolves and eight packs the population grew to 174 wolves in 14 packs in 2003. Since 2003 the population has declined to 118 wolves in 13 packs in late 2005. The decline was due to high pup mortality (22 of 69 (32%) survived) in 2005 that was probably due to canine parvo-virus (CPV), a disease introduced to the park from domestic dogs. Leading causes of mortality were humans (control actions, poaching and vehicle strikes) wolf-wolf killing (intraspecific), and wolves killed by prey (interspecific). Wolf prey has largely been elk, but all eight ungulate species living in YNP have been killed by wolves. Wolf predation on elk has been highly selective with calves preferentially killed in early winter, and old females (average age 14 years) and bulls preyed upon in late winter, although ongoing drought is likely changing predation patterns. Initially bison were not preyed upon but in some areas of YNP where elk are limiting, especially in winter due to migration, bison are becoming a more important food source. Mule deer comprised approximately 25-40% of the summer wolf diet.

Preliminary results indicate that wolves may be having strong ecological effects on the Yellowstone system. Twelve different scavenger species have been documented using wolf-provided carcasses. Grizzly bears (*Ursus arctos*) usurp wolf kills at will, "winning" approximately 80% of contest over wolf kills and this may be an important food source for bears in years when other key foods are not available. Coyotes (*Canis latrans*) were frequently killed by wolves and their population may have declined but is again increasing due to behavioral adaptations (e.g., fewer pack coyotes, more independents). Finally, some areas of woody vegetation may be recovering after nearly a century of suppression by an abundant elk population. Wolves have caused elk behavior to change which has indirectly (trophic cascade) affected willow (*Salix* spp.) and potentially aspen (*Populus tremuloides*) and cottonwood (*Populus* spp.) growth. Beaver (*Castor canadensis*) populations have responded to increased willow as well as songbirds, but

songbird data collection is ongoing.

Conclusions

Re-introduction of wolves to YNP and the surrounding area has been deemed a success. Our initial plan called for 3-5 years of releases and we accomplished recovery with only two years. Wolves are now considered ecologically recovered inside the park. Wolves have helped restore "natural" conditions to the park, a long standing policy objective of the United States National Park Service. Although we did not test the scientifically best wolf re-introduction technique, we achieved success through pen acclimation with a "soft" release. Visiting wolves twice a week to feed them did not habituate them. Release of family groups also was successful, although "hard" release of individuals was successful in another project in Idaho but that area had more habitat for wolves to roam, find each other, and not encounter humans.

The unsuccessful releases we believe were due to accidental mortality (thermal burns), poor group composition, and possibly disturbance from snowmobiles. In the situation with poor group composition 10 orphaned wolf pups from Montana were acclimated with two young adult wolves that had been re-captured and re-acclimated due to a failed release. This particular joining did not produce a cohesive group or pack post-release even for a few days, suggesting that wolf releases should be of individuals, related individuals (family group), or sexually mature individuals of opposite sex both with an without young. Lastly, the only pen that was accessed via snowmobile was also the pen where a family group broke up immediately upon release. Park snowmobile traffic was also audible from the acclimation pen. Coming from Canada where wolves encounter snowmobiles and where hunters and trappers use them as transportation, this could have been a factor in an unsuccessful release.

Avoiding the aggressive encounters between wolves released different years could have been avoided had we not used the same acclimation pens for releases the second year. This presents a significant logistical problem, however, as pens are costly and labor intensive to build so building multiple pens is not a simple undertaking. It was necessary to release more wolves the second year for purposes of genetic diversity, compensating for unsuccessful releases and illegal mortality, so this problem is not easily solved. Outside of Yellowstone recovery of wolves has created more wolf-human conflict. People opposed to wolf re-introduction are still opposed and routinely seeking short-term political fixes. Numerous lawsuits have ensued and are ongoing. Delisting, or removal from the U.S. Endangered Species List, is stalled due to disagreements between the federal government and the state of Wyoming on how wolves should be managed. It is hard to address the wolf-human conflict in that many solutions have been tried. The public outreach prior to re-introduction was unprecedented for the U.S. Government, yet still there was controversy. Some analysts feel greater involvement with a wide array of groups and people (stakeholders) prior to re-introduction planning would have been better in that what occurred was that the government presented a choice between already formulated plans created by a team of government and non-governmental experts, and did not open planning to a wide public. Whatever the solution carnivore re-introduction will require as much sociology as biology, if not more of the former.

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The re-introduction of endangered wild dogs into Hluhluwe-iMfolozi Park, South Africa: an update on the first 25 years

The African wild dog (*Lycaon pictus*) is classified as "Endangered" according to the 2004 IUCN Red List of Threatened Species and is therefore considered to be facing a very high risk of extinction in the wild in the near future. Major threats to wild dogs include human-induced mortality, habitat transformation, interspecific competition with other large carnivores and exposure to infectious diseases (Woodroffe *et al.*, 2004). Therefore, the traditional focus of wild dog conservation efforts has been mainly on mitigating these negative factors in the few remaining viable populations in large protected areas (Woodroffe *et al.*, 2004). However, considering increasingly fragmented landscapes, the absence of sufficiently large protected areas containing suitable wild dog habitat aside from Kruger National Park exactly is the problem in the context of South Africa. After a Population and Habitat Viability Assessment for wild dogs in southern Africa was conducted in 1997, a complementary conservation approach was proposed (Mills *et al.*, 1998) and subsequently implemented, whereby separate sub-populations of wild dogs in several small, geographically isolated conservation areas in South Africa are managed as a single meta-population. This intensive management approach–to supplement the single viable population occurring in Kruger National Park–involves the re-introduction of wild dogs into suitable conservation areas, and periodic translocations among them to mimic natural dispersal and maintain gene flow. Here, we report on the successful re-introduction of wild dogs into Hluhluwe-iMfolozi Park, the core conservation area of the meta-population management plan, updating a previous report by Maddock (1995).

Wild Dog Re-introduction into Hluhluwe-iMfolozi Park

The approximately 900 km^2 Hluhluwe-iMfolozi Park (HiP; formally Hluhluwe-Umfolozi Park) is located in northern KwaZulu-Natal Province, eastern South Africa, just south of 28° and around 32° east. HiP, which was proclaimed in 1895, lies about 300 km south of Kruger National Park, which has the nearest viable population of wild dogs. The park with its subtropical climate has a diverse topography and the predominant vegetation is bushveld savannah. HiP supports a large potential prey base and a broad spectrum of large carnivores, including lions (*Panthera leo*) and spotted hyenas (*Crocuta crocuta*). The park is enclosed by an electrified fence; however, wild dogs and other large carnivores are notoriously difficult to contain within the perimeter fence that separates HiP from the densely human populated surroundings. There is also a public tarmac road bisecting the park. Wild dogs originally were widely distributed in KwaZulu-Natal, with breeding

packs being found in the Zululand region, where HiP is located, still at the beginning of the 1900s. Farmers and state-employed game rangers then extirpated wild dogs presumably for killing livestock and because of their bad reputation. The last pack was recorded in Zululand in the 1930s and after that only stragglers were encountered. After an absence of half a century, 22 wild dogs were re-introduced into HiP in four stages in 1980 and 1981 by the then Natal Parks Board (now Ezemvelo KZN Wildlife). Wild dogs started leaving the park in 1984 and occasionally returned or were chased back, although the majority of emigrants left permanently and settled outside HiP on private land or have emigrated further away since then.

This re-introduction was considered successful based on the survival and breeding of a single pack formed by the released animals (Maddock, 1999), which has persisted up to present. However, despite an addition of four animals in 1986, wild dog numbers in HiP fluctuated greatly over the years and dwindled to a mere five animals in 1996 (Figure 1), without any signs of breeding activities among the remaining individuals. It was then decided to increase the number of wild dogs in an attempt to stimulate breeding through a translocation of four animals to the park in 1997. This was the first implementation of the meta-population management plan, in which the previously largely isolated HiP became linked to other conservation areas through translocations. Another ten animals subsequently were added to the park in 2001 and 2003. All translocations were soft releases, except for 1986. At the end of 2004, there were 48 known wild dogs living in six packs (Figure 1), and future translocations of wild dogs to and from HiP are envisaged. In addition, an unknown number of wild dogs occur around HiP on private land.

Conclusions

Large carnivore re-introductions generally have proved to be problematic and prone to failure for biological and non-biological (i.e. technical, organizational and valuational) reasons. In line with this, many attempts to re-introduce wild dogs met with limited success due to various, often unknown causes, and re-introduction is thus not considered a high priority in wild dog conservation (Woodroffe *et al.*, 2004). Nevertheless, particularly with the implementation of the meta-population management plan, wild dogs have been successfully re-introduced into various sites in South Africa, but the factors leading to success remain elusive. In this regard, the experiences made during the first 25 years of the wild dog project in HiP have greatly improved our understanding of various aspects that are likely to affect the outcome of wild dog re-introduction and translocation attempts,

African wild dog (*Lycaon pictus*)
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particularly as applied in a meta-population management approach (Moehrenschlager & Somers, 2004). Our forthcoming publications on correlates of re-introduction success in wild dogs, including socio-political, behavioural, ecological and modelling data, thus should represent a multi-disciplinary assessment of best practice in large carnivore re-introductions in general.

Acknowledgements
We thank all the people who have been involved in wild dog re-introduction, translocation and monitoring projects in Hluhluwe-iMfolozi Park over the last 25 years, particularly Anthony Maddock and the responsible staff members of Natal Parks Board/Ezemvelo KZN Wildlife.

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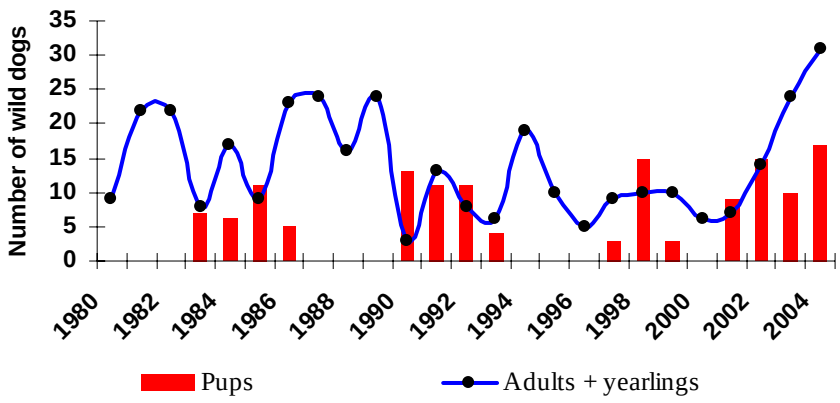
Figure 1. Wild Dog Numbers in Hluhluwe-iMfolozi Park



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Re-introduction of swift fox to the Blackfeet Confederacy Tribal Lands of western North America: three programs, three realities

Swift fox (*Vulpes velox (V.v. hebes)*) native to the great plains of North America and once common throughout its range, are of cultural and spiritual importance to the Plains Tribes. Originally occurring from the US Texas panhandle to Canada's North Saskatchewan River and, west to east across the continent, from the eastern foot hills of the Rockies into Manitoba and Illinois, the swift fox was extirpated from Canada (1920's) and northern USA (1950's). By 1978, the species was classified by the Committee On the Status of Endangered Wildlife In Canada (COSEWIC, 1978) as Extirpated in Canada. Status in US: Swift fox were regarded as occupying 10% of their range and a Candidate 1 species for protection (US Federal Register, 1993, 1995). Based on vegetation mapping, current US geographical distribution of swift foxes re-evaluated to occupying 40% of its range (Kahn *et al.*, 1997), species down listed from Candidate 1 status. Between 1971 and the present Cochrane Ecological Institute (CEI), has initiated, participated in or implemented three swift fox re-introduction programs (Table 1); Canada (1983-1997), US (1998–2002) on Blackfoot lands, Canada (2001 on-going) on Blood (Kainai) Lands in Alberta.

Canadian Program

The CEI, considered the re-introduction of the swift fox (*Vulpes velox*) in Canada as a key contribution towards the restoration of the short and mixed grass prairie ecosystem. Therefore CEI, a non-governmental agency, founded Canada's only swift fox captive breeding colony in 1972. This action resulted, under Provincial permit, in the Canadian swift fox re-introduction program (1983–1997). Program eventually directed by a national Swift Fox Recovery Team (SFRT). SFRT, largely comprised of Canadian provincial and federal government representatives, operated in a jurisdictional role, controlling re-introduction site selection and re-introduction methods. No input from landowners or Aboriginal peoples was requested or used. The goals of the SFRT (National Recovery Plan, (Brechtel, 1996) were:

- Primary: To achieve a viable, self-sustaining population of swift foxes, well distributed across suitable habitats on the Canadian prairies, which would result in the removal of the species from the endangered category by the year 2000, and
- Short-term Objectives: To establish two geographically distinct, but genetically connected core populations with a spring density of an average of five adult foxes per township (93.24 km^2) on 80% of the suitable habitat (currently estimated as a total population of 420 foxes) by the year 2000,
- to identify and ensure long-term security of key swift fox habitat on two core areas of the Canadian prairies.
- to ensure the establishment of swift fox in at least 50% of its remaining suitable habitat on the Canadian range

CEI was initiated in 1972 and maintained a studbook, provided information to government agencies and, in 2005, to the studbook manager for the new swift fox SSC. Resulting from a program initiated in 1993, the DNA of all CEI captive bred swift fox is registered. Funding 1978-991: federal monies accounted for 10% of the cost of maintaining the captive colony, a sum increased (1994-1997) to 20% through provincial contribution. SFRT, undertook three years research (Brechtel *et al.*, 1991) concluding spring was an unsuitable time for release and funding, government and NGO, was better spent on translocation and release of wild stock from the USA in preference to production of Canadian captive-bred animals for re-introduction. Annual re-introductions up to and including 1997, resulted in an estimated wild Canadian swift fox population of 289 split between two "island" sites on the Canada/USA border. Population estimate based upon a calibration census technique, developed in the "core' re-introduction site, assumed every fox trapped equaled 3.5 un-trapped (Cotterill, 1997).

After 1997, no further re-introductions were permitted in Canada and, in 1998 with a population survey estimate unchanged from 289, the species was reclassified as Endangered in Canada (COSEWIC, 1998). The last swift fox survey was completed in February, 2001, resulting in a population estimate of 650. Current (2006) population is unknown but a survey is presently underway. New federal legislation, Species At Risk Act (SARA) was proclaimed in Canada in 2002. SARA is applicable on federal lands, including Tribal land, and requires federal SARA permits. Recovery Teams, and Recovery Plans written prior to 2002, are unrecognized. SARA legislation requires Recovery Strategies. SARA expectation for the new Recovery Strategy, reflect those of the old Recovery Plan, action on habitat protection, habitat mapping, negotiation for species protection between jurisdictions, breeding/ wintering surveys, public outreach, demographic and genetic studies. The cultural value of swift fox re-introduction to indigenous peoples is not a primary requirement for a Recovery Strategy under SARA. With the exception of winter live trapping surveys (1996-87, 1998-99, 2000-01) few requisite actions have been completed, and with these actions uncompleted and current numbers of swift fox in the wild unknown, no decision on re-introduction can be incorporated into the Recovery Strategy.

Blackfeet Program

In 1997 discussions were initiated between the Blackfeet Tribe, Montana, USA and CEI, aimed at returning the extirpated swift fox to land under federal jurisdiction (USA) and Tribal ownership. The lead agency was the Blackfeet Tribal Fish & Game Department, the land, a culturally significant site on native range on Blackfeet Lands, Montana, USA. Sites were selected by the Tribe on the basis of Traditional Aboriginal Environmental Knowledge (TEK). This use of TEK was a first in swift fox re-introduction. Suitability of the site was confirmed by a pre-release biological evaluation undertaken by the CEI. The resulting 5-year program (1998–2002) was the first swift

fox re-introduction in the USA. Canadian captive-bred swift fox were introduced annually. The use of Portable Protective Shelters (PPS) release methodology (Smeeton & Weagle) was employed. All swift fox released were part of a Natural Resources DNA & Forensic Profile Centre, DNA analysis project (Cullingham, 2003). As funding was solely dependent upon charitable donations to the CEI and the Blackfeet Tribe, severe limitations on the level of research possible were unavoidable. The limited research indicated that in 2002 the swift fox population on the Blackfeet Tribal lands were established and the population was increasing. This received further study and the results will be available shortly as a MSc thesis from the University of Montana, USA.

Blood Tribe Program: Kainai Siinopaa Re-introduction

The Blood Tribe, Alberta, Canada, and the Blackfeet, Montana, USA, are members of the Blackfoot Confederacy. This ancient association of four Tribes, native to the western most prairie, is now split by the Canada-USA Border. Blackfeet land runs south from the Border, while the 1,424.49 km^2 of Blood (Kainai) lands lie north, both well within the historic documented range of the swift fox. The Kainai Siinopaa re-introduction is sited on fescue prairie/foothill country adjacent to two national parks, Waterton, Canada and Glacier, USA, the two parks provide a protected corridor of classic swift fox habitat joining the Blackfeet site, Montana, USA, and the Blood Tribe site, Alberta, Canada. This protected corridor joining two re-introduction sites in two different countries is a first in swift fox re-introductions in North America.

In 2001, an elder from the Blood tribe approached CEI and requested a swift fox re-introduction partnership. Over the next three years, one year of government funding was obtained. In 2004, the first swift fox were re-introduced on Blood land. Additional funding for this program was put in place by the Blood Tribal Council, and Blood Land Management created a technical position to support the work. The program overall was designed by CEI to incorporate the lessons learned in the earlier Canadian Program and in the Blackfeet program, including a Band Council Resolution, technological exchange, biophysical survey, GIS habitat mapping, public outreach, TEK, DNA and long-term post release monitoring. The cultural importance of swift fox re-introduction resulted in the return, from museums to the Tribe, of Swift Fox regalia and the revival of the Swift Fox Society. The existence of all these components in one program has made the Kainai Siinopaa re-introduction unique. The new complication in Canada was SARA. The 2004/05 work was conducted under a SARA permit issued to the Blood Tribe. The contradiction is that although permitted under SARA, the program is unsupported by the SFRT. Funding after the first year is dependent upon successful grant applications to government and charitable foundations and the future of the program is in doubt.

Discussion

These three programs illustrate the differing perceptions involved in partnerships (First Nations, government of Canada, in this case, and NGOs) with aboriginal peoples in endangered species re-introduction in North America.

First Nations: The aboriginal perspective was clearly stated by Ira Newbreast, "…from a Native American stand point, Blackfeet perspective if you will, the need for vindication and legitimacy through qualification, quantification and recognition are not often required in matters of the spirit and heart. Which is what this action (swift fox re-introduction) was, and is. I do observe in most scenarios there comes a certain need to substantiate for the purpose of more funding and standing. This of course is a part of the Euro-Western approach, describe the world in clinical clear parameters for the advance and understanding of civilization into the future. Unfortunately, this approach is not legitimized the view of many peoples, indigenous in particular, that is, cumulative factors (including spiritual, heartfelt and cultural values) must be taken into account then priorities may be set from there. I will point out that the most enduring and valuable messages involving animals are those visual and storied accounts. The project worked because when science and bureaucracy cannot co-exist productively, matters of the heart and spirit must guide the way. It was simply the right thing to do". (Newbreast, 25th April 2005).

Table 1. Comparison of swift fox re-introduction programs

Program	Design	Implementation	Funding	Sources of Animals	Releases & Methodology	Survival estimate
Canadian 1983-1997 under Provincial permit.	CEI, Govt.	Mainly government (CEI responsible for captive colony)	Government NGO	841 Canadian captive-bred swift fox re-introduced, 91wild swift fox translocated from the USA and released	1983-985 (soft release) government/University of Calgary. 1985-1993 (hard release) solely government. 1993-1997 hard release (government) and PPS (CEI)	18% to 37% over 1 year based upon radio-collar data (1989-1991)
Blackfeet ,USA 1998–2002 US Federal & State permit Canada federal (export) & provincial permit	CEI	CEI Blackfeet	NGO	123 Canadian captive-bred stock	Blackfeet Tribe and CEI (TEK and PPS)	75% adults over 4 years, 50% juveniles (2 years) based upon radio-collar data (1999-2002)
Kainai Siinopaa 5-year program; Canada 2001–on-going SARA (federal) permit	CEI	CEI and Blood	Partially (12 months) Government, mainly NGO & Blood tribe	Ongoing	Blood Tribe and CEI (TEK and PPS)	Research on-going

During the struggle to find funding in the Blood Program one of the Blood Elders made a similar cryptic and to the point comment: "…If it is meant to happen it will." (Francis First Charger, 14th July 2003). The First Nations people involved with re-introductions take an holistic approach to the return of an animal to its original place in the environment. The animal belongs there, it has rights to live there and should not be disturbed by the intrusive requirements of science. Animals as well as humans are part of the spiritual lives of all creatures on earth and they are returned for truly spiritual reasons. Western Science, and recognition of the programs by western science, are basically immaterial to success. The program end for First Nations was to return the animal to its native habitat and fill a spiritual need.

Child with CEI brochure

Government

In Canada, the government approach is that planning is the prime concern of endangered species management, requiring guidelines to be written, resulting in advisory Recovery Strategies made, but implementation of Recovery Strategy by the responsible ministries is not a requirement under the Act consideration of the restoration of an extirpated population, or one on the brink of extinction, cannot be supported until this lengthy process has been completed.

- "A recovery strategy is a planning document… It sets goals and objectives and identifies the main areas of activities to be undertaken. Detailed planning is done at the action plan stage… " (Species at Risk Act Recovery Strategy Series, 2006).
- As an illustration of the length of time this process can take, SARA was proclaimed in 2002, the advisory Recovery Strategy that has to be produced before an Action plan can be written is not yet completed.
- It is no surprise that government reality is the bureaucratic process of planning and permit issuing. The program end for government in Canada, is to ensure the requirements of legislation was met.

NGOs: It is the expectation of the SFRT that, if the recovery plan is a good one, the 'Conservation Community' will implement it. In other words the 'Conservation Community', this being the NGO's, have been downloaded the responsibility to not only implement plans that they generally did not develop but also to fund the implementation. In the case of the three swift fox programs outlined above the NGOs funded and produced all the captive bred animals for re-introduction, and raised the money to fund the behavioural research which resulted in increased survival of re-introduced swift fox and non-intrusive methods of post release monitoring. The program end for NGOs was to implement a program and to raise the money to implement the program through the business of fund raising.

It is possible to build bridges across the chasm which divides these three perspectives as the CEI has shown in the re-introduction of the swift fox in Canada and Montana, USA. Although CEI has managed to survive the ordeal and the species is on its way to recovery we feel strongly that little has been learned about how to listen and accommodate the different realities in programs such as these. In the final analysis the return of the swift fox, a spiritually and culturally important species to the lands of the Tribes of the Blackfeet Confederacy, was a powerful demonstration of these realities regarding the importance of habitat restoration through endangered species re-introduction. If the government and scientific communities are truly interested in continuing to work with Aboriginal peoples, these realities must become one and time must be spent on gaining a full understanding of why these programs are important to different groups.

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Asiatic Black Bear Restoration on Mt. Jiri, South Korea

The Asiatic black bear (*Ursus thibetanus*) is very close to Koreans as over the centuries they have told and retold the Dangun creation myth. However, they have been reduced by over-hunting and beliefs that products from wild animals are good for human health. As the population of Asiatic black bears is reduced, we really feel the need for protecting wildlife species and therefore started a restoration project for the Asiatic black bear (on 4th September 2001, an experimental release by the National Institute of Environmental Research (NIER) and in December 2002 organization of the Asiatic black bear management team (ABBMT)).

Current Conservation Efforts

It is generally agreed that a wild animal population may be

considered viable when population numbers and survival rates are such that the population has a 95% probability of survival for 100 years. However, Mount Jiri bear population, the largest population of Asiatic black bear in South Korea, is only composed of 5 to 8 bears. The theoretical probability of the Mount Jiri population surviving 100 years is therefore only 3%, and because this population is not considered viable, an intervention such as the release of captive bears is now considered necessary for this population. At the Asiatic Black Bear Population and Habitat Viability Assessment (PHVA) Workshop in 2000, which was held in Seoul, Korea, the result of "Vortex simulation modeling" suggested that introducing six bear cubs every year for five years into Mount Jiri population would stabilize the population. This would result in a minimum viable population composed of 53 bears after ten years and 94% probability of survival after 100 years. The conclusion was that immediate action was necessary or the Mount Jiri bear population would most certainly go extinct. Efforts to introduce bears into the Mount Jiri population were conducted over an initial two year period by the NIER but responsibility for the bear restoration has since been transferred to the Korean National Park Service (KNPS). The ABBMT* is composed of biologists, ecologists, a veterinarian and local communities and cooperates with the local environmentalists.

**** Since 1st January the name of the Asiatic black bear management team (ABBMT) has been changed to the Species Restoration Center (SRC).***

First Experimental Release

In January and February 2001, four black bear cubs, belonging to a subspecies of Asiatic black bear in Mount Jiri, were selected from a breeding facility in Korea. Following separation from their mother by researchers from the NIER, the cubs were weaned and put through a wild adjustment program from April to August 2001. They were attached with radio transmitters and the bears were released into the Gurye region of Mount Jiri National Park on 8th September 2001. This was an experimental release to confirm whether the Asiatic black bear could adapt to the conditions on Mount Jiri National Park and to test re-introduction methodology. The experimental released bears were collected and now they are living in a new nature education facility, where we are studying their behavior in captivity, utilizing a public education component. Our field work conducted while tracking the cubs, provided an excellent base from which to design the next phase of the re-introduction program. This also led to several significant findings by the ABBMT on the habitat and ecology of the remaining wild bears. The ABBMT described bear resting platforms in trees as well as ground nests, they discovered and described footprints and scratching traces on the trees. Bears were found to hibernate in the empty holes, under large rocks and inside big old trees and diets were determined through scat analysis. Additionally the ABBMT was able to document the presence and habitat of several other wildlife species in the Mount Jiri area such as badgers, musk deer, leopard cats, etc.

Asiatic black bear (*Ursus thibetanus*)

Second Release of Russian Bears

In September 2003, a Memorandum of Understanding (MoU) on black bear protection was signed between the Republic of Korea and Russia. The MoU included an agreement on bringing Russian black bears into Korea in 2004. The ABBMT decided to import Russian Asiatic black bear cubs as a result of genetic analysis which found they have the same origins as Korean black bears. Coincidently, the Ussurisk Nature Reserve in Russia where the bears came from had trained had previously successfully trained bear cubs to adapt to the wilderness without human contact. In October 2004, six seven month old Russian bears were imported for release in to Mt. Jiri. These bear cubs were born in the wild but their mother was shot by hunters and they were rescued by bear rehabilitation center in Ussurisk Nature Reserve. A 5.2 ha soft re-introduction enclosure was installed inside the Jirisan National Park and eight CCTV systems installed to monitor bears 24 hrs a day with an electric fence to prevent escape. To reduce the potential for human habituation, only a small number of ABBMT staff and photographers were allowed access to the bears and the staff were required to wear outfits designed to reduce or completely eliminate the bears identifying them as human. Three male and three female cubs, named after three peaks and three valleys in the Mount Jiri area respectively, were fitted with radio ear tags and released after a couple of weeks of training to acclimatize them to the radio ear tags. All six bears successfully hibernated over the 2004/2005 winter and the ABBMT field team successfully tracked and located the bears which were using caves and tree hollows (oak) as dens. Den locations were generally located in areas difficult for people to access and provide wide fields of view which bears can utilize to identify danger. Based on these results the ABBMT considers the project to be partly successful because hibernation is thought to be one of the most important activities during a bears growth.

Future Plan

The bear restoration project has been challenging for the ABBMT but they have made great achievements over the last five years. This is mainly due to the experimental release in 2001 and data obtained, lessons learned as a result of this experimental release. At the same time we are concerned about what is the best choice of transmitter and GPS collar for monitoring, habituation to humans, damage to honey hives, snares etc. during the experimental release period. Until now a total of 14 Asiatic black bears (a total of 20 were released but two cubs were victimized by snares, three cubs were recaptured

Overview of release site

because of failure to adapt to the wild and one cub was lost) have now been successfully released into the Jirisan National Park area. The current project plans aims for the release of six Russian bear cubs each year for the next four years. However many issues pertaining to cooperation with local communities, park visitors, and various other stake holders still remain unresolved. In particular is how best to accommodate participation of multiple groups in the decision making process and controlling bear damage. Future success will therefore rely heavily not only on a successful biological component but in the ability of the SRC to mediate social and political issues and provide sound leadership in the years ahead.

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Re-introduction of the Eurasian otter in NE Spain

Currently accepted taxonomy lists 13 species of otters worldwide, grouped into four different genus. The Eurasian otter (*Lutra lutra*) has a vast geographical range, larger than the remaining other 12 species. It inhabits Europe, North Africa, Russia, China, Japan, Indonesia, Malaysia and part of India, although it has disappeared from several areas of its historical range due to human causes. The Eurasian otter lives in a great variety of aquatic habitats: rivers, streams, wetlands and even coastal areas. The base of the diet of the Eurasian otter in the Iberian Peninsula is fish, but American crayfish (*Procambarus clarkii)* have become important too, especially where this introduced species has become plentiful. The Eurasian otter is a fully protected species, classified as Near Threatened in the IUCN Red Data Book, included in Annex I of CITES, in Annex II of the Bern Convention and in Annexes II (designation of special areas of conservation is needed) and IV (strict protection) of Habitats Directive of European Union.

The otter disappeared from Girona province (Catalonia, NE Spain) in 1984 and in 1993 a project was started in order to restore the disappeared population. The re-introduction was carried out in the Muga and Fluvià river basins, a territory which covers approximately 2,000 km^2. The Aiguamolls de l'Empordà wetlands lie between the mouths of both rivers, with a 4,800 ha protected as Natural Park and 800 ha as Integral Reserve.

The Catalonia Otter Re-introduction Project had two main objectives:

- The restoration of an eradicated population.
- The promotion of river and wetland conservation through a flag species.

Viability Study

The Catalonia Otter Re-introduction Project produced a viability study in order to determine if the project met IUCN/RSG Guidelines for Re-introductions. Before studying habitat quality, it was possible to assess some of the RSG considerations for re-introductions. Although still common in some parts of its area of distribution, the Eurasian otter was classified as Vulnerable and the species had originally been present in the proposed area of re-introduction. The causes of extinction were well known: persecution (hunting, trapping), pollution and habitat destruction. Extinction in the study area was complete when the project was initiated. It was stated that in Spain, Muga and Fluvià were two of the few basins without otters where spontaneous recolonization was unlikely to occur (Ruiz-Olmo & Delibes, 1998) in the short or middle term. The proposed donor populations (from Western Iberian Peninsula) were healthy and increasing in number. The proposed donor populations were the nearest with enough individuals and lived in comparable Mediterranean habitats. The extension of the study area was 200,000 ha, with more than 600 km of river and 3,000 ha of wetlands. Considering the densities found in Catalonia (0.1–1.2 otters/km), the existence of enough habitat for a population with a range between 60 and 720 animals was calculated. The local human population was mainly in favour of the re-introduction, because the otter did not negatively affect the interests of any economic group in the area and, finally, the species was a fully protected species in Spain since 1973.

The habitat conservation studies tried mainly to answer two questions: is the habitat too polluted for the establishment and persistence of an otter population, and is there enough food for an otter population? The role of pollutants in the feasibility of otter re-introduction was focused on PCBs, because these substances were considered the principal causes of otter extinction in large

areas, although there is still controversy about this point. Levels of PCBs ranged between 81 and 136.4 µg/kg wet weight, with 41% of sites with values higher than 110 µg/kg wet weight (Mateo *et al.*, 1999). Fish with levels lower than this 'level of concern' lived in Catalonian rivers with healthy otter populations. High levels of ΣPCBs were detected especially in the upper course of Fluvià river, but the coastal marshes and the greater part of the Muga basin showed PCB levels below those observed in Catalonian rivers where otters are still present. Thus, it was expected that lagoons and channels of the Aiguamolls de l'Empordà Natural Park would be a good place to begin re-introduction in the zone. Fish biomass in the proposed re-introduction area varied between 0.6 and 351.9 gr/m², with only 17% of sites with biomass lower than 8 gr/m², the minimum value calculated to support an otter population in Mediterranean rivers. These results showed that the area could sustain a stable density of otter population, similar to other densities present in otter rivers of the Iberian Peninsula.

Results

Between 1995 and 2000, 55 wild otters from SW and N Spain and SE Portugal were livetrapped with padded leg-hold traps. To reduce the risk of injury, otters were chemically immobilized at trap sites with a combination of ketamine hydrochloride and metedomidine, administered by a blow pipe using plastic darts (Fernández *et al.*, 2002). Once it was completely immobilized, each otter was carefully released from the trap, examined, weighed and its sex identified. Otters showing signs of chronic illness or injuries, as well as pregnant or lactating females, were immediately released and young or sub-adult animals were preferred over older animals. Some animals received a dose of the long-acting neuroleptic Trilafon, to decrease stress level during handling, transport and captive management. After examination, atipamezole was manually injected for recovery, and otters were placed in transport kennels in a cold and dark room and in the evening they were transported to the Barcelona Zoo by van. After 20-30 days at the zoo's housing facilities, where the animals were medically evaluated and fitted with an implanted radiotransmitter, the otters were released and radio-tracking initiated.

Otter re-introduction became an unique opportunity to dispose of an "artificially designed" population in order to study ecological and behavioural aspects of the species and to compare several methods of estimating otter distribution and density (Ruiz-Olmo *et al.*, 2001). The re-introduction program finished in 2001, although indirect monitoring through tracks and spraints, and molecular scatology has continued, already 10 years since the first release. Re-introduction of the otter in the Muga and Fluvia Basins succeeded because of the geographical area occupied by the otter increased the percentage of positive otter stations. The molecular scatology studies, although still provisional, have found 22 different genotypes, none of them coincident with the released individuals (A. Fernando, pers. comm.), which means that most of the present population is already descendant from the otters re-introduced between 1995 and 2000. Post-release mortality was 22% one year after release, similar to or lower than other successful otter re-introduction programs and mortality was due mainly to traffic (56%). Long-term persistence of the re-introduced population was

Male otter (*Lutra lutra*)
© Deli Saavedra

studied through a Population Viability Analysis (PVA) and the result was a low risk of extinction in the next 100 years, with most scenarios (65%) meeting the criterion of a minimum of 90% probability of survival. Population modelling highlighted the importance of preventing road kills, which cause more than 50% of otter mortality, through the construction of fauna passages, the fencing of some dangerous road stretches and the use of speed restrictions (Saavedra, 2002).

Environmental Education Program

The Environmental Education Program was essential for the achievement of the Catalonian Otter Re-introduction Project's second objective: the promotion of the conservation of rivers and wetlands using an emblematic species. The program began with the creation of a tale for children along with other pedagogical tools. The schools of the re-introduction area were visited, bringing the message of river and wetlands conservation and promoting the creation of local groups (in every village in the area) called *Otter Groups*. These groups were voluntarily conserving and restoring their nearest stretch of river, removing rubbish, planting trees, preparing exhibitions and events about nature protection and so on. All these activities had the economic support of private sponsorship.

Conclusions

The Catalonia Re-introduction Otter Project has achieved the creation of a new otter population, that persists over time, reproduces regularly and is gradually dispersing, even to new river basins (Ter and Llobregat in Spain; Tec and Tet in France). The project has produced abundant scientific data (including two doctoral thesis) and has also tuned a protocol for trapping, handling and releasing wild otters that can provide useful information for similar programs (Fernández *et al.*, 2002 & Saavedra, 2002).

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Update on drill re-introduction plans in Nigeria

Pandrillus recently submitted a 3-year re-introduction plan for the drill (*Mandrillus leucophaeus*) for review by the Cross River State Forestry Commission and the three NGOs (Wildlife Conservation Society, Nigerian Conservation Foundation, Fauna & Flora International), with whom Pandrillus partners to manage and protect the Afi Mountain Wildlife Sanctuary, our proposed release site. Animals for re-introduction would be drawn from the Drill Rehab. & Breeding Center's six groups that include wild born, first, second and third generation captive-bred individuals.

Proposed Release Site Protection

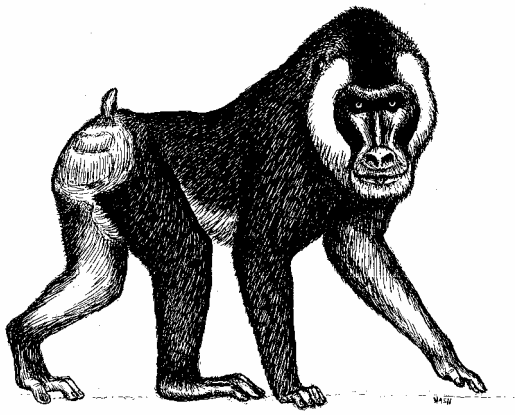
The Forestry Commission's sanctuary headquarters is now staffed with 2 wildlife officers and 12 rangers. Recently, the NGOs employed 10 community rangers who patrol in mixed teams with the government rangers, making a combined force of 22 protection staff for the approximately 100 km^2 sanctuary. Former DRBC manager Ubi Sam Ettah is now the sanctuary's Conservation Coordinator. Ettah organizes anti-poaching patrols, monitors encroachment, liaises with partners and surrounding communities, and participates actively in patrols and prosecution of offenders. In the last 2 years, the partnership supported creation of a community delegates' network in 16 villages, ranger training, awareness-raising workshops, and support for community schools. WCS is rehabilitating its research camp within the sanctuary and construction of three permanent ranger posts is planned.

Re-introduction Plan

Year One

- ***Census extant wild drill population at release site:*** an 8-week survey in rainy season will be repeated in dry season.
- ***Community sensitization***: visit each of 16 villages surrounding release site, traditional rulers and local government.
- ***Select telemetry equipment:*** uncertainty remains as to which technology may be most effective under closed canopy in deep canyons and valleys of the sanctuary.
- Acquire telemetry collars and human-test them throughout sanctuary to corroborate with handheld GPS results.
- ***Trial drill re-introduction:*** 2 captive bred, collared, adult males from well-represented lineages, who have lived in multi-hectare, naturally forested enclosures at the release site all their lives.
- ***Monitoring:*** field team will attempt visual location every 4 weeks to assess status, collect fecal samples, and corroborate telemetry data.

Drill (*Mandrillus leucophaeus*)
© Stephen Nash/Conservation International



Year Two

- ***Assemble release group (30-45):*** add animals to an existing group to maximize genetic diversity, and remove others to retain diversity of captive population.
- ***Final preparation:*** veterinary screening, microchip implantation, sampling, collaring of dominant and one other male.
- ***Re-introduction of drill group:*** methodology may be adapted from lessons learned with trial release.
- Monitoring: field team will attempt visual location every 4 weeks.
- ***Monitoring:*** visual location of trial males every 8 weeks after initial 12 months.

Year Three

- Monitoring of all released animals will continue assuming the collars remain functional; after 12 months visual location of group every 8 weeks.
- ***Evaluate the re-introduction on these parameters:***
  - ⇒ Survival, reproduction, general health.
  - ⇒ Group cohesion, demographic changes, interactions with wild conspecifics.
  - ⇒ Telemetry equipment viability and effectiveness.
  - ⇒ Ground-tracking effectiveness.
  - ⇒ Local, national and international public relations value for wildlife conservation in Nigeria.
- Analyze data and share results.

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Application of the RSG Guidelines in the case of confiscated mountain gorillas, Virunga Massif: Rwanda, Uganda & DRC

The mountain gorilla (*Gorilla beringei beringei*) is currently classified as endangered by IUCN Red List Criteria (2000), with approximately 700 individuals remaining in the wild. There are no mountain gorillas known to be in captivity, aside from the confiscated orphan currently managed in Rwanda. As late as the 1980s, mountain gorillas were still being hunted for various purposes but by the 1990s, with adequate protection, poaching was no longer considered a major threat to the population. Unfortunately, 2002 saw a resurgence in mountain gorilla poaching for the capture of live infants, with three separate incidents recorded in the Virunga Massif. These events resulted in the deaths of at least six adult gorillas and the recovery of two orphaned infants. One of the recovered infants disappeared and was presumed dead after an initially successful immediate return to his own group, while the second died after multiple failed attempts to re-introduce her to non-natal groups. A third poached infant was never recovered, while a fourth was suspected of being captured but was also never found. In 2004 another infant mountain gorilla was recovered from poachers. The IUCN guidelines were used in the decision making process for both the 2002 case with multiple re-introduction attempts and the 2004 case, which is ongoing.

Following 2000 *IUCN Guidelines for the Placement of Confiscated Animals* (GPCA), three possible options were considered for the recovered gorillas: a) return to the wild, b) captivity, and c) euthanasia. Of the three options, euthanasia was considered ethically difficult and unacceptable for an endangered species. Captivity was also considered inappropriate given the social nature of gorillas and the lack of both other mountain gorillas in captivity and of a suitable facility in the region. It was also thought that in the case of a high profile species, such as the mountain gorilla, captivity or euthanasia would create a negative conservation message. In both cases, return to the wild was carefully considered and, after extensive discussion, agreed upon by all parties. The main points in support of return to the wild were that: 1) the Virunga origin of both infants was certain; 2) each was a potentially breeding female for a population that is very small and of high conservation value; and 3) each had been in captivity for a relatively short period, fewer than two weeks at the time of confiscation.

After the eventual failure in the 2002 case, and with no successful historical examples of returning mountain gorilla infants to non-natal groups, a more rigorous decision-making approach was followed in the 2004 case. A scientific steering committee was formed, composed of representatives from the five major government and NGO partners (Congolese Institute for the Conservation of Nature, Rwandan Office of Tourism and National Parks, Mountain Gorilla Veterinary Project, Karisoke Research Center of the Dian Fossey Gorilla Fund International, and the International Gorilla Conservation Program). The committee considered a successful introduction to be defined as successful integration into a wild gorilla group and subsequent reproduction, and worked through the IUCN GPCA decision tree according to figure 1. Working through the decision trees in June 2005, the committee found that the gorilla's situation remained on hold at 'Return to Wild' Question 5. According to behavioral experts on multiple evaluations, she was not yet behaving normally but had progressed considerably since her

Figure 1. DECISION TREE

Q1. Will "Return to the Wild" make a significant contribution to the conservation of the species? Is there a management program that has sufficient resources to enable return according to IUCN Re-introduction Guidelines?
A1: YES. There is not currently a dedicated management program with sufficient resources to enable return according to IUCN guidelines, but the partners are committed to finding and dedicating the resources and establishing such a management program herein.

Q2. Has animal been subjected to a comprehensive veterinary screening and quarantine?
A2: YES.

Q3. Has animal been found to be disease-free by comprehensive veterinary screening and quarantine, or can they be treated for any infection discovered?
A3: YES, and screening will continue.

Q4. Can the country of origin and site of capture be confirmed?
A4: In terms of country or site of capture, no, but definitely within the same population (Virunga Massif), therefore YES.

Q5. Does the animal exhibit behavioral abnormalities that might make it unsuitable for return to the wild?
A: At the current time, YES. Therefore IUCN Guidelines dictate pursuing captive options, at least until behavior is closer to normal. We recommend periodic reevaluation of this question as it is evident that her behavior is slowly returning to normal and we anticipate that the answer will eventually be 'NO.'

Q6. (pending)
Can the animal be returned expeditiously to its' site of origin (specific location), and will benefits to conservation of the species outweigh any risks of such action?
A: It will no longer be considered 'expeditious' but will benefit the conservation of the species, so overall YES. Therefore repatriate and reinforce according to IUCN Guidelines.

Q7. & Q8. (pending and expect not to reach these questions)

Mountain Gorilla (*Gorilla beringei beringei*)
mother and infant
© Katie Fawcett

confiscation. It was the unanimous consensus of the committee, and later agreed to by all stakeholders, that the gorilla should remain in captivity at least until she exhibits normal behavior. She is currently being re-evaluated approximately every three months and was deemed ready for social introduction and mixing with other gorillas in captivity in October 2005. Though there are no other mountain gorillas in captivity, there are currently five eastern lowland gorilla (*Gorilla beringei graueri*) orphans managed by the same stakeholders. Though they are a different subspecies, the infant eastern lowland gorillas and the mountain gorilla are of the same species, and provide the best option for socializing the orphan mountain gorilla. Recommendations have been made by the committee to unite all six gorillas at a single care site in the near future and are pending ratification by the two protected areas authorities.

The *IUCN Guidelines for Nonhuman Primate Re-introductions* (2002) were also consulted and though helpful, were generally not applicable as the return of orphaned mountain gorillas to their established wild populations is considered a restocking, re-inforcement, or supplementation rather than a re-introduction. The committee found the need to further supplement the IUCN GPCA guidelines as a number of important decisions needed to be considered for the 2004 case. The IUCN GPCA have provided a useful basis for the decision making process in the cases of mountain gorilla orphans. These relatively unique cases have, however, required a number of additional logistical, political and technical considerations that have built upon the existing framework. The mountain gorilla conservation stakeholders look forward to continuing to use and enhance the IUCN guidelines as they move forward in attempting to establish a methodology for successfully returning confiscated mountain gorillas to the wild.

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Re-introduction of gibbons in Sarawak, Malaysia

The Bornean gibbon (*Hylobates muelleri*) is currently listed as a Totally Protected Species under the Wildlife Protection Ordinance (1998) of Sarawak. There are three sub-species of Bornean gibbons: *H. m. funereus*, *H. m. muelleri* and *H. m. abbotti,* which can be differentiated based on the colour and patterns of their coats. The Bornean gibbon is endemic to Borneo and in Sarawak it occurs in the lowland and hilly dipterocarp forests of Gunung Mulu National Park (NP), Lanjak-Entimau Wildlife Sanctuary (WS), Samunsam WS as well as in the north and south of Saribas. Smaller populations can be found in Batang Ai, Niah and Lambir Hills NPs as well as in the proposed Pulong Tau NP. Gibbons are diurnal and completely arboreal primate and their diet consists of ripe fleshy fruits, young leaves and small insects.

The major threat to the survival of the Bornean gibbon is habitat disturbance and hunting. As a result, there were large numbers of gibbons that ended up at rehabilitation centres. At rehabilitation centre such as the Semenggoh Wildlife Rehabilitation Centre (WRC) in Kuching, Sarawak, the authority has tried to use the 'hard release' method to re-introduce gibbons into the wild since the late 1970's. In Sarawak, re-introducing confiscated or surrendered primates into the wild were probably practised as one of the measures to overcome the problems of insufficient holding space as well as for tourist attraction. Up to the 1980's there have been at least 122 gibbons released in Semenggoh (Bennett, 1989a). However, only less than 10% of the gibbons survived (Bennett, 1989a & 1989b). Although it is not impossible to re-introduce gibbon successfully into its natural environment, it is critically important for the authority to allow the formation of pair bonds between animals while they were in captivity, careful selection of suitable release area, a gradual shift to a natural diet at the point of release and post-release follow-up (Caldecott & Kavanagh, 1983; Brockelman & Chivers, 1984). In addition, the selection of suitable release area must also take into account the possibility of introducing wild gibbons to new diseases as well as the competition for limited food resources if the rehabilitated gibbons were to be released into forest area already populated with gibbons (Leighton & Whitten, 1984).

Methods

In the beginning, confiscated animals of totally protected status like orang-utans, gibbons and hornbills were released in the forest area surrounding the Semenggoh WRC. Under the gibbon rehabilitation program of the 1980's, it was emphasised that gibbons should be kept in pairs and preferably be between the ages of 4-5 years old before release. There was no indication, however, that the gibbons less than four years old were given any training prior to their release. By 1998, the release of wild animals into the forest of Semenggoh was stopped and animals received by the centre were either transferred to Matang Wildlife Centre (WC) or to other parts of the country.

A Case Study

On the 5th November 2000, a female pet gibbon was surrendered to Semenggoh WRC. At the time of arrival to the centre, the gibbon was estimated to be 6 months old and was given the name 'Chow'. Although the release of totally protected animals had been stopped in Semenggoh, considering its young age and the possibility of rehabilitation training, a special permission was acquired from the National Parks and Wildlife Division of the Sarawak Forest Department to train and re-introduce Chow in Semenggoh. Apart from its young age, there were several other reasons to why Chow had been chosen as a suitable candidate for the rehabilitation training and re-introduction at Semenggoh WRC: 1) no companion gibbon of similar age, 2) to prevent the development of negative behaviours such as aggression and stereotypy while in captivity, and 3) gibbon re-introduction program has not yet been established in the new Matang WC.

Rehabilitation Training

Chow was trained using the 'soft-release' method similar to that used for the orang-utans at Semenggoh and Matang. Upon arrival she was quarantined for about 5 months during which medical assessment and treatment to injuries and simple diseases were carried out. Chow was screened for Hepatitis-A and B as well as Herpes 1 and 2 for which they were found to be all negative. During quarantine period, Chow was bottle-fed using formulated powdered milk for animals and was fed with fruits twice daily in its cage (in the morning at 09:00 hrs and afternoon at 14:30 hrs). The training started on the 19th April 2001 within a specially designed enclosure. The enclosure consists of 3 interconnecting individual cages with individual sliding doors. Each individual cage is 1.5 x 1.5 x 1.5 m in diameters and has 2 sliding doors in the front and at the back. The cages were connected using bolts and nuts with their openings facing each other. The enclosure was designed in such a way that it could ease the introduction of different individual gibbons prior to their release by first keeping them confined in adjacent cages, and when the time is right for them to be introduced, the sliding doors in between the cages can be opened to make a bigger 'pair-bond' cage. Several loops of ropes were assembled within and outside of the cage leading towards the trees from both the front and back doors. However, only one door would be opened during every training period. A small feeding platform was also provided in the cage.

Chow was subjected to daily training and monitoring both in the morning and afternoon. Training begins after feeding time in the cage. At the early stage of training, Chow had to be hand carried out of her cage into the nearby trees. It was observed that Chow like to come to the ground to be with the trainer and only played in one single tree during each training session. Also at this stage, the trees where she played were those located closest to the enclosure. Three months later (July 2001), it was observed that Chow started to climb trees on her own without any assistance from the trainer. She voluntarily went out of her cage after the door was opened, climbed the ropes and into the trees. The door of the cage was always opened on the side facing towards the release area. The release area was designated into 3 zones.

Bornean gibbon (*Hylobates muelleri*)

During July 2001, Chow only confined herself within Zone 1. By this time she was already able to respond to name-calls made by the trainer each time she was called back into the cage at the end of each training session. In order to lure her back into the cage a small amount of food was placed in the cage. It was also observed that she was still quite attached to the trainer and interacted with the latter by touching, holding or play biting. During this time she still like to come to the ground whenever she noticed that the trainer was walking towards the tree where she played.

By August 2001, Chow started to produce bubbling calls distinctive to Bornean gibbons by imitating the sounds made by the captive gibbons in nearby enclosures. Apart from bubbling, she also produced 'crying' sounds whenever she was not being released (when it rains) or when the enclosure was locked at the end of the day. She made loud bubbling calls especially in the morning, but not as frequent or as lengthy as the captive adult gibbons. Through the end of August to November 2001, it was observed that Chow had been fully conditioned to the training program because she voluntarily climbed out of the enclosure when the door had been opened (morning: 08:30 hrs–09:30 hrs, afternoon: 13:30 hrs-14:30 hrs) and returned back into it at near exact times (morning: 11:30 hrs-12:30 hrs, afternoon: 16:30 hrs–17:30 hrs) without the needs to be called by the trainer. She also became more distant to the trainer and avoided visitors that came to centre to observe orang-utan's feeding. She did not interact with the trainer anymore during release time but did so shortly before caging time. She also did not play bite with the trainer and had become completely arboreal. By this time, it was also observed that Chow had extended her territory into Zone 2 and 3 progressively each day and foraged for naturally available foods. At the end of the observation period in November 2001, Chow had befriended a tame juvenile male long-tailed macaque (*Macaca fascicularis*) also released in the area. Chow was commonly seen play fighting and climbing trees together with the macaque during her release sessions. Although Chow had not been released full time after the observation has ended but the future plan is there for her to be released into deeper part of the forest and be in contact with the existing feral gibbon population of Semenggoh.

Discussion and Recommendations

It was observed that gibbons could be subjected to rehabilitation and re-introduction using positive re-enforcement (using food rewards) and soft release (or gradual release) method. In order to determine the positive impact of the program, these behavioural parameters should be assessed: 1) restricted interaction between rehabilitated gibbons and trainer or visitors, 2) gibbons become completely arboreal after release, 3) gibbons readily foraged for naturally available food items, 4) extension of the gibbon's territory, and 5) the gibbons did not show any aggressive behaviour toward humans or to other gibbons. Apart from the prerequisites mentioned by the others (Caldecott & Kavanagh, 1983; Brockelman & Chivers, 1984; Leighton & Whitten, 1984), to ensure success in the gibbon re-introduction program, it is recommended that specialised enclosure system be used for training gibbons and the re-introduction facilities should be built within the release area. Also, there should be minimal contact between gibbons and humans and if the gibbons are still young (less than 1 year old), it is good if the quarantine period does not exceed 6 months and they should undergo training as soon as they have been found negative to various diseases. If the re-introduction candidates are adults, the quarantine period should also be made as short as possible because the longer they are in captivity, they more they are prone to succumb to negative behaviours like aggression and stereotypy. Finally, for every re-introduction program conducted, there should be a continuous monitoring of the released individuals.

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BIRDS

The corncrake re-introduction project in the UK

Since the previous article on this RSPB/English Nature/ZSL partnership project (see *Re-introduction News*

Corncrake (*Crex crex*)
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No. 23 November 2003), there have been encouraging developments, but we are still some way from establishing a breeding population in the wild. During the course of summer 2003, a total of 52 young corncrakes (*Crex crex*) were released. In spring/summer 2004, we were disappointed that no calling males were heard on the reserve, but a wild (presumed) female was seen and a captive male released to join her. Later in the summer, three unringed juveniles were seen nearby, constituting the first successful breeding here for at least 50 years, and showing that the project was on course. 2004 was again a successful breeding season at Whipsnade, with the number of juveniles released reaching 75, but this was still below the target of 100 per annum. Hopes were high that a good number of corncrakes would return in 2005, but only one calling male was heard. He was trapped and found to be carrying a ring, which proved that he had been released in 2004. Again the captive birds had a productive season and 78 juveniles were released during the summer. It had been expected that around six released male corncrakes would have returned as adults to the Nene Washes in 2005. The fact that only one captive-bred male did so is of concern, and the fact that the breeding stock is highly inbred may be at least a contributory factor in this poor return rate. The project steering group agreed that it was very important to obtain new, unrelated, stock in 2005, to add to the captive breeding population. There are very few corncrakes in captivity, and it was felt that these may well be originally from the same stock as those at Whipsnade. The conclusion was therefore reached that any new corncrakes should come from a wild source. During summer 2005, four adult males were obtained from the wild in Poland, and eleven corncrake chicks were taken from an island off the west coast of Scotland.

At the time of writing, preparations for the 2006 breeding season are under way, and the hope is to exceed the target of 100 juveniles this year. We also hope that a good number of last year's releases will return, but previous experience does not give us a great deal of optimism. However, the inclusion of new breeding stock should bring benefits in 2007. As things stand, the project will continue for two more years, at which stage an asessment will be undertaken. The current project is an experimental first phase-if it proves possible to establish a corncrake population in England, it is likely that other projects will be set up, including possibly one in north Wales and another on the Scottish mainland. This would be in line with the

long-term BAP target of establishing populations in each of the four countries of the UK.

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Attempts to re-establish bird fauna in the Bavarian Forest National Park, Germany

In striking contrast to the early national parks in America, Africa or Asia, which were mostly established in natural landscape near to a primary state, national parks in central Europe are founded in former used areas. Therefore their management aims at a development of ecosystems to a state of secondary nature. Due to the local history of utilization, hunting and human management in the area, even strict reserves suffer from a substantial lack of biodiversity. When the Bavarian Forest National Park, which is located just at the border to Czech Republic, was founded in 1970, a serious number of larger vertebrates were locally extinct (like wolf, bear, lynx and moose among the mammals, and like eagle owl, Ural owl, black stork, crane, peregrine, lesser spotted eagle, common raven among the birds), or threatened in fact of a quick decline of population density (like river otter, capercaillie, black grouse). As these species would be of high value for conservation as well as important for natural processes in the ecosystems (e.g. by influencing the vegetation by browsing, seed transport, digging soil or fertilising by their faeces, and by acting in a predator-prey mutualism), some projects on re-introduction and re-stocking were planned in the early 1970's.

Starting with the project on eagle owl (*Bubo bubo*) three breeding facilities were built, and 100 young born, in captivity, were released between 1972 and 1982. But the result of an extensive census demonstrated, that this very big nocturnal predator is not able to settle in the higher mountains, where the national park was founded, as harsh winters, with a long lasting and high snow cover diminish their hunting success. Therefore most breeding pairs established themselves in areas lower than 600 m sea level, mostly in rocky canyons at main rivers and in quarries. As for the project on raven (*Corvus corax*) we had only two pairs in captivity for disposal, most of the released birds came from zoo parks and from a wild population in eastern Germany. From 1974 about 163 ravens were released. They have currently managed to establish 6-8 breeding pairs in the forest.

Founding a successful breeding stock of Ural owl (*Strix uralensis*) was much more difficult, as information about reproduction in captivity was missing totally. But based on intensive observations of courtship behaviour we succeeded in obtaining the first offspring in 1973, followed by more or less regular reproduction. The breeding stock of five pairs in the national park, together with the offspring from cooperating zoos and private partners allowed the release of 215 young owls between 1975 and 2005. Likewise we encouraged our colleagues from the adjoining National Park Šumava, in Czech Republic, to participate in this project since 1991, and even our neighbours in Austria in 2001. About 250 Ural owls were freed altogether, to establish themselves in the mountainous forests. Up to know about 10 successful breeding pairs have been recorded in the field, but the project aims for a minimum number of 30 pairs in the whole area. The project on capercaillie (*Tetrao urogallus*), which is the largest member of the grouse family worldwide, was the most complex, as we had to learn training techniques, to prepare the chickens for an independent life in the forest. Starting with a small breeding stock of native birds (caught as one-day-old chicks in the forest) we built up a large aviary with 2 cocks and about 6-8 hens. Avoiding any hand-rearing we favoured natural breeding by capercaillie hens or domestic hens as foster mothers. Between 1985 and 2000, we released 412 young grouse from the breeding station. In cooperation between the national park and the administration of state forest, and a hunters association, an establishment of 8 centres for release were arranged along the mountain chain of the Bavarian and Bohemian forests. Therefore in this area of about 600 km² a total of 1,376 grouse were released. This expensive project was stopped in 2000 due to a bark beetle infestation, which reached "catastrophic" proportions in 1986, and which killed about 100 km² of old spruce forest in the core area of capercaillies habitat.

Today projects for re-introducing the Ural owl and the raven continue but less intensively. Likewise the peregrine (*Falco peregrinus*) and black stork (*Ciconia nigra*) have came back to the woodlands in the mountains by natural recolonization! Restoration of the original bird fauna will continue and might also include the lesser spotted eagle (*Aquila pomerina*) and/or crane (*Grus grus*) in the future.

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Re-introduction of South Island fernbird in Christchurch, New Zealand

A re-introduction plan for the locally extinct South Island fernbird *(Bowdleria punctata)* was prepared towards the end of 2005 as a paper towards a Masters of Forestry Science degree at the University of Canterbury School of Forestry, Christchurch, New Zealand. The plan is intended to be implemented as a joint project between the Christchurch City Council (CCC), Environment Canterbury, the Department of Conservation and various community groups including local Maori for which the bird holds special cultural significance. The project is in its very early stages, however in-depth discussions with the range of stakeholders are set to begin over the next few months. Although once described as one of New Zealand's most common birds, fernbirds became locally extinct in the Christchurch area around 1898, with their last known population persisting at the Puharakekenui Wetlands; an area of approximately 80 ha situated on the northern edge of Christchurch city on the East Coast of the South Island. As with many other native species, the causes the fernbirds decline to local extinction may have been attributed to a range of factors including loss and/or modification of habitat, fragmentation, predation, competition from introduced exotic birds and possibly

South Island fernbirds of east and west coast provenances from the Canterbury Museum collection
© Antony Shadbolt

avian disease. However these factors are able to be actively managed to levels that pose a minimal threat to new fernbird populations.

The plan focuses on the establishment of a viable fernbird population at the Puharakekenui Wetlands. The wetlands have the potential to be restored and managed as a mainland island, offering a rare opportunity for fernbird re-introductions to occur in close vicinity to an urban area. A broad vision for the re-introduction of fernbird to Christchurch sees a viable, flourishing and robust population of fernbird not just at the Puharakekenui Wetlands, but also at a range of other suitable habitat sites, including sites both within and outside the CCC area. In this way it is envisaged that the future populations will function as a region-wide metapopulation. While there is some debate over whether the East Coast birds may be different enough from their West Coast counterparts to justify splitting the two forms as a sub-specific level, the most practical sites from which to source founder populations for re-introductions to the Christchurch area would be from salt-marsh edges or pakihi swamps on the West Coast of the South Island. Many of these wetlands are under threat of conversion to agriculture or forestry, and therefore sourcing birds from such locations can be likened to 'rescuing' a population that would otherwise be displaced by development. A number of sources have reported that the two forms (East Coast and West Coast) are distinctive in the field, and similarities have also been noticed between Stewart Island birds and West Coast populations. However, where Codfish Island fernbirds were noted to be morphologically different to South Island fernbirds, genetic testing revealed no differences between the two populations. Furthermore, specimens of fernbirds from Canterbury Museum collection were viewed to compare any visual differences between the two provenances, and no significant visual distinctions were found to be evident. The powers of dispersal from the release site will be limited due to the poor flight ability of the species. However ongoing habitat modification planned in the vicinity of the wetlands will go some way to overcoming this issue through the provision and enhancement of linear wildlife habitat along the Styx River, Seafield Park and Brooklands Lagoon margins. Furthermore, birds may be able to navigate along the forest edge of the adjacent Channeys Plantation *(a Pinus radiata* production forest).

Short term management will largely be limited to habitat restoration and animal pest control. Supplementary feeding will not be carried out due to the difficulties of provisioning primary insectivores with appropriate foods. Longer-term and ongoing management will include further habitat restoration and connectivity, animal pest control and supplementation of the original founder population. Various re-introduction scenarios were modelled using Vortex 9.1, and supplementation was revealed to be important in terms of overcoming issues of inbreeding and a depletion in gene diversity within the isolated populations. Birds used for supplementation would be sourced from suitable sites on the West Coast which were again destined for conversion to agriculture and or forestry. Furthermore, in the long term when other fernbird populations have become established at other sites around Christchurch, birds would be sourced from these populations in exchange for birds harvested from the Puharakekenui Wetlands. As well as the exchange of live birds, genetic improvements to the population(s) could be achieved through either translocation of eggs between nests in different populations, or through artificial insemination.

New Zealand has a long history of species translocations, and backed with a rich and diverse body of theory, it also has a strong international profile as a place where such translocations have met with a high rate of success. The re-introduction of fernbird back into the Christchurch city area is therefore an exciting prospect, and not only has conservation value for the species itself, but also heightens awareness of conservation values in general.

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Saving Philippine hornbills on Panay Island, Philippines

The Philippine Endemic Species Conservation Project (PESCP) endeavors to preserve endemic hornbills threatened by ongoing forest destruction and nest poaching through an integrated conservation and precautionary development project; which benefits both the forest and the upland communities. On Panay alone, the native forest is down to a measly 8% of its original cover and its wildlife will be downsized similarly. From its beginning, the PESCP focused on the threatened Tarictic hornbill (*Penelopides p. panini*) and the critically threatened writhed-billed hornbill (*Aceros waldeni*), Panay endemites inhabiting the Central Panay Mountain Range, the former also occurring in the NW Panay Peninsula.

Aside from a massive and very successful nest guarding scheme preventing nest robbery of the writhed-bill hornbills both species are cared for in a rehabilitation facility in PESCP's Research Station in Sibaliw since 1997. In it confiscated Tarictics are prepared for release back into the wild to strengthen the wild population. They are softly released and their fates monitored by radio telemetry while the writhed-bills are still kept on hold to benefit later on from lessons learnt through the release of their smaller relative. Specifically birds were collected through confiscation, donation, and otherwise, then hand-reared and maintained properly to get them ready for release in their natural habitat. Pre-release training involved offering the birds bundles of fruit-laden branches

so that they could exercise maneuvering in dense foliage that they otherwise failed to negotiate. Upon release supplementary feeding for up to two months was found to be beneficial though birds recognized fruits in the forest right away that they had not been fed before. When the birds were in good shape, they were checked for general health (for example, blood count, blood chemistry), pathogens and endoparasites by the project veterinarian Dr. E. Sanchez, thus placing the release project in the top 10% of such projects worldwide; surprisingly approximately 90% out of 29 avian release projects failed to employ any pre-release health check (*Bird Special of 'Re-introduction News' No. 19, 2000*). Thereafter birds are radio-tagged and softly released in groups of at least two into the surrounding peninsula forest around the Research Station. Their whereabouts are monitored almost daily by telemetry to check their survival and reproduction. Monitoring of released hornbills starts on the first day a bird was marked (radio-tagged).

Accordingly monitored birds paired up with wild ones in the forest and from among 14 monitored hornbills two males bred successfully with wild females, the first such record for any hornbill worldwide. Additionally, pairing up with wild birds reduced the released hornbills tameness to humans, which can be a potential problem. Nonetheless, post-release breeding proves that rehabilitated birds are sufficiently socialized to successfully pair up with wild birds. This does not exclude that deficiencies remain due to hand-raising and the circumstances of captivity.

Close monitoring of released birds proves to be vital as this can ensure that the released birds are doing well in the wild. But the handheld YAGI antennas being used by PESCP at present are quite inadequate to detect and closely monitor the tagged Tarictics. Long-range dipole antennas and data loggers are needed for a longer-term monitoring of the fates of these endangered birds. These dipole antennas would optimally feed their signals into receivers with data loggers. The stationary antennas would be placed on the ridges in the peninsula to ensure maximum range pick-up of radio signals. At present, PESCP does not have the financial means to import these gadgets, as it is a non-profit organization. Once the organization can find the means to purchase these dipole antennas, through benevolent individuals and organizations that care for the conservation of these endangered species, then the survival of Tarictics on Panay can be much better gauged.

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Update on the night heron substitution in Bermuda

This article reviews the long-term prognosis of the translocation and hand rearing between 1976 and 1978 of nestling Yellow-crowned night herons of the nominate race (*Nyctanassa violacea violacea*),from Florida as a surrogate for an endemic night heron derived from *N. violacea* that became extinct soon after human settlement in 1612. It was hoped that a restored breeding population of night herons would serve as a biological control for the red landcrab (*Gecarcinus lateralis*), which had become a superabundant pest in the interim Wingate (1982) & Olson and Wingate (in press).

I had assumed that potential breeding sites for this heron on tiny, urbanized Bermuda would be extremely few and that this would impose severe limits on the success of the re-introduction. The first breeding colony was indeed in Bermuda's only true "wilderness" area, but by 1985 small breeding colonies were establishing all over the island in situations that I would previously have considered entirely unsuitable. There were three contributing reasons for this, one of which could never have been anticipated. Firstly, there is no hunting in Bermuda and the bird protection laws are surprisingly well respected; secondly the herons themselves are extremely cryptic when nesting and most people fail to notice nests even when they are in close proximity. Thirdly, and quite unexpectedly there was a dramatic change in the nature of Bermuda's vegetation by the late 1980's as a result of the aggressive growth of new invasive tree species, and the effects on this new and ill-adapted woodland of a series of major hurricane events beginning in 1987. Formerly accessible woodlots were rapidly degraded into impenetrable tangles of up-rooted trees and broken branches, notably fiddlewood (*Citherexylum spinosum*) and Brazil pepper (*Schinus terebinthefolia*). Thickets as small as 1/4 acre surrounded by suburbia can now support nesting herons, as long as they escape the perennial threat of the bulldozer! While it has been difficult to census this primarily nocturnal and otherwise secretive bird, the night heron attained islandwide distribution by the mid 1980s and stabilized in the 1990s somewhere between 150 and 350 birds.

The night herons effectiveness as a biological control for land crabs has far exceeded original expectations. Indeed

Yellow-crowned night heron (*Nyctanassa violacea violacea*)
© Richard Ground

there is a mistaken perception by some members of the public that it is causing the extinction of the crab, but this is primarily because it controls the crabs most effectively in open manicured areas such as lawns and golf courses where people notice the difference, and where, incidentally, the control was most desired. More than 7% of Bermuda's total land area is managed as golf courses and I was originally skeptical that a biological control agent which depends on a balance between predator and prey would achieve sufficient control to satisfy golf course managers who were in the habit of using deadly pesticide baits to poison the crabs. Yet, by the 1990's they had all unilaterally stopped using crab baits because the heron was achieving 100% control. Evidently, the expansive areas of mown fairways provide no hiding places for the crabs and they do not now colonize beyond the rough verges.

The balance is achieved in Bermuda's more densely vegetated areas where the herons have more difficulty hunting. Here, the crab burrow densities are about 50% of previous levels. My own assessment is that the landcrab is nowhere near endangered, but has simply declined from the status of an abundant pest to common. This is borne out by the fact that landcrabs of all age classes continue to be the main food item long after the heron population has stabilized. In any case two other factors have contributed to the landcrabs actual or apparent decline. The first is rampant development, especially in coastal areas where it was most common; the second is a huge increase of traffic on the roads. During spawning time in early July thousands have to cross coastal roads to reach the sea and these days the toll to traffic is catastrophic; a third factor, which may contribute to the *perception* of decline is that the reduced population, now more in balance with the food supply, no longer needs to range so far or so long on the surface, and natural selection from constant predation has made the crabs much more cautious about coming out of their burrows.

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Oriental white stork re-introduction in Japan

On 8th September 2005, five Oriental white storks (*Ciconia boyciana*) were released on trial at the stork research center newly opened in 1999 named "Homeland for the Oriental White Stork" in Toyooka City, Hyogo prefecture, Japan. This test release was a part of the re-introduction project of the species and was the first attempt since the extinction of the last population of this species in Japan. Their behaviors in the wild have been observed by the staff of the research center with the collaboration of people from the local community, and the

Oriental white stork (*Ciconia boyciana*)
© Koichi Murata

results will be used as background information for the restoration or re-establishment of stork habitat. The five storks that were released have expanded their range of activities and gradually became independent. Furthermore, breeding is expected to occur next spring because some of the birds showed pairing behavior.

Past History

The last wild stork was caught and kept in captivity for a breeding program in 1971. Although presently there are 2,000 to 3,000 storks in the continent, this bird was the last of the species in Japan (Murata, 1997, 1999 & Yamamoto, 2005). Captive breeding of domestic storks at "Toyooka Stork Breeding Center" that was first established in 1965 failed because of aging and/or pesticide exposure in storks. The Japanese population finally reached extinction in 1981 when the last captive bird died of pancreatic cancer at the animal hospital of Kobe Municipal Oji Zoo (Murata *et al.*, 1993). The captive propagation program was employed because it established successful breeding using six young storks imported from the former Soviet Union to the breeding center. The first chick hatched at the center in 1989. Subsequently, storks bred at some zoos in Japan were also included in the program in order to maintain genetic diversity; the total captive population thus increased to 100 by 1992. There were a total of 204 captive storks at the breeding facilities in Toyooka City and Japanese zoos as of the end of 2004 (Yamamoto, 2005). Considering the success of the captive propagation, we started future planning for the re-introduction of the species in 1992. As part of the plan, the above-mentioned "Homeland for the Oriental White Stork" was established at the same time. The ground area of the facility is approximately 165 ha and it is situated at Shohunji district, Toyooka City, Hyogo prefecture, Japan. The captive-born storks in the re-introduction program were trained; five birds were selected from the training group for the test release.

Re-introduction Efforts

Environmental consideration and re-establishment of the re-introduced storks have been carried out with the help of the local governmental staff together with the local residents. In Toyooka City, some farmers are attempting farming without chemical pesticides and weeding rice fields by using hybrid ducks; this practice is termed "Aigamo-farming." A citizen group is working on

environmental education for school children in order to teach the importance of conservation. Thus, the Oriental white stork re-introduction project has received social and economical support in the region (Murata, 1999).

Controversial Points

Some drawbacks in this project need to be overcome. One of them is with respect to the genetic diversity observed among the storks. Concurrent with the re-introduction project, we tried to analyze the genetic differences between the extinct Japanese population and the Russian or Chinese population of this stork species used for the captive breeding program. DNA of the extinct birds was extracted from stuffed specimens obtained from some public facilities in Toyooka City (Yamamoto *et al.*, 2000). The results obtained indicated slight differences in the mtDNA cytochrome b sequences of domestic and continental storks. In particular, the difference between the Japanese and Russian populations was considerably greater than that between the Japanese and Chinese populations. This result indicates that the storks genetically related to the extinct population should be re-introduced in Japan (Murata *et al.*, 2004). Furthermore, since the recent captive storks were obtained after breeding a founding population that consisted of a limited number of individuals, systematic captive propagation program is necessary to maintain genetic diversity among the re-introduced population over an extended time period. In conjunction with the environmental restoration, reconstruction, and education in the region, biological studies such as artificial breeding using the method of embryological engineering, preventive veterinary medicine (Murata, 1997), and genetic studies are necessary for the long-term re-introduction plan for the Oriental white stork.

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PLANTS

Sharing experiences and expertise: guidelines and workshops for the re-introduction of threatened plants in Australia

The 'Guidelines for the translocation of threatened plants in Australia' was first published by the Australian Network for Plant Conservation (ANPC) in 1997, after a dedicated workshop recognised the need for formal Guidelines to support the increasing number of re-introductions (in Australia the general term used is 'translocations'). The first edition was extremely successful and has been extensively used by conservation agencies, community groups, environmental consultants and local governments. However, much additional experience has been gained since, with a dramatic increase in research-based plant re-introductions in the last few years. As a result, a new team of experts was brought together to prepare a second edition of the Guidelines which was launched in 2004 (see ***http://www.anbg.gov.au/anpc/*** if interested in obtaining a copy). More than a second edition, this is a completely new publication. The new Guidelines have been reorganized into a more user-friendly document filled with relevant definitions and a wide range of new up to date examples illustrating why the issues discussed are important and can contribute to re-introduction success or failure. The main objective of this publication is to describe the complexity of re-introductions and to provide suggestions on how to best plan, develop and manage such considerable undertakings.

After the initial introduction chapter describing the scope of the Guidelines and defining the basic terminology, Chapters 2 and 3 describe how to recognize if re-introduction is really the best conservation option, and on the type of preliminary information that is needed before such a project can be initiated. The next three chapters focus on the preparation of a translocation proposal (a legal requirement in Australia when dealing with rare species), the pre-translocation preparation (plants, sites, people) and the translocation itself (planting). Chapter 7 focuses on what are arguably the issues more likely to have a crucial impact on the success of the project: long-term monitoring, management and evaluation of success. The commitment needed for these important post-re-introduction steps is sometimes overlooked and can lead to the failure of the whole project. The final chapter discusses community involvement and is followed by a detailed study case on *Grevillea scapigera*, one of the most comprehensive plant re-introduction projects in Australia.

Since the launch of the Guidelines, a series of workshops was run by the ANPC across Australia. These workshops examined the question of plant translocation and created a discussion forum for assessing risks and requirements of this conservation approach, while creating the opportunity for local presenters to discuss their cases.

Although this publication was developed from practical experience and applied research from Australia, the approaches suggested have much broader application. For instance, in 2005 a successful workshop based on these Guidelines and presented by its authors was organised by Botanic Gardens Conservation International (BGCI) in Pune, India. This particular workshop presented practical and theoretical approaches for the successful translocations of rare plants and emphasised the importance of scientific design, monitoring and long-term commitment to conservation and management projects in general.

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Pre-reintroduction planning: assessing the suitability of plant material and planting sites in rainforest remnants of northern NSW Australia

Starting in the Miocene, rainforest in Australia was significantly reduced in area and distribution by climate change that led to increased aridity. The remaining moist forest refugia are scattered along the east coast, from the northern tropics to the temperate forests of the south. In the sub-tropical region of south-eastern Queensland and north-eastern New South Wales (NSW, Australia) the remnant areas of rainforest represent a range of ecological communities that are significant centres of biodiversity and endemism. This region alone retains over 50 endemic plant genera and 200+ rainforest species at the northerly or southerly limit of their distribution. Recent anthropogenic pressure, including forestry activities, clearing for agricultural purposes, and residential development, has reduced many species to critically low numbers and all but obliterated their habitat. As a result, these fragmented remnants harbor a considerable number of threatened plants and animals. In order to ensure their long-term survival, conservation agencies are considering re-introduction as a possible management option. Local NGOs have also supported on-ground community conservation initiatives based on rainforest regeneration and reconstruction techniques developed within the region over the last 20 years, and are now interested in the prospect of including locally threatened species within their projects. It is now widely acknowledged that re-introductions are complex and resource intensive, and can be potentially detrimental to highly threatened species. Such activities are generally considered as a last resort, should be complementary to *in-situ* management options and only undertaken if sufficient information is available to ensure the re-establishment of self-sustaining populations within suitable habitat. Therefore, careful preliminary planning and research are essential. Three local examples of pre-re-introduction studies are presented to illustrate how background information can inform re-introduction planning and (depending on the circumstances) influence the nature of the proposed activities.

When not to re-introduce: *Acronychia littoralis* (Rutaceae)

Acronychia littoralis T.Hartley & J.Williams is restricted to small remaining pockets of littoral rainforests within the region, and co-occurs with a number of more common species from the same genus from which it can be difficult to differentiate. The distinguishing morphological features of this small tree (oil dots and fruit characters) are often unreliable and it was suggested that *A. littoralis* could be a natural hybrid with two distinct morphological forms (northern and southern). The unreliability of these morphological characters has (until recently) complicated littoral rainforest conservation, as the presence of this rare species was (in some cases) an impetus to delay or terminate further coastal 'development'. In that context, misidentification could potentially result in the clearing of whole populations. More recently some community groups have shown an interest in the re-introduction or re-inforcement of populations within rainforest remnants to further assist species conservation and recovery, and habitat preservation. In such cases the use of unsuitable material could also significantly compromise existing populations. Thus, at all levels, adequate management actions could not progress unless the taxonomic status of this tree was clarified.

Genetic studies showed that *A. littoralis* represents two distinct taxonomic units originating from natural hybridisation events between locally common species (Rossetto, 2005). These findings have important management implications, particularly since introgression appears to be possible between *A. littoralis* and its parental species, thus explaining the intermediate features of some individuals that make them difficult to identify without DNA-based approaches. Consequently, until a quantitative and qualitative study on natural introgression levels and their consequences is completed, all local plantings of rare and common species in the genus *Acronychia* have been discouraged.

Experimental re-introduction: *Elaeocarpus williamsianus* (Elaeocarpaceae)

Elaeocarpus williamsianus Guymer is known from nine sites of lowland subtropical rainforest. This small multi-stemmed tree is capable of vigorous vegetative growth and most of the remaining sites are on steep, eroding and often disturbed slopes where active vegetative growth provides a

Elaeocarpus williamsianus
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competitive advantage. However, a study on the reproductive biology and genetics of this tree found that all but one population consist of single clones (Rossetto *et al*., 2004). Thus the hundreds of above-ground stems (ramets) across all sites represent a total of only 10 genetically distinct individuals (genets). Furthermore, viable seed have only been recovered at the only site with two clones, suggesting that *E. williamsianus* is a preferential outcrosser. The considerable geographic distance between genets is therefore a major potential impediment to sexual reproduction.

These findings and the fact that the majority of the sites are weed infested and within private property (including a banana plantation), suggest that the long-term safety of *E. williamsianus* cannot be guaranteed by the existing populations. The loss of even one single site/clone would represent a significant loss of diversity and a permanent reduction in distribution range (since the lack of viable seed implies that natural re-colonisation events are unlikely). As a result, the re-establishment of new populations that include equal numbers of each of the 10 clones within protected areas is currently being planned. Experimental sites will include a re-inforcement site, where only a few stems of one of the clones remain and where an equivalent number of each of the other clones will be planted. A protected new site where even numbers of all the clones will be introduced is also being considered. This approach will establish new populations based on the maximum genetic diversity and potential for sexual reproduction (with all its evolutionary advantages).

Rare species re-introduction as part of the restoration of an endangered ecological community: *Fontainea oraria* (Euphorbiaceae) in littoral rainforest

Fontainea oraria Jessup & Guymer is a small dioecious tree under extreme threat of extinction, being restricted to 10 adult trees within a single site in private, highly disturbed land. Only one female tree currently contributes to successive generations, and although the species and its' endangered ecological community habitat are legally protected, *F. oraria* is clearly threatened by potential stochastic events that could destroy this last population (Rossetto *et al*., 2000). Further pressure comes from the fact that this small tree is found within one of the most economically-valuable coastal strips of Australia, and residential development of land adjacent to the sole remaining site has been approved. No comparable sites are locally available, thus until other suitable areas are identified, the only option is to restore the rainforest remnant and reinforce the existing population. The management and conservation of *F. oraria* and its endangered ecological community are currently being planned with the support of the land owner.

As both the species and ecological community are endangered, careful consideration is needed before the restoration of the local habitat can proceed. One of the issues that needed attention was the identification of suitable sources for the plant material to be used in the habitat restoration as there are no remaining similar undisturbed sites. An ecological investigation of other surrounding rainforest sites based on the classification and ordination of floristic and environmental variables identified a range of suitable plant material and sources (Kooyman & Rossetto *in review*). This information will be

Fontainea oraria
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useful for the restoration of the original site and for the identification and management of possible sites for future conservation introduction projects. The combination of ecological, environmental and genetic information can now support enhanced re-introduction and restoration planning for *F. oraria* and its habitat.

Conclusion

A valuable outcome from the process of conducting conservation and management-focused research across a range of rare rainforest plants from northern NSW, is the realisation that although every species has its own important life history trait combinations and environmental tolerances that need to be considered, a combined multi-species and habitat approach is likely to be both more resource effective and more likely to succeed. Environmental, ecological and even genetic data (particularly when related species are involved) can be simultaneously collected for a number of species that share similar habitat preferences and distribution patterns. The information obtained is likely to provide answers for species-specific questions, as well as identify broader conservation and management issues. As a result, our future research and planning will increasingly follow a multi-species approach.

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