Re-introduction NEWS 23

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Re-introduction NEWS
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Letter from the Chairman, IUCN/SSC Re-introduction Specialist Group, Environmental Research & Wildlife Development Agency, UAE
DR. FREDERIC J. LAUNAY

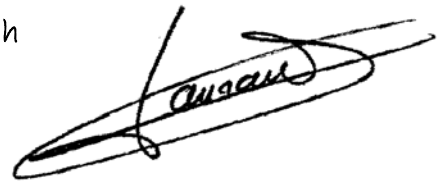
Issue 23 has added a new General Updates section which provides the reader with short clips and updates on a variety of projects and we hope this is a useful addition to this issue. We are always trying to make this newsletter more interesting and useful and hope our readers find it of value.

I would like to welcome and congratulate Carlos R. Ruiz-Miranda who has recently been appointed as the new RSG Meso- and South-America Regional Chair. Carlos is based at the Universidade Estadual Norte Fluminense in Rio de Janiero, Brazil. We hope the RSG can now have a greater impact in this region! This issue also has some interesting articles from the region and we hope that we shall be able to provide our readers with more insights of re-introduction projects from Meso- and South-America.

The RSG has also now set up its new website at www.iucnsscrsg.org. I would like to take this opportunity to thank the SSC staff who were initially assisting the RSG by maintaining a web-presence on the IUCN/SSC website. We are now able to regularly update our own site and I would encourage re-introduction practitioners to submit summaries of their projects for posting on the website. The website also has access to the RSG CD and this issue of the newsletter will also be posted on our website.

We are going to start updating the RSG Re-introduction Projects Database. The last update culminated in the publication of the Re-introduction Practitioners Directory 1998. We now hope to establish a database at the RSG Secretariat and which we will hopefully receive updated and new information from re-introduction practitioners to populate this database. We will then publish regular updates on to our website. I encourage you to contact the RSG Secretariat to register yourselves so we can be able to send you the data sheets when they are ready.

The next IUCN World Congress will be held in Bangkok in November, 2004 and we are contemplating to hold an RSG meeting for members who may be attending this congress. We have communicated a previous correspondence on this through our e-mail listserver but if you are attending please contact the Secretariat and provide us with your details. We need to know early enough so that we can start making the necessary arrangements.



GENERAL UPDATES

RSG Resource CD v 1.0 Jan 2003

The RSG produced and disseminated a resource mini-CD in January 2003. This CD was produced for two main reasons:

- To fulfill the objectives of the RSG and Species Survival Commission (SSC) Strategic Plan. The SSC Objective 3 calls for increased capacity to provide timely, innovative and powerful solutions to conservation problems through internal and external access to SSC publications, products and lessons learned.
- Due to a diminishing stock of hard copies of past RSG literature coupled with high mailing costs of hard copy material. The CD has been extensively distributed and is also accessible through the RSG website at ***www.iucnsscrsg.org***.

The CD contains, 1) a general introduction, 2) 22 issues of the RSG's newsletters (November 1990-January 2003), 3) RSG guidelines, SSC and other conservation policies and reports, and, 4) Re-introduction Practitioners Directory, RSG library bibliography, RSG and SSC Strategic Plans.

We would like to take this opportunity to thank the following organizations for their support, production and distribution of this CD:

- Denver Zoological Foundation, USA
- Environmental Research & Wildlife Development Agency, UAE
- Durrell Wildlife Conservation trust, Channel Islands
- National Tropical Botanical Garden, USA

New RSG website

The RSG launched a new website on 4th August 2003 and the address of this website is **www.iucnsscrsg.org**. The RSG previously had a page on the SSC specialist groups website but it was not possible to regularly update this site. This new site has a News Update page which will be updated regularly and will contain latest news and other information. As of 2nd November 2003 this website had recorded a total of 904 hits.

Conservation medicine and impact of RSG CD

Conservation medicine is an emerging field that involves the integration of veterinary medicine and conservation biology. There is increasing recognition that veterinarians have an important role to play within interdisciplinary teams working on environmental conservation programs. Wildlife agencies, zoos, agriculture departments, landcare groups and other non-government organisations require veterinary expertise for endangered species recovery and conservation programs.

The Masters in Veterinary Studies (Conservation Medicine) and Postgraduate Certificate in Veterinary Conservation Medicine are new postgraduate programs commencing at Murdoch University, Australia in 2004. They have been developed to provide graduate veterinarians with the opportunity to obtain training and expertise in wildlife, zoo and conservation medicine. They will also be relevant to graduates seeking to incorporate wildlife and exotic animal medicine into private practice. The course will be offered to veterinarians both in Australia and overseas by distance education.

Components of the course focus on endangered species recovery programs, as well as the role of the IUCN in nature conservation. The Re-introduction Specialist Group CD will be linked to the electronic library server that students will be using for these postgraduate programs. The information contained on the RSG CD, particularly the RSG recommendations and publications, is not only relevant to the postgraduate course but will be invaluable reading for the students.

Kris Warren, Murdoch University, WA, Australia,
e-mail: kwarren@murdoch.edu.au

Guidelines for *in* situ translocation of the African elephant for conservation purposes

The IUCN/SC African Elephant Specialist Group (AfESG) in conjunction with the Re-introduction and Veterinary Specialist Groups has produced the above guidelines to provide informed advice to decision-makers in African range state governments, managers on the ground, NGO's, donors and other practitioners wishing to re-introduce or translocate African elephant (*Loxodonta africana*) populations for the primary purpose of conserving this species in the long term. These guidelines are now currently in press and are also being translated into French and Portuguese. They will be widely disseminated to relevant organizations and also be put on the WWW.

Galliforme Re-introduction Guidelines

The RSG has also signed an MoU with the World Pheasant Association (WPA) which is the umbrella organisation for the five Galliformes Specialist Groups (Pheasant, Grouse, Partridges, Quail, Francolins, Megapodes and Cracids) which operate under the joint parentage of WPA and SSC/ IUCN. This project is in the preliminary stage but we are aiming to draft Galliforme Re-introduction Guidelines which will be useful in assisting Galliforme recovery projects worldwide.

If you wish to find out more about this initiative contact Phil McGowan, Conservation Director, WPA (*pmcgowan@gct.org.uk*) or Phil Seddon, RSG Bird Section Chair (*philip.seddon@stonebow.otago.ac.nz*).

Review of the ANPC translocation guidelines

The publication titled Guidelines for the Translocation of Threatened Plants in Australia is currently being revised. First published by the Australian Network for Plant Conservation in 1997, this is the only published guide focusing in detail on the re-introduction of plants, and contains principles and approaches that are relevant and applicable throughout the world. The guidelines have become an important planning resource in Australia; helping groups and organizations to decide whether translocation is the best option for their situation. The content provides information on useful approaches from planning through to monitoring and follow-up work, as well as useful contact details and case studies.

The IUCN/SSC RSG will be involved in reviewing a draft of the second edition when it is released for public comment in January — February 2004. Keep an eye on the RSG web site *www.iucnsscrsg.org* and the Australian Network for Plant Conservation website *http://www.anbg.gov.au/anpc* for updates about the review.

If you are involved in plant translocation projects and would like to provide input on a full draft in January-February 2004, receive more information, or order a copy please contact: ANPC National Office, GPO Box 1777, Canberra, ACT 2601, AUSTRALIA, Tel: +(0)2-6250-9509, Fax: +(0)2-6250-9528, E-mail: anpc@deh.gov.au

Re-introduction Science: development of an Avian Re-introduction Database

Re-introduction programs are complex, diverse, expensive, risky experiments. In any scientific research program, the first task for a researcher is identification of the known information. However publications on re-introductions are not easily located; there is no specific journal, series of books, or single resource. Even when information is located, the methodologies are not consistently reported and variables are often not quantified in any standardized format. The difficulty in acquiring data on past re-introductions can compromise our present and future attempts to conserve populations.

In a partnership, Lincoln Park Zoo's Department of Conservation and Science and the U. S. Fish and Wildlife Service have created an exhaustive database of avian re-introductions from over 25 countries to address the difficulty of finding data on past reintroductions. The Avian Re-introduction Database is populated with 80 biological variables that span species life history to the quality of the release site. The variables were identified after extensive literature searches and focused on information critical to the success of a release plan; for example, they include survivorship, supplementation, number and sex of individuals, and whether the original cause of decline had been addressed before release. We populated the database with data found through examination of peer reviewed articles, websites, grey literature, and personal contact with project managers. Consistent data quality was a focus of the structure and every value in a quantitative variable is associated with the original source for its value. In addition, the values are collected in a standardized format that allows analysis across species. As of September 2003, the Avian Re-introduction Database contains re-introductions on 61 species, 193 sites and 569 events with over 200 sources associated with the variables. We anticipate that most data will be collected, entered, and validated by January 2004.

Unfortunately, many re-introduction projects have not published data on their programs or have published limited data relevant to releases. At the present, the lack of data seriously limits the value of the database. Please contact us if you have been involved in a re-introduction and would contribute your data. Please contact Joanne Earnhardt at Lincoln Park Zoo, 2001 N. Clark St., Chicago, Il 60657, U.S.A. or by e-mail at *jearnhardt@lpzoo.org*

Sahelo-Saharan Interest Group (SSIG)

The SSIG is a network of like-minded individuals and organizations committed to conserving the wildlife of the Sahelian and Saharan countries of Africa. SSIG is independent, non-governmental and apolitical in nature. The Group was formed in May 2000 as a result of a range states meeting organized by the Convention on Migratory Species (CMS) to adopt an Action Plan for six species of Sahelo-Saharan ungulate: the addax and scimitar-horned oryx, and the dama, dorcas, slender-horned and Cuvier's gazelles. One of the Group's aims is to promote and contribute tangibly to the implementation of the CMS Action Plan.

Beyond the Action Plan, SSIG interests extend to all types of aridland fauna, flora and traditional land-use practices necessary for the maintenance of healthy desert ecosystems. Communicating the unique values and importance of deserts to wildlife and people alike is also high on SSIG's agenda. The SSIG network is currently made up of some 60 members, linked by a list-server committed to proactively sharing information, resources and skills. SSIG's membership reflects a wide range of institutions, including research centres, zoos and zoological associations, museums, IUCN Specialist Groups, NGOs and government and inter-governmental agencies, studbook keepers, SSP and EEP coordinators. It also comprises a very broad range of wildlife management and conservation expertise, including captive breeding, species re-introduction, genetics and reproduction, wildlife health and husbandry, protected areas establishment and management, wildlife survey, remote sensing, etc. SSIG meets annually to share information, provide updates on work undertaken, and to discuss projects for the coming year.

To date, SSIG has been involved in both *in situ* and *ex situ* conservation efforts in Chad, Egypt, Ethiopia, Mali, Mauritania, Morocco, Niger, Senegal and Tunisia. SSIG's long-term vision is to see the now critically endangered wildlife of the Sahel and Sahara restored to sites across its former range. Intrinsic to this will be the development of new conservation models whose success depends on the custodianship of nomadic desert dwellers, as well as more traditional forms of protection provided through the establishment of national parks and game reserves.

Programmatically, a top priority for SSIG is *in situ* conservation efforts in Chad and Niger. Recent SSIG surveys have identified key sites for conservation of the critically endangered addax, dama gazelle and Saharan cheetah. They have also identified increased threats, notably from foreign hunting parties. One of SSIG's immediate institutional goals is to establish a small permanent presence with full-time executive capacity for increased communications, fundraising and technical support.

For further information about SSIG and its work, please contact its Chairperson at the following address: Steven L. Monfort, DVM, PhD, Smithsonian's National Zoological Park Conservation & Research Center, 1500 Remount Road Front Royal, VA 22630, Tel: 1-540-635-6589, Fax: 1-540- 635-6506, e-mail: smonfort@crc.si.edu

Turks & Caicos iguana translocation program update

In January 2002, we translocated 158 critically endangered Turks and Caicos iguanas (*Cyclura carinata*) from two large islands where they are threatened by development and feral mammals to three small, protected islands lacking these threats and resident iguana populations. In collaboration with our program partners in the Turks and Caicos Department of Environment and Coastal Resources, introduced rats were eradicated from four islands. Hormone studies to determine baseline corticosterone levels and evaluate the stress of capture and translocation were initiated, and hematology, blood chemistry, and parasitology analyses were also carried out to determine baseline parameters and possible effects of translocation on health.

Working with local botanists in the Turks and Caicos, we generated complete plant lists for all of the source and translocation cays, and initiated quantitative vegetation surveys. Our behavioral observations and field samples added 25 native plant species to the extensive list of food items previously compiled for this species. We have also initiated analyses of 40 known iguana food species, along with quantitative seasonal dietary studies on all source and translocation islands. All this data is being entered into a comprehensive GIS database for all source and translocation cays. On each follow-up visit, we have recaptured as many translocated animals as possible to measure their growth and document dispersal, movement patterns, reproduction, and habitat use. Although data analysis for this work is ongoing, initial results of the translocations are very promising. Despite showing signs of stress shortly after being translocated (decreased mass and increased corticosterone and blood protein levels), all of the translocated animals recaptured in June-July or October-November had rebounded and grown significantly. Nesting activity was also observed on all of the translocation cays in June and hatchlings were captured on each cay in October, providing evidence of successful reproduction. Further, the average size of juveniles on each of the translocation cays two months after hatching is already larger than on the corresponding source cays.
Finally, informative signage was prepared for use on all of the translocation cays, and a series of newspaper and magazine articles published featuring the conservation status of the iguana and how individual citizens can help. At the close of 2002, Dr. Gerber was honored with the Turks and Caicos National Trust's 2002 Conservation Award for his work.

Contributed by Allison Alberts, Ph.D., e-mail: aalberts@sandiegozoo.org *& Glenn Gerber, Ph.D., e-mail:* ggerber@sandiegozoo.org*, Division of Applied Conservation, Zoological Society of San Diego, USA*

Latest on the brown bear translocation to the Italian Central Alps

With the aim of recovering the Alpine population of bears, a translocation was started in 1999 by the Province of Trento, the Natural Park Adamello Brenta and the Italian Wildlife Institute, with the cooperation of the Slovenian Wildlife Service. Before approving the translocation project, a detailed study was realised by the National Wildlife Institute, assessing the feasibility of the program, the social acceptance and the costs.

During 1999-2002, a total of 10 animals (3:7) were captured in Slovenia and released into the Central Alps. The translocation had no effect on the source population, because the number of captured animals was taken off from the Slovenian annual hunting quota. Bears were transported on a van equipped with air conditioning and an internal video surveillance system; a veterinarian was always present during the capture, transport and release phases. All animals were fitted with transmitters (1 radio collar and 2 ear transmitters on each individual) and intensively radio-tracked. One female died under an avalanche in winter 2000/2001. The first reproduction occurred in spring 2002 (2 cubs), and a second this year (2 cubs; one preyed upon by a golden eagle last April). Damage caused by the bears (mostly bee-hives destruction) has been rapidly compensated through a private insurance and/or funds provided by the Provincial administration. An emergency team was created to manage critical situations.

A "Bear Committee" comprising of bee-hive farmers, livestock breeders, NGOs, local administrations amongst others periodically meets to promote circulation of information and to raise issues. The local hunters association cooperates with the monitoring and a public relation officer was hired. This adopted cooperative approach managed to limit the opposition by residents to the translocation.

Piero Genovesi, National Wildlife Institute – Italy, e-mail: infspapk@iperbole.bologna.it

New swift fox re-introduction project

The Cochrane Ecological Institute (CEI) has initiated a new swift fox (*Vulpes velox*) re-introduction project in close collaboration with the Blood (Kainai) tribe of southern Alberta, Canada. The swift fox is a spiritually and culturally significant species for the Blood Tribe. Briefly, this project has the following aims:

- A habitat survey to establish a baseline of the fauna and flora and to identify key habitat for the swift fox. This will provide the Blood Tribe with the first habitat survey of their lands.
- Provide capacity building to the Blood Tribe in species re-introduction and habitat management.
- To re-introduce the extirpated swift fox to Blood Tribal Lands
- To evaluate and monitor the human dimensions of a re-introduction program.
- To share the results through an interactive, multi-media educational website.
- To establish another population of swift fox in an area where habitat corridors will eventually enable this population to connect with the re-introduced population on the Blackfeet Tribal Lands in Montana, USA (Waters *et al.*, in prep).

As with the re-introduction project on Blackfeet Tribal Lands all re-introduced swift fox will originate from the CEI's captive breeding group. Hair samples from every individual in captivity at the CEI have been collected and analyzed. This work is being undertaken by a graduate student at the Natural Resources DNA Profiling & Forensic Centre at the University of Trent in Ontario, Canada. This project will also enable us to survey the re-introduced population of swift fox non-invasively with the use of hair traps developed at CEI (Waters *et al.*, in prep.).

Sian S. Waters & Clio Smeeton, Cochrane Ecological Institute, Alberta, e-mail: cei@nucleus.com*, URL:* www.ceinst.org

Update From Hawai`i – puaiohi re-introduction program continues for fifth year

The Hawai`i Endangered Bird Conservation Program, administered by the Zoological Society of San Diego and in partnership with the U.S. Fish and Wildlife Service, the Hawai`i Division of Forestry and Wildlife and the U.S.G.S.-Biological Resources Division successfully re-introduced 18 puaiohi (*Myadestes palmeri)* in the native rainforests of the Alaka`i Wilderness Area on the island of Kaua`i. This is the fifth consecutive year for the re-introduction program, which has released 60 captive-reared Puaiohi to date.

Survivorship for the first 30 days post-release is at least 58% and may be as high as 87%. Released birds from each of the five years have been confirmed to breed in the wild, both with other captive-reared/released birds as well as with wild birds. The free-living population was estimated to be 250-300 birds in 1997, but more recent field surveys indicate an unconfirmed growth in the population.
Submitted by Alan Lieberman and Grant Beauprez, e-mail: liebermana@prodigy.net

Hermann's tortoises affected by forest fires in France

Between 17th July and 5th September 2003, 20% of the Massif des Maures, Var, France, has been destroyed by "arson" forest fires. Several major populations of the endangered Hermann's tortoise (*Testudo hermanni hermanni*) have been partially destroyed in the areas of Vidauban, Plan de la Tour and La Mole. A national restoration program is under way which is initiated by the French Ministry of Ecology and Sustainable Development. SOPTOM proposes various actions for the protection of this species such as surveys and restoration of populations. We are especially worried by the general public that gathers tortoises to "to protect them against fires" and an increase in mortality due to mowers used to clear-cut bushes to prevent and slow down fires.

In Vidauban, SOPTOM previously studied a site where 2/3 of the area has been destroyed by the fire of 17th to 18th July. The population was estimated to be 334 ±77 adult tortoises (Lincoln-Petersen index), and juveniles were reported all over the site. After the fire, we found 37 corpses of subadult and adult tortoises (min 95mm CL) and 13 adult tortoises alive which have been immediately translocated to the closest un-burnt area. As all Var suffered a severe drought since mid-May, it is assumed that many tortoises were aestivating underground, which would explain why some of them survived the fire which spread rapidly at 4km/h. But this may also lead us to underestimate mortality as we cannot count how many tortoises died underground. Mortality of juveniles and eggs could not be assessed as no remains were found. This disaster stresses how vulnerable chelonian populations can be to fires or urbanisation. Surveys should also be implemented to make sure that the populations partially destroyed by the fires can recover by themselves as soon as the vegetation grows back. Otherwise, releases may be needed to support recovery, and should be planned ahead of time as juveniles cannot be released before sanitary and genetic surveys are done and predation risk is minimized (5-6 year old juveniles). Recent population dynamic studies should also be very helpful in predicting which release program should be efficient with regard to the dynamic of the remaining population and the ability to reproduce Hermann's tortoises in captivity (Pedrono, 2000).

Barbara Livoreil, Soptom – CRCC, Tortoise Village, Gonfaron, France, e-mail: Blivoreil@aol.com

2,216 zoo-bred field crickets released into Southern England & good news too for the wart-biter cricket

As part of English Nature's long running Species Recovery Program for the field cricket (*Gryllus campestris*), this year's breeding effort at London Zoo provided 2,216 late instar nymphs for releasing into three separate sites in Southern England (including the Isle of Wight and 2 sites in West Sussex). This release population was derived from a founder stock of 3:3 crickets collected from the single surviving wild colony earlier in the year. Prior to field release a rigorous health screening protocol was followed to ensure that the release stock was not present with any parasite profiles not already known to be present in the native UK wild population. As in previous years, these newly released populations will be subjected to follow up survey to ascertain

whether the respective populations have successfully established.

Similar follow up survey work, conducted by English Nature colleagues, this summer confirmed that an earlier set of captive breeding and site release work conducted for the wart-biter cricket (*Decticus verrucivorus*) has resulted in an established population at the two Kent release sites. Unlike the field cricket, this species has a complex egg development phase resulting in a two-year cycle before hatching (although it can be as long as 10 years). Hence the delayed confirmation that these site releases were successful.

Paul Pearce-Kelly, Curator of Invertebrates, Zoological Society of London, UK, e-mail: Paul.Pearce-Kelly@zsl.org

RSPB corncrake release in UK

The Royal Society for the Protection of Birds (RSPB) is pleased to give details of an ambitious project to restore the corncrake as a regular breeding species in England, decades after its disappearance from the British mainland. This is a partnership project between the Royal Society for the Protection of Birds, English Nature and Whipsnade Wild Animal Park. In February 2001, 15 young captive-bred corncrakes were imported from Germany. They were quarantined and spent the spring at an indoor facility at Chester Zoo; in June they were transferred to purpose-built outdoor pens at Whipsnade Wild Animal Park.

Disappointingly, no breeding took place that summer, and in the autumn they were moved to a heated indoor enclosure for the winter. In April 2002, the birds were moved back into individual outdoor pens, where the males soon began vigorous calling. They were introduced to females one by one, and egg-laying began in earnest in mid-May. The first brood of chicks hatched on 16th June, followed by others later in June. Unfortunately, a weasel found its way into the breeding enclosure, and killed a number of chicks and adults before being discovered. As a result, only 10 chicks were reared successfully. Four were kept at Whipsnade for breeding, but the remaining six were released onto an RSPB reserve in eastern England at five weeks old. By then they were full-grown and able to fly strongly. The hope was that they would migrate normally to winter quarters in Africa, returning to the nature reserve next spring. Unfortunately, no calling males were heard on the reserve in spring 2003, though this was to be expected, given the small number of birds that were released.

In December 2002, fifteen more young corncrakes were imported from Germany to join the captive flock. In April 2003, loud calling began as the birds came into breeding condition and, during the summer, well over 100 eggs were laid. The first six chicks were released in June, and by mid August a total of 42 had been released, with a final nine due to be liberated later in the month. Unfortunately, one radio-tagged birds has been lost to predation. The original plan was to release at least 100 birds annually for three years. We are still some way from achieving this sort of number, so it will be important to discuss how it might be possible to produce a larger total in future years. The original three-year project is due to finish in March 2004, but English Nature and Whipsnade Wild Animal Park are keen to continue for another three years, now that the breeding techniques have been shown to work. We are, of course, still some way from getting a breeding population established - the return of released birds to the nature reserve next spring is an essential next step in achieving that.

Peter Newbery, UK, e-mail: peter.newbery@rspb.org.uk

South Islands saddlebacks and robins released in New Zealand

On Sept. 12 2003, 18 South Island saddleback (*Philesturnus carunculatus carunculatus*) and 18 South Island robins (*Petroica australis australis*) were released on Erin Island in Lake Te Anau, Fiordland, New Zealand. This was a joint project between the New Zealand Department of Conservation Te Anau Area Office and the University of Otago. This translocation was significant in a New Zealand context because it was: i) the first release of saddleback back into primarily beech forest habitat, where they have been absent for approximately 100 years, and ii) onto an island that was within swimming distance to stoats, a major (introduced) predator of saddlebacks and of robins.

This transfer has two objectives: i) to assess the value of predator-controlled inshore islands for the translocation of threatened species that are normally vulnerable to introduced mammalian predators, and, ii) to determine the short and long term effects of inbreeding in small island populations. Erin Island had been cleared of stoats since Nov. 2001, although a juvenile stoat was trapped there most recently in July. Stoat control was intensified on the island and the adjacent mainland just before the release took place. In addition to assessing the value of inshore islands for translocation of threatened species, the transfer will form part of a planned sister-study to one underway on Ulva I. by University of Otago, as part of research program to investigate the effects of close inbreeding and reduced genetic variation on nesting success and survival of small island populations of birds. This is one of the first times that all birds caught for transfer had blood samples for genetic analysis taken *before* they were released, to determine whether individuals that have more genetic variability have a greater survival and/or subsequent breeding success. Birds also had standard body size measurements taken as well as blood and faecal samples for disease screening to determine whether other traits could affect successful establishment. The blood sampling and banding of all subsequent offspring will allow pedigrees to be constructed and used to study the effects of inbreeding in island birds.

Monitoring of saddleback and robin survival and nesting success as well as conducting the genetic analysis will be done by University of Otago PhD student Sabrina Taylor over a three year period.

Ian Jamieson, e-mail: ian.jamieson@stonebow.otago.ac.nz

Funding required for fish supplementation project

The Azraq killifish supplementation project in Jordan is being carried out to save this unique endemic species which is only found in the Azraq Oasis from extinction (see *Re-introduction NEWS* 22 January 2003: 29-30). The principal scientist, Mr. Nashat Hamdan is carrying out this interesting project. They have managed to receive partial funding for this MSc project and still require more funding. If anyone is intereseted or knows of any suitable funding sources please contact Mr. Hamidan at: *nashat@go.com.jo*

10th International hamster workshop

The proceedings of the 10th meeting of the International Hamster Workgroup held from 12th till 14th October 2002 in Tongeren, Belgium have been published. The central theme of the congress was breeding and re-introduction and as a result the international hamster workgroup published an official statement concerning *ex situ* conservation measures for the hamster. This book is essential for all those who are interested in the hamster and its biotope.

For further information contact Saskia Mercelis at e-mail:
saskia.mercelis@natuurpunt.be

FISH

The release of sharks from public and private aquariums

Sharks are an integral component of marine ecosystems and are now a major conservation concern. Globally, shark populations are in trouble, with a recent study in the Northwest Atlantic finding that total populations of sharks such as scalloped hammerheads, whites and threshers have each dropped by over 75% in the past 15 years (Baum *et al.*, 2003). This decline is largely attributed to the expansion of fishing fleets out into the open ocean in the last 50 years. The study estimates that all recorded shark species, with the exception of makos, have declined more than 50% in the past eight to 15 years. In other species, such as the hammerhead shark, the population has dropped by 86% since 1986.

Shark fisheries have expanded in size and number around the world since the mid-1980s, primarily in response to the rapidly increasing demand for shark fins, meat and cartilage. Despite the boom-and-bust nature of virtually all shark fisheries over the past century, most shark fisheries still lack monitoring or management. For example, only a handful of the 125 countries that are now involved in shark fishing and international trade have even the most minimal management in place, and there is still no management for sharks fished on the high seas. As a result, many shark populations are now depleted and some are considered threatened (Camhi *et al.*, 1998). At the 2002 CITES Conference of the Parties, both the whale shark and basking shark were accepted for listing under Appendix II (*www.cites.org*).

Sharks are widely held in zoos and aquariums and, increasingly, education and awareness of the conservation issues facing these large marine predators is being shared with millions of visitors. In general, their life history means that these fishes are currently unlikely candidates for captive breeding and re-introduction programs. However, an important benefit of captive breeding programs is the collection of information about reproductive strategies, growth rates, maturity and other life history parameters. This information may be used by policy makers, with appropriate caution, to help formulate elasmobranch conservation management strategies (Rose *et al.*, in press.). The release of captive sharks has occurred historically and continues today. In general, little thought has been given to the scientific robustness of such activities and in some cases re-introduction has been used as a means of disposal of unwanted specimens, against the recommendations of the IUCN Re-introduction Specialist Group, and other professional organization guidelines e.g. AZA, 1992. One area of increasing concern is the release of sharks from the private sector, specifically from misguided acquisitions of

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species that grow extremely large yet are available in the hobby, such as nurse sharks. Some animal activist groups are actively campaigning to rescue sharks from pet shops, restaurants and nightclubs and return them to 'the wild'.

Approach

This subject has been under discussion within the aquarium community and this article aims to outline some of the considerations with regards to the release of sharks. The information in this article was obtained through basic questionnaires, e-mail discussion fora and panel discussions at aquarium conferences.

Discussion

There must be a reason to release any species into the wild, for example if the species has become locally extinct or supplementation of a small population is required to correct skewed sex ratios. The *IUCN Guidelines for Re-introduction* clearly state that the availability of surplus stock is not a reason to release animals into the wild. Many of the common species kept in aquariums have been released into the wild, including Caribbean reef, lemon, nurse, sandbars, sand tigers, silky and seven-gill sharks and dogfish. The reasons behind the release may be that the animal has outgrown a facility, or is surplus to requirements. On a number of occasions, sharks have been released after very short periods in captivity (days to weeks).

Some animal activist groups are actively campaigning to rescue sharks from pet shops, restaurants and nightclubs and return them to 'the wild'.

There is only one documented report of shark releases from an aquarium as part of a co-ordinated conservation program that is looking to improve the status of the species in the wild (Henningsen *et al.*, 1996). The National Aquarium in Baltimore (NAIB), USA is located near the Chesapeake and Delaware bays, which are important nursery areas for the sandbar shark (*Carcharhinus plumbeus*), and other migratory coastal species. For the past 16 years, NAIB has collected elasmobranchs for display using bottom set longlines in the Delaware Bay. In addition to capturing animals for display, over 250 sharks have been tagged in conjunction with the National Marine Fisheries Service Apex Predator Investigation Program: (*http://na.nefsc.noaa.gov/sharks/intro.html*). Juvenile sandbar sharks are maintained in captivity for one year, and then tagged and released into the Delaware Bay. During their stay in captivity, information is collected on their growth and food intake as well as tag shedding. The program has also been used to gather data on biology and reproductive physiology (endocrinology). Blood samples collected from wild-caught sharks are examined for cell morphology, counts and distribution. There is little clinical information on elasmobranch haematology and these data also serve as a reference for health assessment of captive sharks.

The best documented information on a single released shark is from a sevengill known as 'Big Emma' at Monterey Bay Aquarium (Van Dykhuizen, 1998). After four years, Big Emma had developed an abrasion on her snout and was showing potentially aggressive behavior to divers in the tank and a decision was made to release her. The shark was tagged with an external identifying tag and released into the Monterey Bay. On 16th October 1994, in Humboldt Bay, two years and four months after her release in Monterey, a sportfisherman captured Emma. She had returned to the same bay she came from six years before, a distance of about 400 miles. Rose *et al.* (2003) outline the many problematic issues that emphasise the need for extreme prudence when formulating elasmobranch re-introduction programs. There are valid concerns that re-introduction could potentially expose discrete 'wild' elasmobranch communities to exotic parasites or 'exotic' genetic material. In addition, re-introduced elasmobranchs, that have previously received antibiotic treatment, may be carriers of resistant strains of pathogens. Finally, the consumption of re-captured elasmobranchs may represent a health risk if they were given a chemico-therapeutic agent during their time in captivity.

Professional aquariums recognize the importance of veterinary screening of sharks prior to release, and many institutions have comprehensive routine health monitoring procedures in place independent of any release programs. There is some evidence that elasmobranchs, and especially sharks, are less prone to many of the pathogenic parasites that affect bony fishes with similar ranges. However, concerns of exposure to new species of pathogen or those that have a different virulence than native populations remain a concern. Tagging released animals has taken place in some cases. In the USA this has been with National Marine Fisheries Service (NMFS) shark tags, or with PIT (physical implant) tags. A concern is the generally low rate of returns for tags of this kind (<6% in the NMFS Apex Predator Cooperative Shark Tagging Program) means that data on the survival or otherwise of released sharks is potentially limited. However, considering the overall lack of information on most shark species, this data has still proved valuable. Satellite tracking is potentially able to provide better information, such as environmental parameters, though only for relatively short time periods after release. A limitation is that these tags are expensive but they are designed to estimate daily position and environmental data, such as temperature and depth.

The legislation controlling releases of native elasmobranch species to areas within their natural range is limited. In North America, there is no written rule or policy regulating their release, though prior permission is required in some states. However, if the animal had ever been treated with any non-FDA (Food and Drug Administration) approved drug that could affect a human that caught and ate the animal, then the release is forbidden, except with drugs approved for use on food fishes after appropriate depuration. In the UK, there is no legislation controlling release of native species, though as with many countries, the release of non-native species is banned. Shark releases are of single individuals rather than large numbers and the total number of animals released is relatively known (though not well documented). The potential negative impact on wild populations is therefore potentially limited, though the benefit of the release, even from an individual welfare point of view, is likewise limited. Pre-release preparations have included the holding of species in lagoon areas prior to release and feeding of live prey for two weeks prior to release. One of the benefits of the release of sharks has been the publicity received that has often been used to raise awareness on shark conservation issues. A concern is that

the fate of some of the sharks rescued from poor facilities, such as the nurse shark exhibited in a Burger King fast-food restaurant in Toronto, Canada, and another in a nightclub in Detroit, USA is that they would otherwise be euthanised. The abundance of these species as unwanted pets has overwhelmed public aquariums that no longer have capacity for these fishes.

When considering the large coastal sharks in pet trade, the issue lies with the inappropriate nature of the acquisition. The individual may not be aware of the final size of the animal, as is common for many other fish species purchased through the pet trade. Education and responsibility in the pet trade is required, as exemplified by associations such as OATA (Ornamental Aquarium Trade Association). The institutional and regional collection planning process being undertaken by aquariums and their related associations namely the American Association of Zoos and Aquariums (AZA); European Association of Zoos and Aquariums (EAZA); European Union of Aquarium Curators (EUAC) encourage the appropriate collective management of species in facilities and reduce the issues of over-population of species and the holding of species in inappropriate facilities.

Conclusion

The release of sharks as currently practiced has no obvious conservation benefit, other than data collection through tagging related research, and raises some significant concerns. It is clear that a more definitive policy needs to be developed and this is being undertaken by the respective North American and European Taxon Advisory Groups (AZA, EAZA/EUAC) with the IUCN RSG Fish Section Chair. Criteria will provide a way of evaluating current practices and may eliminate some of the current industry collection practices.

To minimize the negative effects of shark releases, the immediate introduction of the following conditions is recommended for any captive shark that is being considered for release (adapted from Mohan, in press):

- They have been quarantined and housed only with sympatric species from the area where they will be released, to reduce the risk of spreading novel pathogens and disease.
- No water has been shared with non-sympatric display animals (as above).
- They have not been housed with individuals of the same species that have died from undiagnosed diseases.
- Fresh food (containing parasites) has been limited to sympatric species. Drug treatments throughout the animals' life have been limited to FDA approved aquaculture chemicals.
- Entire captive custody history is known so all above can be confirmed (including the holding situation at collectors, wholesalers, other facilities where animals formerly resided, etc).
- Releases are not "imprinted" on humans e.g. through hand-feeding, and therefore would be no threat to swimmers etc.
- Full health screening is carried out prior to release and the complete medical history is known.
- The animal can be returned to the point locality of collection in the wild.

These rules make releases from many exhibits unlikely. Moreover, they would impact the collection of animals for experimental husbandry trials by some facilities. They are, however, no obstacle to releases of animals in a number of situations. Open systems containing endemic (to the display location) animals in particular, would not be affected by these guidelines. Except where they meet all of the above criteria, releases are not part of a responsible collection plan and animals should be retained for life, which includes transfer to other facilities. The release of sharks is not currently part of any conservation management plan, but their use in public education programs in aquariums is a vital component of their conservation.

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BIRDS

A template for re-introductions in Seychelles: A Solution in Search of a Problem? - *in reply*

A globally threatened endemic species recovery program started in the Plan period, co-ordinated by an NGO, and implemented in partnership with the Government of Seychelles and private island owners, has rescued the critically endangered Seychelles magpie robin from immediate danger. This quote from the section on environmental successes of the last ten years in the national Environment Management Plan of Seychelles (EMPS) 2000 – 2010 is in contrast to the gloomy picture painted by Justin Gerlach in his article *Where Guidelines can Help: a history of re-introductions in Seychelles*, published in issue 22 of this newsletter. In fact, it is the only species conservation program cited as a success in the EMPS. We consider the article to be a complete misrepresentation of the actual situation and this present note is a response from the conservation managers' viewpoint.

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Planned Interventions

The Gerlach article gives the impression that magpie robin re-introductions have been undertaken in a willy-nilly fashion. Nothing can be further from the truth. The Magpie Robin Recovery Program, initiated by BirdLife International, was the first conservation program in Seychelles to adopt a logical framework (LFA) work program with an overall goal, purpose and objectives, devised by stakeholders. There are set targets to be achieved over a determined time frame. The attainment of the objectives and targets are monitored, and assessed by the Royal Society for Protection of Birds (RSPB) on an annual basis (Parr & Shah, 1999). Resources, such through the GEF-funded Management of Avian Ecosystems project, are sourced through intensive fund raising efforts and new technical partners are brought on board from any part of the world where they can be located. The Seychelles Magpie robin Recovery Team (SMART) meets regularly and decisions are minuted and acted on through a paid co-ordinator. A quarterly report is produced and circulated to stakeholders and an annual review of progress since 1998 published.

Surely, these guidelines, like others, are not to be taken as holy writ engraved in stone.

A case history in experimentation?

The author chastises the Recovery Program for what he calls experimentation. However, the text subtitled *Seychelles magpie robin – a case history in experimentation* contradicts previous statements and writings by the author. The Seychelles Red Data Book (Gerlach, 1997) proposes re-introduction to larger islands, namely Silhouette, in the presence of alien predators to *allow the effect of rats and cats to be tested*; this would appear to be a highly experimental approach.

Adaptive management

In the rush to judge success against general guidelines, one of the most important concepts in real-world conservation, adaptive management, falls between the cracks. Conservation is not a machine whose buttons we can click every day and expect the same problems and the same responses. Adaptive management has been a key process in the Recovery Program in the last few years. *This evolution is characterized by the degree of flexibility in approach and management style through fine tuning pre-established work program objectives. This has enabled the Recovery Program to adapt to changing circumstances whilst remaining on track. As adaptive management is realized, we believe that genuine stakeholders should found the Recovery Program on participatory priority setting and action* (Parr *et al.*, 2000).

Participatory management

Decisions to do with magpie robins are not taken by a single organization, as seems to be inferred in the article. SMART consists of a group of highly skilled technicians from all the organizations managing sites with magpie robin populations, as well as from the Seychelles government. Decisions are taken by consensus. Ideas are discussed with other parties, particularly scientists and technical experts assisting the Recovery Program (Parr & Shah, 1999). The actions criticized by the author were nonetheless agreed with all the relevant individuals and agencies including the management of the island providing the birds, management of the recipient island, the Seychelles government, scientists and technical experts outside SMART, the donor agencies and the executing agency (Millet & Shah, 2001). Memorandums of Understanding were in fact signed with Aride island management and with the Seychelles Government.

The recovery tool box

The article's focus on re-introductions obscures the fact that re-introduction is one tool, albeit an important one, in the Recovery Program's tool kit. This tool kit includes research on food availability and habitat quality, genetic studies, reforestation, alien predator eradication, mitigation measures on predator free islands, avian care and welfare, supplementary feeding of wild populations, provision of nest boxes, monitoring, database management and reporting, training, public education and so forth. The kit is being constantly enhanced with new purpose-made tools such as the Captive Management Handbook, the SMART Field Workers' Manual (in prep.) and the handbook entitled *Biodiversity Assessment of Small Islands: Methods developed in Seychelles to Assist in Restoration*. The article unfortunately misleads the reader into thinking that re-introduction is a stand-alone activity.

One size does not fit all

The main thrust of the argument is that somehow (the author does not really state how) the RSG/SSC guidelines were not adopted properly and therefore re-introduction success remains patchy. This argument does a great disservice to the RSG/SSC guidelines. Surely, these guidelines, like others, are not to be taken as holy writ engraved in stone. They must be recommendations, advocated for sensible practice and not as dogma. The NPTS re-introduction guidelines mentioned in the article were rejected by the Seychelles Bird Forum and never adopted as national policy because they were far too prescriptive and not part of an overall recovery program framework or tool kit.

The map is not the territory

The author's predilection to equate success with adoption of a set menu underlines his inability to understand the difference between what can be called the map and the territory. General guidelines such as the one developed by the SSC/RSG provide only a rough map to what is, in some cases, unknown territory. To become overly focused on guidelines is to miss the point – a flagship species which is still not secure and needs very urgent conservation action.

Contradictions in the promotion of Guidelines

The beneficial role of guidelines is presented in a contradictory manner. For instance, the Seychelles warbler re-introductions to Cousine and Aride are given as examples of planned re-introductions covering *all issues subsequently highlighted by the RSG guidelines*. However, as conducted prior to the production of said guidelines, these cannot be used as an example of their benefit. The article goes on to provide examples of re-introductions. The Seychelles white-eye in 2001, Seychelles fody and magpie robin in 2002, all were planned in detail, had unparalleled commitment of resources and all broadly followed the RSG guidelines, but despite this the latter two are subject to criticism, the former to praise. The argument simply does not hold together; re-introductions not following guidelines are commended, and some of those that did follow guidelines are criticized.

Risk aversion and fear of failure

The article concludes with the title "Return to Risk". This defines the author's position. He seems risk-averse, and perhaps has never worked with the concept of acceptable risk. Risk assessment and risk management are part of any successful conservation program. The notion of rescuing a critically endangered species, which at the start of the Recovery Program was also a data-deficient one, was always considered risky. It was risky to believe that adequate scientific information could be gathered in time to make the correct management decisions. Prior to re-introductions, it was risky to attempt to manage the entire world population, miles from anywhere on an island - Fregate - that hosted activities (agriculture, livestock development, and tourism) seemingly incompatible with conservation. It was risky to believe that the government and people of one of the smallest countries in the world and which has a micro-economy would have the resources, understanding and staying power to support the Recovery Program. In 2000, it was risky to try saving magpie robins from rats on Fregate island by holding the entire population on the island in captivity for months and using poison bait dropped by helicopter against the rodents. It was risky to translocate birds to Aride Island, where previous re-introductions had failed. However, decision-makers and conservation managers from BirdLife International, RSPB, Nature Seychelles, SMART, the Seychelles Government and other organizations accepted risk as axiomatic and put aside fear of failure. The net result is that risks were translated into challenges and faced successfully (Millet & Shah, 2001).

Hobson's Choice

Amidst all the heat raised in the article, what seems to be forgotten is that the magpie robin was probably the most endangered bird in the world in the 1970's when BirdLife International discovered the population was at a low of 16 individuals found only on one island. Today, because of the planned and successful use of methodologies and tools such as re-introductions and habitat management, the population is at an all time high of 110 birds on four islands. The options for the bird are extremely limited because there are very few predator-free islands with suitable habitats available. We must establish new populations to increase range and numbers. There are no other choices (Millet & Shah, 2001). The Recovery Program cannot therefore be compared to re-introductions mentioned in the article, such as that carried out for the Aldabra Rail, a sub-species which is not on the list of threatened birds of the world (BirdLife International, 2000). The magpie robin is still the most critically endangered bird in Seychelles and HAS to be downlisted in the IUCN Red List whilst there is still a window of opportunity to mobilize resources and to suitably restore islands.

Conclusions

We would like to make a plea for a more multi-dimensional and trans-disciplinary management approach to the complex problem of trying to save critically endangered species in Small Island Developing States (SIDS). Conservation is as much an art as it is a science and those who believe they can use boilerplate solutions and succeed are mistaken. In a dire case like the Seychelles magpie robin the answer must be the following: anything possible

must be done; anything impossible must be attempted.

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Re-introduction of endemic birds in the Seychelles: a response — *in reply*

The article *Where guidelines can help: a history of re-introductions in Seychelles* in *Re-introduction NEWS* No: 22 purports to demonstrate by example the benefits of re-introduction guidelines. However, the article is filled with inaccuracies and contradictions, and omits important information, resulting in a misleading account of the role of re-introduction in the Seychelles. We do not intend to refute all inaccuracies and false claims; this would be too time consuming but we do intend to provide a broader context of the role of re-introductions and address some of the larger omissions and inaccuracies.

The context of avian conservation and island management

The article misinforms because it fails to place re-introduction into the context of conservation options and priorities within the granitic Seychelles. Eleven species of endemic land birds occur within the granitic islands, eight of these are listed as being of global conservation concern; of these four are classed as Critically Endangered. The majority of endangered birds are listed in B and D categories; indicative of small range, fragmented populations and small populations, for example the Seychelles magpie robin (*Copsychus sechellarum*) Critical D1, D2., Seychelles warbler (*Acrocephalus seychellensis*) Vulnerable D2., Seychelles paradise flycatcher (*Terpsiphone corvina*) Critical B1+2c, D1, D2., Seychelles white-eye (*Zosterops modestus*) Critical B1+2c, D1; D2. and Seychelles fody (*Foudia sechellarum*) Vulnerable D2 . There can be little doubt that loss of native habitat and the introduction of alien predators are the primary factors accounting for the decline and in some cases extinction of native land birds. Given that the ranges of the majority of endemic land birds are highly fragmented and that many are or were restricted to one or a few smaller islands, the potential for natural expansion even when the causes for decline are alleviated is extremely limited. Most endemic landbirds are poor dispersers having only limited powers of flight and examples of inter-island movement have been recorded infrequently (Shah & Parr, 1999). The probability therefore of most endemic passerines dispersing to a suitable island in sufficient numbers to establish a population is slight. Therefore re-introduction of endemic birds has been used to increase the ranges and numbers of several native birds: the Seychelles magpie robin (1–4 islands), Seychelles Warbler (1-3 islands), Seychelles white-eye (2-3 islands) and Seychelles fody (3-4 islands) within the granitic archipelago.

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Recent research and conservation

Recent research and conservation action including re-introductions has been undertaken in the context of a great deal of research unlike what is stated in the article. Between 1999 and 2001 the GEF-financed Avian Ecosystems Restoration Project implemented by Nature Seychelles undertook three research projects related to the conservation of endemic birds, and in-depth biodiversity surveys and assessment of conservation potential of inner Seychelles islands. In addition, an enormous amount of research has been undertaken on the Seychelles magpie robin, initiated in the 1980's by Birdlife International and WWF and research is still continuing. In 2001, National Species Action Plans for endangered birds were written, and endorsed by the Seychelles Government. In some instances such as for the magpie robin and the Seychelles fody, the Action Plans clearly propose re-introduction.

The science behind the magpie robin recovery program

The article gives a highly distorted account of the recovery program and the role of re-introductions. Some of the most important and successful actions, and significantly the large amount of research that has driven the program, are omitted completely giving the impression that re-introductions have been conducted on some sort of ad-hoc basis. The recovery program was initiated in 1990, with a population of 23 birds on just one island. Initial actions concentrated on Fregate Island which held the last surviving population. The work took a dual approach of research in parallel with conservation management; a wide array of methods and tools such as the provision of nestboxes, habitat creation, supplemental feeding and alien predator control resulted in an increase in the population and yielded sufficient stock to attempt re-introduction. In 1995 brown rats (*Rattus norvegicus*) became established on Fregate and in 2000 were eradicated in a collaborative project implemented by the island management, the Seychelles Government and Nature Seychelles. The project involved the aerial application of rodenticide and the captive management of the entire population of magpie robins and over 300 Seychelles fodies (Shah, 2001). The island remains free of rodents and the growing population there is now in excess of 50 magpie robins.

The article argues that assessments of food availability are wrong, and that there is some evidence to suggest that food supplies on Aride, in the dry season, may be poorer than on Fregate. In reality, there is now a large amount of evidence to suggest that we have ecologically relevant methods for assessing habitat quality in magpie robins. Komdeur (1986) clearly demonstrated a direct link between invertebrate abundance in the litter and soil and reproductive output in robins. Food limitations on reproduction were confirmed by food supplementation experiments. Subsequent work has built on this and has shown that food abundance in the litter and soil, is strongly correlated with the order in which territories were settled on Cousin when re-introductions took place, and that there is a strong, asymptotic relationship between food abundance within a territory (Njoroge, 2002). The evidence collected on Aride indicated that the island could support a viable population and that supplementary feeding would be advantageous for birds released onto Aride to maintain high levels of reproductive output (Njoroge, 2002).

Furthermore, Wagner (2001) has shown that invertebrate abundance on Aride, measured during the 2001 dry season, was approximately double that found on Fregate. Wagner also showed that dietary composition on Cousin is more diverse than previously documented: discarded fish or spilled fish from seabirds, reptiles and seabird eggs contribute up to 80% of the dietary wet weight. Aride supports larger seabird colonies then Cousin and hence has large amounts of these foods available to magpie robins during the main seabird breeding season: the dry monsoon.

Selection of sites to establish new populations

Apart from the extensive ecological studies mentioned, a range of factors has been considered prior to the selection of new sites. These include the assessment of alien mammalian and avian predators on potential release sites, the area of available habitat and importantly island management and protected status of potential islands. Management of islands and legal protection are important considerations for the long term prognosis of re-introduced populations given the vulnerability of magpie robins to secondary pesticide poisoning, accidental death and the risks of alien predator introduction where large volumes of cargo are imported. Aride, like Cousin is a very good choice for re-introduction based on these criteria.

Improvements in the science

The article argues that the situation on Aride may have been better if IUCN guidelines had been followed, but fails to explain how. In fact, every attempt was made within the recovery program to collect and apply relevant data, and react to problems that appeared. For example, re-introductions were 'hard' released prior to 2000 and this raised concerns that birds on Aride may have been stressed making them more vulnerable to infection, which in turn might have led to increased mortality. As a result, the recent re-introduction in 2002 was based on a 'soft' or delayed release. It included intensive post-release management and supplemental feeding. In addition, a numerically larger re-introduction, based on demonstrated food and habitat availability, was used to account for anticipated mortality during establishment, and the stock included juvenile birds that generally adapt better to a new location.

Mortality of magpie robins

Mortality rates post-release on Aride were expected and the situation is distorted by the article. Similarly the article is misleading on the productivity of the re-introduced population. Four breeding attempts have produced juveniles, three of which survive and seven translocated birds are extant. Similarly, the need for follow up management had been identified and a dedicated staff member manages and monitors the birds. Veterinary consultants are on call and contingency plans are in place. Success indicators were included in the re-introduction proposal: the short term indicator (0 – 12 months) included 50% mortality for juveniles and 25% mortality for adults. Mortality has exceeded this target by 16%; however, other short term indicators such as juveniles raised to independence have been achieved. At one year post re-introduction a small population of 10 birds appears to have established and appears to be stable (only one loss in 6 months). It is too early to declare the re-introduction attempt a failure or a success; however the long term (>5 years) success indicator *self sustaining population with reduced conservation management* appears attainable.

The Seychelles fody re-introduction

In 2002, a stock of 65 fodies was re-introduced to Aride. Once again a number of statements are false: a re-introduction plan was indeed produced and a Memorandum of Understanding was signed by the relevant parties and supported by the Seychelles Government. The ridiculous concept mentioned in the article of a planned release at sea is not backed by any proof and is not worthy of any further comment. Concerns raised by the article that the species is a significant egg predator of seabirds or the Seychelles warbler appear unfounded as these birds have all increased

on Fregate, Cousin and Cousine islands in the presence of large, relatively high density populations of fodies. The statement that no post-release program is in place is completely false as a permanent staff member and a PhD student monitor the re-introduced population. A three year project studying the ecology and diet of the Seychelles fody (Nature Seychelles, RSPB and Reading University) is ongoing.

Conclusion

In our response we placed the role of re-introduction in the context of avian conservation options in the granitic Seychelles. We have demonstrated that re-introductions undertaken as a part of the Seychelles magpie robin recovery program have been supported by a large amount of solid data gathered over many years and have been undertaken in a planned manner using a range of adaptive methods and tools and with stakeholder agreement. We have also provided evidence to demonstrate the efficacy of the Seychelles fody re-introductions. We have thus demonstrated that the rationale of the article is flawed.

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Drastic decline in the translocated ultramarine lorikeet population on Fatu Iva, Marquesas Islands, French Polynesia

Endemic to the Marquesas Islands, the ultramarine lorikeet (*Vini ultramarine*) is one of the most endangered of insular lorikeets. Although thought to have once ranged over most of the archipelago, until recently it was found only on the northern Marquesas Islands of Ua Huka, Nuku Hiva and Ua Pou. However, its status on the latter two islands is so rare that previous surveys to assess the populations on Nuku Hiva (Kuehler *et al.*, 1997 and Ziembicki & Raust, in prep.) and Ua Pou (Kuehler *et al.*, 1997) failed to locate any lorikeets. Although isolated individuals have recently been observed on both islands, the sizes of these populations and persisting threats suggest that they are in imminent danger of extinction (Raust, 1998; Raust, 1999 & Ziembicki and Raust, in prep.). The main threat to the ultramarine lorikeet is believed to be from introduced rats, particularly the black rat (*Rattus rattus*), principally as nest predators. Declines of lorikeets have coincided with the progressive arrival of rats to their islands. The only relatively healthy population exists on the small island of Ua Huka, currently believed to be black rat free.

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Previous translocation efforts

Because of the status and extreme vulnerability of this species a translocation of the ultramarine lorikeet was conducted by the San Diego Zoological Society, San Diego, USA in the early 1990s (Kuehler *et al.*, 1997). Between 1992

and 1994, a total of twenty-nine individuals were relocated from the island of Ua Huka to the southern island of Fatu Iva which is the smallest of the inhabited Marquesan islands (some 80km^2) and the archipelago's most southerly. It was considered an adequate refuge for the species being relatively undisturbed, with appropriate habitat and apparently black rat free (Kuehler *et al.*, 1997). A subsequent survey in 1997 found that the translocation effort had been successful with a population increase to an estimated 51 lorikeets (Liebermann *et al.*, 1997).

Current status

Thibault and Meyer (2000) documented the presence of black rats on Fatu Iva at all altitudes surveyed at the entrance of Omoa valley. Subsequent surveys have also documented the presence of black rats in Punahitahi valley (Blanvillain and Ziembicki, in prep.). The numbers and distribution of rats suggest that they had become established on the island at least a few years earlier, though the exact date is not known. Kuehler *et al.* (1997) do not indicate whether they surveyed the island for rats prior to or after the translocation. In July 2002, Mark Ziembicki spent three weeks on Fatu Iva, joined by Caroline Blanvillain for a period of one week, as part of a project to assess the status of the species on the island and to introduce measures to counter the effects of rats (Blanvillain and Ziembicki, in prep.). During this time the island was intensively surveyed for lorikeets and areas surveyed at least once included the Omoa village, Omoa valley, Hanavave village and associated valleys, Ouia valley, Punahitahi valley, Hoopu valley, Puipuauwihi valley, Yolande valley, Hanaui valley, Vaieenui valley, Araki valley, Matau valley, Tetana valley, Vavata valley, ranges between Ouia and Hanavave valleys and the Omoa to Hanavave road. Repeated surveys were conducted in the vicinity of the original translocation release site and other areas where lorikeets were seen by locals.

The main threat to the ultramarine lorikeet is believed to be from introduced rats, particularly the black rat (*Rattus rattus*), principally as nest predators.

Despite intensive efforts a total of only eight observations of lorikeets over the survey period were made. These included six observations of a single individual and two observations of a pair. Of these, three observations were in the Yolande valley, three in the Punahitahi valley and two in the Omoa valley in an area between the two other valleys. All observations were therefore in the same general vicinity and in a radius of approximately 1.5 km of the original release site. It is, therefore, quite likely that we repeatedly sighted the same birds and no young or sub-adults were observed. Interviews with locals in Omoa village confirm that lorikeets have disappeared from the village area and surrounding valleys and are now only seen occasionally as single individuals or in pairs at the far ends of Omoa, Punahitahi and Yolande valleys. This is in contrast to the situation just 3 - 4 years ago when they were reportedly regularly seen in the village, especially during mango and kava fruiting season. Similarly, locals in the Hanavave valley no longer see lorikeets even though they had spread there since their translocation and release in the Omoa valley (Kuehler *et al.*, 1997). According to our observations we estimate that less than ten, and possibly as few as three, lorikeets remain on Fatu Iva.

Conservation efforts and the future

To counter the effects of introduced rats on Fatu Iva the Societé d'Ornithologie de Polynésie with the aid of the World Parrot Trust has implemented a preliminary conservation program to stabilize this declining population of lorikeets. A number of preferred nesting trees with hollows have been identified in the areas where lorikeets were observed and rendered 'rat-proof' by the placement of tin sheeting around trunks to prevent rats climbing them. Artificial nest boxes are undergoing a trial in preferred types of trees, in valleys favored by lorikeets, to further facilitate nesting in a safe environment. Additionally, in collaboration with the Fatu Iva Monarch conservation program (a critically endangered Fatu Iva endemic) the Societé d'Ornithologie de Polynésie has initiated a rat poisoning program in the Punahitahi valley which is the site of repeated sightings of lorikeets and home to at least four Fatu Iva Monarch territories (Blanvillain & Ziembicki, in prep.). Unfortunately, given the small population of ultramarine lorikeets on Fatu Iva these efforts may be too late. The remote nature of the island and expense of travel and conducting work there make it difficult to monitor this population and the results of conservation efforts regularly. Nonetheless, urgent action is required if this translocated population is to be saved.

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Re-introduction of the white-winged guan in north-west Peru

The white-winged guan (*Penelope albipennis*) is a cracid endemic of the dry forests of northwest Peru. It is classified as Critically Threatened due to hunting and habitat loss and its wild population is estimated at less than 250 individuals (BirdLife International, 2000). Its distribution is now restricted to a small narrow strip along the western foothills of the Andes, where it inhabits dense forest in ravines with permanent water sources. After its discovery in Tumbes in 1877, there were no more records of the species and by 1973 it was considered extinct (Delacour *et al.*, 1973). However, it was re-discovered in 1977 by del Solar and O'Neill (de Macedo, 1979) in Lambayeque. After the re-discovery del Solar began a captive-breeding program in the village of Olmos with the long-term aim of re-introducing the guan back into its historic habitat. The first captive-born chick was born in 1986 and by 1990 there were 24 captive guans and in 2000 there were 100. With this success, conditions were now favorable to initiate the White-winged Guan Pilot Re-introduction Program in 2000.

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Re-introduction site selection and characteristics

The re-introduction site was selected in accordance with the IUCN criteria as set out in the *IUCN Guidelines for Re-introductions* (IUCN, 1995) and is located inside the Chaparrí Private Conservation Area – a community owned protected area. The site chosen was a ravine within the guan´s historical distribution area but from where it had been extirpated some 20 years ago due to hunting. The habitat characteristics of the site ensured that the ecological needs of the guans would be met and that hunting had ceased due to the communities fully supporting the re-introduction program. The main objective of the pilot re-introduction program was to establish a viable long term white-winged guan population, permitting re-introduced individuals to successfully reproduce in the wild. Now that a new wild population has been established at this site it will now be connected with existing known wild populations found at Cásupe (12 km from the release site), Caña Brava (18 km) and the Reserved Zone of Laquipampa (19 km), thus forming a corridor between the re-introduction area and these sites. This will facilitate the exchange of genetic material among individuals and so avoid possible genetic depression within these small populations, which can be at risk of disappearing due to their geographical isolation. A second objective of this project was to return to the Santa Catalina de Chongoyape community who are owners of the land, a natural resource, which if well-managed could benefit the local community through eco-tourism.

White-winged guan selection

Individuals were selected from the captive-breeding center in Olmos, taking into account the following considerations:

- Maximize distance in blood relationship between individuals in the release group in an effort to minimize inbreeding.
- Have an adequate proportion of both sexes (1:1) to form the founder group. Due to the monogamy of the guans there should be an adequate proportion of both sexes (1:1).
- Choose individuals in optimal health to avoid disease transmission between the release group and with the wild population and other fauna. Individuals destined for release should undergo an appropriate veterinary screening protocol.
- Ensure the temperament of any individual to be released is not too tame or too aggressive. Also choose recently mature individuals from both the F1 and F2 generations to make them experience their first sexually active breeding season in the wild.

Pre-release methods

Three different pre-release methods were tested in order to find out how best to adapt individuals to their new surroundings in terms of both survivorship and ease of surveillance. The "big cage" which is a large semi-captivity cage constructed out of rope mesh and is built in a ravine, covering an area 70 m x 30 m (2100 m^2), with a height of 13 m in the highest part. This enclosure includes part of the ravine's permanent watercourse and native trees and bushes such as *Ficus padifolia*, *Cordia lutea* and *Mutingia calabura*, which are natural food sources of wild guans. Ten individuals were kept inside the cage for a period ranging from one to 18 months. The "small cage" method consisted of a semi-captive cage located on a mountain slope, covering an area 25 m x 5.5 m (138 m^2), with a height of 2 m. Water was artificially supplied and the main type of bush found inside the enclosure was overo (*Cordia lutea*). Six individuals were kept inside this cage for period ranging from one to five months. The last method used involved taking individuals from the Olmos captive-breeding center straight to the re-introduction site and hard-release them directly into the wild without the use of pre-release cages. This method was used in the case when replacement of individuals was carried out.

Pre-release management

Guans inside the pre-release cages were supplied with supplementary food. This additional food was decreased during the wet season when natural food sources such as wild fruits became more abundant. Even with the additional food supply present the guans continued consuming flowers, fruits, leaves and fruits from the surroundings of their new environment. Harris hawk (*Parabuteo unicinctus*) are known to predate upon white-winged guans (adults and chicks) so to prepare the release individuals against this predator, a trained hawk was used to predate and kill domestic chickens outside the cages and in the presence of the guans. They responded well to the Harris hawk presence and used dense bushes to hide in as soon as they saw the raptor's shadow. Anti-predator control was carried out to capture and relocate predator species such the pampas cat (*Oncifelis colocolo*), sechuran fox (*Pseudalopex sechurae*), tayra (*Eira barbara*) and South American opossum (*Didelphis albiventris*).

Release

On 23rd September 2001, six guans from the small cage were released and on 11th October 2001, ten from the big cage were released. These individuals were released from the semi-captive cages to the wild in a gradual manner by allowing them first to remain in the area directly outside the enclosures until they became accustomed to their new surroundings and were confident enough to move away and explore their new environment on their own accord.

Post-release management and monitoring

Food was provided for a year after release to measure if individuals were independent enough to find food from natural sources to fully sustain themselves and artificial nests were also supplied (similar to those used in the breeding center). Released guans were all marked with two leg bands of different color combinations to allow identification by sight and additionally ten of the sixteen released guans were fitted with AVM "Backpack" transmitters. The guans attached with a radio-transmitter were tracked at least once a week during the first three months and then once a month. Individuals without transmitters were also searched for and monitored during this time. A Geographical Information System (GIS) was constructed to analyze the released guans movement and it consists of a digital map of the re-introduction area and includes water sources, rivers, altitude, roads, human settlements and vegetation types.

Results

The distance the individuals move from the release site is a function of the availability of food and water. These movements were generally solitary and this varied from a few meters up to 13 km with registered dispersions of 6 km, 7 km, 10 km and 11 km respectively. Three pairs were formed after release and all attempted to breed in the first breeding season (November to April). Two pairs failed in nesting due to predation of their nests and one pair built their nest on the ground which was predated three days after the eggs were laid and they then moved to an artificial nest in a tree but the male was predated upon. A second pair constructed two different nests but laid eggs in a third constructed nest but this was also predated. A third pair built their own nest in a more ´predator-safe´ location in a 5 m tree covered with bushes and they laid a single egg which they incubated normally. During the first days of April 2002 they hatched a chick that has since matured to an adult completely in the wild. With reference to survival it has been found that the highest predation occurs inside the semi-captive cages during the dry season (May – December). Of the released individuals at least three died and it has been found that predation of adults by the pampas cat and humans also occurs. Predation of nests by the sechuran fox and opossums has also been observed. Two guans were returned to the breeding center due to health problems (broken leg and ear infection) and another three due to unsuitable tame behavior.

Conclusions

- We can conclude from the data obtained that with the dispersion distances that it is possible to connect the re-introduced population with the nearest wild populations. However what has not occurred is that the guans have not moved in the correct direction to meet a wild population.
- Regarding the time spent in the semi-captive cages there has been no significant difference with respect to survival rates once released. Also the risk of predation within the actual cage was higher the longer the individuals were kept there and therefore for future releases the time spent in a semi-captive should be kept as short as possible.
- Awareness campaigns with local communities in the area should be intensified both before and during the implementation stage. The only known case of predation by humans occurred outside of the conservation area by a settler who claimed not to know the species.
- Breeding by re-introduced individuals appears to be feasible as they behave similar to wild guans in respect to nest building and protecting their chicks. The fact that a first chick was obtained only six months after the release date, is a positive sign that gives reason for hope to be able to save this species from extinction. The reproductive success of re-introduced individuals is a sign of a success implementation of this re-introduction program (Sanz & Grajal, 1998).

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A 14-year old captive-bred Puerto Rican plain pigeon stills survives in the wild!

The Puerto Rican plain pigeon (*Columba inornata wetmorei*) is an endemic endangered subspecies which was once considered extinct but was rediscovered in east-central Puerto Rico (Cidra) in the 1960's. The first census conducted on the species reported about 50 individuals (USFWS, 1982) and these low numbers prompted a captive-breeding program at the Humacao Campus of the University of Puerto Rico which began in 1983 (Conser & Pérez-Rivera, 1989). The main objectives of the captive research program was to develop appropriate techniques to breed the species in captivity and to re-introduce the plain pigeon in different habitats in Puerto Rico, where the bird was formerly present (Pérez-Rivera & Ruiz-Lebrón, 1999).

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Captive-breeding

In 1984, the first captive-bred squab was produced in the Humacao Aviary and in 1987 we began using "pigeon milk" obtained from giant runt squabs (*Columba livia*) to supplement the diet of plain pigeon chicks either hand-raised or those not properly fed by foster parents. In this way we reduced mortality of plain pigeon squabs to less than 5% and one year later we were able to do some environmental enhancement on the cages (e.g. allowing vegetation growth at the periphery of cages) and behavioral management of pairs (e.g. allowing males to observe each other and perform territorial behavior), which allowed plain pigeon pairs to breed by their own for the first time. Although the plain pigeon only lays one egg per clutch, in 1989 using recycling techniques, artificial incubation and ring doves (*Streptopelia roseogrisea var risoria*) as foster parents and we produced a total of 44 plain pigeon squabs from just eight pairs of plain pigeons.

Old captive-bred or raised pigeons are considered problematic for re-introduction purposes (Swinnerton *et al.*, 2000), our findings at least provide evidence to re-evaluate this issue.

Release

In 1992, we began to plan the experimental release of birds produced in captivity and birds destined to be released (after health screening) were divided into three main groups:

- pigeons raised by their own parents (naturals),
- birds raised by foster parents, and
- hand raised.

At least 50% of the birds to be released were equipped with radio-transmitters while the others were fitted USFWS bands and with colored leg bands to identify them in the field. The first group of captive-bred Puerto Rican plain pigeons, consisting of birds raised by their own parents, were released in Cidra (open woodland) in April 1993. Most of the birds remained in the vicinity of the release area and at least 50% of the birds survived. Two additional experiments were conducted in Cidra where most of the birds were lost to illegal hunting and hawk predation. Since then, two additional releases have been conducted in the Carite Forest, Cayey (closed montane habitat) where most birds leave the forest within two weeks and two in Comerio (open woodland where other plain pigeons are present). For descriptions of the release area and the results of some of these experiments see Pérez-Rivera et al. (1994) and Pérez-Rivera and Ruiz Lebrón (1999). The fifth release of plain pigeons was conducted on 20th May 1998 at the Carite Forest. The released group consisted of hand-raised birds held in captivity for at least eight years and three red-banded pigeons were the oldest of the group (9.5–10 years) being born between August 1988 (two individuals) and January 1989 (one individual). Within a week, three of the birds moved outside the forest (>15 km) and one was found in Caguas, another in Guayama and a third one probably returned to Humacao (about 35 miles from the release site). After a week these birds were never observed again except for a plain pigeon that was found in southwestern Puerto Rico (Boquerón, Cabo Rojo, about 60 miles from the release site). Presently, the captive-breeding program for the Puerto Rican plain pigeon has come to an end and agencies in charge of the protection of the species have taken this decision based on an increase in the distribution and numbers of the species in the wild. Presently, the species has colonized Comerio and the population has reached a minimum of 1000 individuals.

Discussion

On 13th June 2002, while working in Comerio, Pérez-Rivera observed, within a group of plain pigeons an awkward individual which was dark colored and molting heavily and lacking feathers on the tail, wings and the neck area. When the bird split its legs between two twigs to feed, Pérez was able to observe a red band on its leg which corresponds to old pigeons released in Carite in 1998. For two weeks we surveyed the area trying to locate the bird again and read its

band number but without any success. On 1st February 2003, José Velázquez and Edwin Guevara, observed three plain pigeons within the same area of the previous observation and among these there was a dark colored plain pigeon lacking some feathers on its neck, with a red band and we assumed it was the same bird previously observed. On 15th March, the red band individual was observed again and this time it was preening on an electric wire and the last sighting was at the same locality on 15th April. These sightings are very important and significant, firstly because this plain pigeon has survived in the wild for at least 4 years and 10 months, a record for the species on the wild. The previous record was from a bird also released in Carite (Cayey) that moved to Cabo Rojo and which was observed feeding in a backyard for about a year. Secondly, because at the time of the final sighting this plain pigeon was at least 14 years and three months old which is also a record for this species in the wild. The survival record for a plain pigeon, at least in captivity, is of "Alex" which was the first birds introduced into the Humacao aviary 20 years ago. Thirdly, the old bird has joined the wild population and apparently has found a mate and finally it survived Hurricane Georges in September 1998. Old captive-bred or raised pigeons are considered problematic for re-introduction purposes (Swinnerton *et al.*, 2000), our findings at least provide evidence to re-evaluate this issue.

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The International Advisory Group for Northern Bald Ibis (IAGNBI) and the potential role for re-introduction in the conservation of northern bald ibis

The northern bald ibis (*Geronticus eremita*) is classed as 'critically threatened' by IUCN, with the wild populations having declined sharply for centuries over their once wide range. It occurred over much of north and northeast Africa, the Middle East and the European Alps, but disappeared from the Alps over 400 years ago. The decline was more recent in Morocco and Algeria, largely disappearing over the past ten to fifty years, leaving just two main colonies in Morocco, totaling over 85 breeding pairs in 2003, and three pairs at one site in Syria. Populations in Turkey, Yemen and Eritrea also apparently declined to extinction during these more recent times. Meanwhile, captive populations held mainly in European zoos have grown to over 1600 individuals, of mainly Moroccan origin (Turkish and Moroccan birds are genetically distinct), and the question of whether re-introduction could be a useful conservation tool for the species arises.

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Captive breeding

A socially complex and gregarious species, northern bald ibis nests colonially, and feeds and roosts in groups. The social intricacies of the species have made it an attractive species

for behavioral studies, such as those carried out at the Konrad Lorenz Institute, but tend to complicate the methodology needed to care for the birds and certainly for any sudden changes to the birds' environment that re-introduction involves. When birds were first taken into captivity for example, they all perished. It was not until a second batch was collected, and husbandry methods were improved that the birds even survived. Various factors were found to be crucial to bringing the birds into breeding condition, most notably having the right food supply. Prior to this, breeding success was particularly poor, and hand rearing offered the main possibility for even maintaining the population level (Pegoraro, 1996). Once diet and some other conditions such as nest-ledges, cliff space and dynamics had been sorted out, breeding productivity improved markedly, and the captive population increased quite quickly.

Wild populations

Meanwhile, the plight of the wild populations in the 1960s and 70s was particularly alarming, when many of the wild colonies, that had numbered over 50 in Morocco alone around 1900, dwindled to extinction (Bowden *et al.*, 2003). The only apparently healthy exception to the sorry state of decline has been the population at Souss-Massa, near Agadir in Morocco. The Turkish population at Bireçik, thought to be the last of the Eastern population and genetically distinct from the Moroccan birds, went extinct in the wild in 1989. Conservationists recognizing these problems succeeded in creating a National Park for the main wild Moroccan population, but the efforts in Turkey were less successful, where only an *in-situ* semi-wild population now remains. Subsequently, a tiny remnant population has been found persisting in Syria in 2002 (Serra, 2003), but the total wild population of the species today consists of barely 90 breeding pairs.

Subsequently, a tiny remnant population has been found persisting in Syria in 2002 (Serra, 2003)

Releases

The dramatic decline of the wild populations, coinciding with the increase in captive birds, lead to the hope that releases might be a useful way to boost the wild population. Well-documented release trials were carried out in Israel in the 1980s, and other work and experiences at Bireçik, Italy and Austria were all informative but totally unsuccessful. It was now clear that any straightforward release would not work, that more careful nurturing of the birds was likely to be needed. Proposals for releases in other areas such as Spain were treated cautiously because of these problems, and it was at this stage that several meetings were held in an attempt to bring ideas together. Much of the work that had been carried out was done by quite a dispersed set of organizations and individuals, and at a meeting held in Agadir, Morocco, in March 1999 these were brought together and a report produced bringing this information together (Anon., 1999). The creation of the International Advisory Group for Northern Bald Ibis (IAGNBI) was very much a response of this meeting, to try to ensure more communication between workers to work towards a coordinated effort in this vein. Among the achievements of the Group so far, two e-mail newsletters have been produced, which are available on request. Meanwhile, the priority to maintain the wild populations has remained paramount, although ironically has probably proved to be more difficult to fundraise for than work on release methodology.

In the comparatively short period since the creation of IAGNBI, a number of further advances have been made, with the first established free-flying population being established in Austria (Kotrschal, 2003). A hand-rearing methodology in the first stages of establishing a new population appeared to offer the best chance of success, but an unfortunate added complication is that for almost all areas where northern bald ibis formerly occurred, they would have been migratory. This poses two major challenges, one being that the birds do not have instinctive knowledge of where to go, and would need to be 'shown' this, and secondly that we often don't actually know where the populations would have wintered in the first place! The Konrad Lorenz Institute's work, that has been successful in establishing a sedentary population, has taken on the challenge to trying to teach the birds to migrate. This work by the 'waldrappteam.at' team is ongoing, and whilst it does assume we know they need to go, it is showing signs of success in getting the birds to follow microlite planes, and further trials are currently in progress. The next phase will be to see whether the birds will be capable of doing such journeys unaided, once they have been shown the way. A meeting was called by IAGNBI, and held in Innsbruck in July 2003 to bring the work on wild, semi-wild and captive birds together, and try to develop some guidelines and priorities for the ways that work is most needed to address the problems, particularly relating to release trials. The output from the meeting will feed into the Species Action Planning process, and a meeting is planned in Madrid early in 2004, to be funded by the African-Eurasian Migratory Waterbird Agreement (AEWA), to formalize a Species Action Plan.

It is generally felt that there is the potential for re-introduction to help with the conservation of the species, especially in parts of the former range well away from the wild birds. There are however, worries that this may be distracting from the higher priority of conservation efforts for the remaining wild birds and their habitat. The Moroccan northern bald ibis population has been the priority focus of the Souss-Massa National Park, with the support of BirdLife International. It is unusual in that it is largely resident, although some dispersal and movements of juveniles in particular may be over large distances. The three pairs in Syria, however, leave the breeding area as soon as the juveniles have fully fledged in July, and finding out where they spend the non-breeding season is a question that has huge significance, both for conserving these birds, but also for understanding what the winter habitat requirements might be. Efforts now focus on finding the answer through satellite telemetry, a question we thought it might have been too late to answer!

Conclusion

The output from the July meeting in Innsbruck will be available from myself by e-mail by the time this article appears, and includes more information about IAGNBI, articles on the current projects on all of the wild and semi-wild birds, as well as the latest progress on re-introduction trials.

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Returning the Socorro Dove to its ancestral home in Mexico

Since the previous report on the Socorro dove project published in the *Re-introduction NEWS* (Walter, 1993), the project has achieved important goals. The Socorro dove (*Zenaida graysoni*) was an endemic bird from Socorro Island of the Revillagigedo Archipelago, which lies 600 km south of the tip of Baja California in Mexico where it became extinct sometime between 1972-1978. The last written report of the dove describes the killing of several of the doves by visitors on the island (Velasco-Murgía, 1982). After the introduction of cats in 1975 (Capt. M. Mares, pers. comm.), the combined effect of human and cat predation drove the dove population to extinction. Fortunately, Edward Gifford, a member of the California Academy of Sciences, California, USA expedition to the Revillagigedo Islands in 1925, brought several doves to the mainland. Those doves were bred in California, USA and some individuals were sent to Europe. Californian fishermen were bringing additional doves to the mainland until the late 1940's (P. Kandianidis, pers. comm.), but the exact whereabouts of these individuals is not known. Socorro doves were also brought to mainland Mexico at least twice, but those breeding attempts failed and, currently, there are none kept by Mexican breeders (Lt. F. Becerra, pers. comm.).

In the early 1980's, the late Dr. Luis Baptista (California Academy of Sciences) had found evidence for the specific status of the Socorro dove as distinct from the mourning dove (*Zenaida macroura*). Baptista conceived the Socorro dove re-introduction project when he realized that a viable population was available in captivity in both North America and Europe. Moreover, the involvement of Mexican authorities and the creation of a Biosphere Reserve in the region in June 1994 gave credence to the possibility of an international restoration program for the Revillagigedo Archipelago. Unfortunately, in the 1990's, hybridization with mourning doves became pervasive in the captive US population, most likely due to the aggressive nature of paired Socorro doves in aviaries. Also certain complications in the Mexican Government did not allow conservation efforts to proceed.

The European breeding program

In Europe, both the Cologne and Frankfurt Zoos in Germany and the private interest group - Wild Pigeons and Doves, decided to start a joint effort to increase the size of their captive Socorro dove population. Socorro dove keepers agreed to regard all the Socorro doves in their possession as belonging to the Breeding Program and communicate with the coordinator about possible transfers of the birds. Breeders gave details of the birds in their collections and tried to clarify as much as possible the origin of their doves. In 1995, the European Association of Zoos and Aquaria (EAZA) recognized the program for the Socorro dove as an official European Endangered Species Program (EEP). Modern studbook software is employed to help with the analysis of population parameters in order to generate recommendations for the genetic and demographic management of the population. After this, Socorro doves were distributed to several zoos and bird parks in at least five European countries (Belgium, The Netherlands, England, Spain and Germany). Today, over 90 % of EEP participants are zoos and bird parks and on 31st December 2002, 359 Socorro doves were listed in the EEP studbook and 71 (35.35.1) of which were reported as living to the EEP coordinator. Marlow Bird Park in Germany has recently opened a special breeding unit for the species and at the time of writing, 13 young birds have been raised by six different pairs at this facility.

Genetic analyses

Island Endemics Foundation (IE), a non-profit organization founded by Dr. Baptista in1988, has continued with the re-introduction project after his untimely death in 2000. The different components of the recovery program have been previously presented elsewhere (Baptista *et al.*, 1996; Baptista & Martínez-Gómez, 1996 and Baptista, 2000). The first task undertaken was to assess the degree of purity of captive Socorro doves and many captive birds in the US and Europe were compared by DNA testing to pure Socorro doves kept in Dr. Baptista's aviaries. DNA fingerprinting and sequencing conducted by Juan Martínez in the labs of Drs. Patricia Parker and Robert Ricklefs at UM – Saint Louis, USA confirmed that hybridization with mourning doves is extensive in the U.S. population. More importantly, there is a high degree of relatedness within the extant European population and Dr. Baptista's pure Socorro doves. Thus, the European population, managed by Dr. Stefan Stadler at the Frankfurt Zoo, will be used in re-introduction efforts.

Preparing Socorro Island: aviaries and disease risk assessment

In August 2001, Island Endemics established a strategic partnership with the Mexican navy. The navy received the

Socorro dove project with great enthusiasm and agreed to collaborate in a joint venture to build state-of-the-art breeding aviaries on Socorro. Architect Carmen Rodríguez and her colleagues designed aviaries based on the expert advise of breeders in Europe, the United States, and the pink pigeon project in Mauritius. The plans were finalized in mid-2003 with input from navy engineers and a navy crew began construction on the island in August 2003. Island Endemics is working in a collaborative program to sample the columbid populations on Socorro to assess the presence of pathogens on the Island that could affect the re-introduced Socorro doves. Saturnino Yanga and Dr. Douglas Bell of California State University at Sacramento,

DNA fingerprinting and sequencing conducted by Juan Martínez in the labs of Drs. Patricia Parker and Robert Ricklefs at UM – Saint Louis, USA confirmed that hybridization with mourning doves is extensive in the U.S. population.

Juan Martínez (IE) and Dr. Patricia Escalante of UNAM, will screen resident birds in December 2003 and January 2004. Laboratory analyses will follow shortly after in order to have a risk assessment ready by the summer of 2004.

Planning the return

We are currently developing the plan for the operation of the aviaries and the release phase of the project. The first Socorro Doves will be flown back to Mexico in the near future with the help of Mexico's National Commission for Natural Protected Areas (CONANP). A successful re-introduction together with a comprehensive restoration program will not only benefit the Socorro dove and other endangered species like the Socorro mockingbird (*Mimodes graysoni*) and Townsend's shearwater (*Puffinus auricualaris auricualaris*), but will open the possibility to bring the islands to a state of recovery that closely resembles its pristine condition.

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PLANTS

Wicked ways with wildlife

It started when a sixth grader wrote to me for help with her class project entitled *Wicked Ways with Alpine Wildlife*. Her contribution was on how alpine development was threatening the edelweiss (*Leontopodium alpinum*), Switzerland's emblematic flower, and I sent her some information. She was so pleased to receive it that she replied "Thank you so much! I have planted edelweiss seeds and once my plants have grown a bit I will go up to the Alps and put them back in nature!" I then quickly pointed her (and her teacher) to the *IUCN/SSC Guidelines for Re-introductions*, to which she replied that she had no idea that planting species from packets of wildflower seeds back in the wild could be a problem, and the plants would stay in her garden. One small victory to stop genetic pollution, but how many other cases of well-meaning but mis-guided reinforcements or re-introductions take place by people who think that they are doing something good? Obviously a lot more education is needed.

This example is a minor one that would not have doomed Switzerland's edelweiss population to extinction. But as more and more plant species become critically threatened to the point where you can count their effective population on a few hands, artificial propagation and recovery programs are the only hope for their future survival. But these recovery programs must be done correctly and to the highest possible standard, otherwise conservationists may be doing more harm than good. I am happy to say that an increasing number of plant conservationists tell me that they are using the *IUCN/SSC Guidelines for Re-introductions* for their work. However many people are still unaware of the need for rigorous re-introduction or reinforcement work, and with the best of intentions are harming the species that they are trying to save. How many gardeners have you met that have taken a plant into their garden in order to "save it", and if successful in propagating it have then thought it good to "return it to the wild"? They are probably not the ones reading *Re-introduction NEWS* as this newsletter is aimed at the professional conservationist. But it is up to the professionals to spread the word and stop unauthorized and well-meant re-introductions whenever they can. Whether it means speaking to sixth-graders or to botanists who should know better.

So in effect this "re-introduction" was in fact an "introduction" of something quite probably genetically different to what once grew in the area, and of dubious conservation value.

I just learned of a re-introduction project where people should have known better, but the country will remain unnamed in order to protect the guilty. It was a well-meant attempt to conserve a ruderal species which is in decline throughout its range, and which had not been seen since 1940 in this country (apart from supposedly wild plants turning up in a flower bed in a botanic garden in 1989). However the botanic garden was then moved, and the plants did not survive being transplanted. The species was therefore evaluated as Extinct in the Wild (EW) in 1999. However this evaluation may have been premature, as this species, being a ruderal and growing in human-influenced habitats, has a way of popping up again in unexpected places, and it had only been 10 years since the last specimens, although of dubious origin, were recorded. Since this species was identified as EW, a well-meaning botanist then took plants from another nearby botanic garden, and planted them out in the wild. But not only did he break rule 1 (was the plant really Extinct in the Wild?) but it then turned out that although the plants came from a local botanic garden, they had been propagated from seed that had come from another botanic garden in another part of the country. And when that accession was checked, it turned out that these plants had come from another garden in another country, a long way away from where the plant was eventually "re-introduced". So in effect this "re-introduction" was in fact an "introduction" of something quite probably genetically different to what once grew in the area, and of dubious conservation value. And with potentially far more serious long-term conservation consequences than had the sixth-grader planted her Edelweiss "back" in the Alps.

As always, *Re-introduction NEWS* provides information and new ideas and methods for species re-introductions, as well as stimulates more re-introduction programs for critically threatened species. However equally important is education on what people should NOT do, and how good practices in propagation, including meticulous record-keeping and science, are essential if we are to continue to conserve the diversity of life which we enjoy today.

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MAMMALS

The Arabian oryx in Oman: finding a way forward

The Arabian Oryx Re-introduction Project in Oman was one of the classic conservation success stories of the 1980s and early 1990s (Stanley Price, 1989 & Spalton, 1993). The project became a world leader in what was then the relatively new discipline of re-introduction. Indeed the only international body devoted to re-introduction, the Re-introduction Specialist Group of the Species Survival Commission (SSC) of IUCN established in 1988, evolved from the Oryx Project in Oman (Stanley Price & Soorae, 2003).

However, despite this successful start, between 1996-1999 the re-introduced herds of oryx were decimated by poachers for live trade. Numbers crashed from approximately 450 in the wild at the beginning of 1996 to an estimated 96 by February 1999 (Spalton *et al.,* 1999). Four years later there are just six female oryx in the wild and an estimated 100 males and poaching has not been stopped. In this short paper I present some of the issues behind this crisis. This analysis is not complete but by raising the key issues, pertinent to many if not all re-introductions, I hope this paper is helpful to those working on similar programs in the region and elsewhere. It is my intention to present a more comprehensive examination at a later date.

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Security

The oryx are highly visible in the open desert, they are conspicuous, roam over a huge area, require a low ranger staff to animal ratio and vehicle movement throughout the habitat is easy (Stanley Price, 1989). As Stanley Price stated these were all factors that helped in the re-introduction yet they also meant that the oryx could be easily poached and in three years poachers, using fast vehicles, removed over 200 oryx. Oryx Project rangers, whose prime responsibility was to 'monitor' the oryx, and other security forces, whose principal role was not wildlife protection, had no experience or training in anti-poaching measures and they struggled to contain the situation. With time and training an anti-poaching role became better understood by oryx project rangers and security forces alike and today operations are more successful. However, experience of the last few years has proven that an effective anti-poaching force needs to bring together the infrastructural and legal authority of the police with the desert knowledge and sense of ownership of locally recruited rangers. In addition any force needs to be supported by suitable air cover to allow it to be effective in an area of 34,000 km^2.

... where private collectors pay sums of at least US$ 12,000 for a single oryx has driven the poaching of Oman's wildlife ...

Legislation

Oman has had wildlife legislation since 1976 when the hunting, capture or chasing of a number of large mammal species (including the oryx) was banned. However, in 1996 penalties were insufficient to deter poachers, neither the police force nor the courts had experience of wildlife crimes and wildlife rangers lacked comprehensive legal authority to effectively carry out anti-poaching operations. Courts and legal advisers are now better equipped to deal with wildlife crimes and under new legislation poachers can face up to 5 years imprisonment and a fine of US$12,000. Additional new legislation is under development to give Oryx Project rangers increased legal authority.

Wildlife trade

Hunting and capture of oryx was the primary cause of the extinction of the oryx in the wild in 1972. This threat seemed no longer present during feasibility studies in 1978 or during the first years of the re-introduction after first release in 1982. However, by 1988 gazelle were being poached for illegal live trade and in 1996 the oryx entered the same live trade to markets outside Oman. By 2002 the trade had broadened to include a range of species from across Oman. Trade may be the manifestation of a number of issues but there is little escaping the fact that the presence of a market where private collectors pay sums of at least US$ 12,000 for a single oryx has driven the poaching of Oman's wildlife, inside and out with the Arabian Oryx Sanctuary. As well as addressing root causes of the poaching, Oman is attempting to tackle the trade issue more directly and is considering ratifying CITES while also working with concerned neighbor states to develop bilateral initiatives to combat this problem.

Community involvement and empowerment

One of the early successes of the oryx project was the sense of complete community involvement in the oryx re-establishment as a consequence of the economic and social benefits that reached most families of the Bedouin herdsmen who regarded the project areas as their home (Stanley Price, 1989). Men of the local community hold most of the jobs in the Project and that no members of this community have either been charged or convicted for oryx poaching is testimony to the degree of local support. However, over time the range used by the re-introduced oryx expanded into areas used by other communities that at present have no stake in the re-introduction process nor the protected area. Inevitably a project that is perceived to 'belong' to one community may expect little support from adjacent communities. In the case of the oryx the high prices paid outside Oman for live oryx combined with an absence of any sense of ownership of the oryx has meant that a minority of people from communities at the margins of the re-introduction area and elsewhere have turned readily to poaching as their stake in the re-introduction.

Achieving a balance between communities and engaging those responsible for poaching are amongst the most complex issues faced by the project but both are vital components for long-term stability. Building on the success of existing local community involvement, the Project has recently appointed an Assistant Project Manager from the local community thereby extending direct inclusion in the Project to decision making at a policy level. However, there could be further empowerment allowing community leaders near and far to have a voice in the re-introduction process and especially in the management of the Sanctuary. This is not an easy approach to follow and requires a better understanding of how each community views the re-introduction and most importantly what their expectations are. To achieve this understanding, and to better reflect the fact that the principal challenges that currently face the oryx are non-biological, the project plans to recruit a social scientist; a step that may be increasingly taken by conservation programs seeking solutions to socio-economic issues.

Finding a balance between people and wildlife

In 1989 Stanley Price predicted that even when the re-introduction area was declared a nature reserve the local people would continue to live in it and the re-establishing oryx would have to share their range. This has indeed turned out to be the case. The Arabian Oryx Sanctuary was officially created in 1994 and today the local people have access with their domestic stock to 99% of the Sanctuary area. During the 21 years since the oryx were first released only two agreements have been made with the local people limiting the location of their temporary settlements. The first was before the release of the first herd when the local community was asked to avoid settling in 10 km^2 at the re-introduction site – this in a protected area of 34,000 km^2.

The second was just after the release of the first herd when a traditional grazing reserve was declared around the herd for three months. A proposal in 1986 that oryx moving to fresh grazing should not be displaced by arriving families and stock proved impossible and to the present day local people can move their mobile homes and stock freely over the re-introduction area regardless of the oryx or other wildlife. However, the absence of controls on stock numbers, imposed or voluntary, combined with off-road driving has meant that the grazing resource of the Sanctuary is severely depleted. The domestic stock are maintained at unsustainable levels through the use of very expensive feed supplements while the oryx seem to be able to manage in the degraded rangelands. Controls have become necessary – ironically more so for the livelihood of the local communities than for the survival of the oryx and other wildlife.

Building national support for the oryx

It would be easy to assume that a project with a good international reputation would also be well known and understood in the country of its execution. Certainly the Oryx Project was known and its principle objectives understood throughout the local community of the re-introduction area. However, after poaching started in 1996 it became clear that this message had not been disseminated to many people elsewhere in Oman where the Project was invariably misunderstood or often unknown. To some extent this has been rectified through targeted programs with schools and colleges; ironically the poaching has raised awareness of the Project and its remit in some sectors. Support can also be harnessed by providing greater economic returns, locally and nationally. Environmental tourism programs have brought modest revenue to local guides and tour operators. However, there is much to be done to encourage a sense of national ownership of the oryx and the protected area.

Conclusion

The early years of the Oryx Project were a time of great achievement. From a biological point of view the oryx has not proved difficult to re-introduce and can be considered a highly re-introducible species where natural habitat is largely intact (Stanley Price, 1989; Spalton, 1993 & Ostrowski 1998). The *IUCN Guidelines for Re-introduction* were developed from the success of the oryx re-introduction. When a viable population in the wild was reached in early 1996 it was tempting to conclude that the re-introduction was complete. Perhaps it was, but the start of poaching later the same year proved that keeping the re-introduced herds in the wild was to be a greater challenge than the establishment of the population.

Time has shown that the successful long term re-introduction of the oryx in Oman hinges less on biological factors but on our ability to implement programs that address wildlife trade, incentives for conservation, broad community participation and building support.

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Arabian oryx re-introduction into Mahazat as-Sayd protected area – Saudi Arabia: from rehabilitation to population management

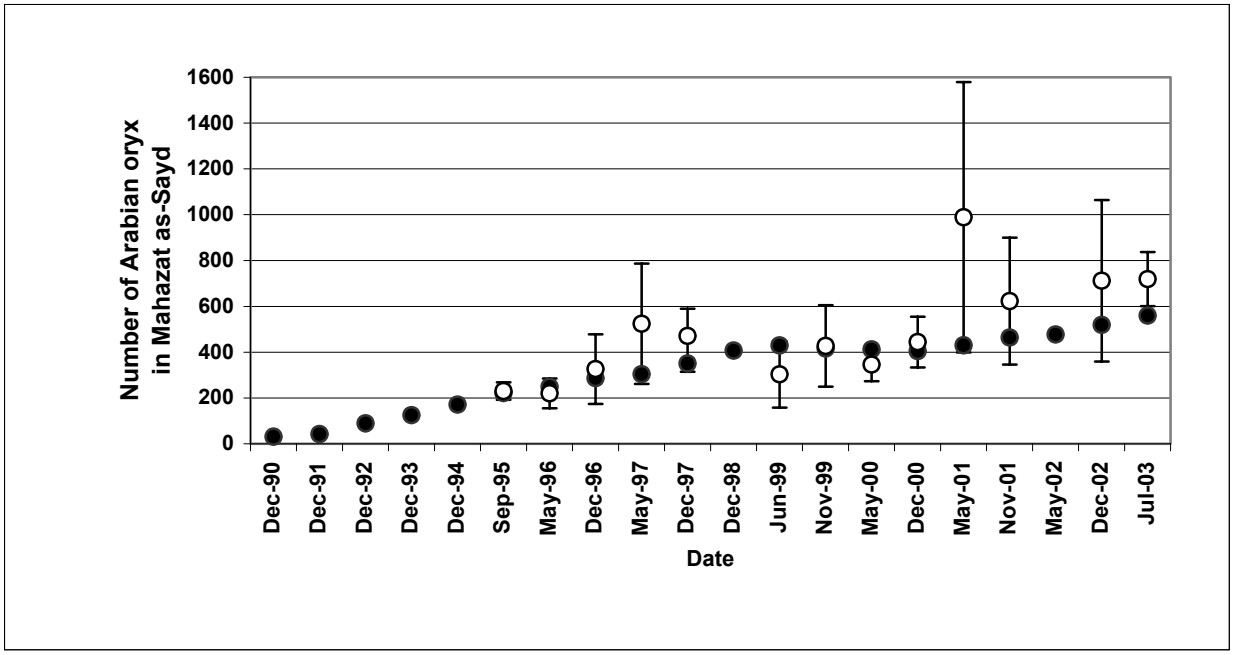
The Arabian oryx (*Oryx leucoryx*) formerly occurred throughout the Arabian Peninsula deserts and was extirpated from the wild by hunting in the early 1970's (Henderson, 1974). In 1986 an intensive captive-breeding program was started at the National Wildlife Research Center (NWRC), Taif, Saudi Arabia. The first site considered for the re-introduction of oryx in Saudi Arabia was the Mahazat as-Sayd (Ostrowski *et al.*, 1998). The area consisted of a 2,244-km^2 tract of flat, arid steppe desert in west-central Saudi Arabia (28º15'N, 41º40'E). After being designated as a protected nature reserve in 1988, Mahazat as-Sayd was surrounded by a fence in 1989 to exclude domestic livestock. Other than temporary pools after sporadic rain (average 90-100 mm per year), the area provides no drinking water for oryx.

Between 1990 and 1993, 72 Arabian oryx from the NWRC and foreign collections (e.g. San Diego Wild Animal Park, USA) were moved to the reserve and held within a 2 km^2 enclosure, and then released into the protected area. The re-introduced animals survived without food and water supplementation. During 1990-1993, a team of rangers under the supervision of the reserve's manager tracked and located oryx daily. As the population grew and animals dispersed into many small herds it became increasingly difficult to account for all of the oryx each day. Since May 1995 regular transect surveys have been carried out in the reserve and population trends have been documented in the protected area (Seddon *et al.*, 2003). Between 1990 and 1997, the population increased steadily up to about 400 individuals (see Figure 1 below). Then in 1998 and 1999, because of severe drought conditions, the population leveled off around 350-400 individuals. Between 2001 and 2003 good rainfalls, and resulting good forage conditions allowed the population to recover and increase to an estimated 720 individuals (95% confidence interval: 600–840) in July 2003.

Necessary management of the rehabilitated population

Although the ecological capacity of a protected area is an issue particularly difficult to address in temperate countries, it becomes a supreme challenge in arid environments where spatial and temporal heterogeneity of the range habitat scales in meters and rarely in kilometers. Acknowledging this difficulty we have designed a demographic model for the Arabian oryx in Mahazat as-Sayd, using satellite imagery, range quality assessment, eco-physiological data

Figure 1. Growth of the Mahazat as-Sayd oryx population between 1990 and 2003. Two estimates are presented (●: ranger's estimate based on known births and deaths; 0: Mark re-sighting estimate).



and population demography data (Treydte *et al.*, 2001). The model predicts that the maximal carrying capacity for the protected area would be 800-850 oryx. Above this threshold the population is likely to undergo significant density-dependant mortality during periods of under-average forage conditions. The model also evaluates the probability of extinction (frequency with which 100 initial populations fall to zero within 100 years) of the Mahazat as-Sayd oryx population under various management strategies. The probability of extinction was high when no management was applied to the population (probability of extinction varied between 0.3 and 0.92 according to combination of assumptions) whereas removing every year all oryx above 70% of carrying capacity provided the lowest probability of extinction, and the lowest population size variation whatever was the combination of assumptions. A more readily applicable management option; removing annually 15% of the current population, would also provide a low probability of extinction, despite wide fluctuations in population size.

Management decisions are simple in their principles but relatively complex to implement on the ground. The method of "removal" of oryx must be discussed (either physically through culling or capture and emigration or virtually through sterilization procedures) and funding appended according to management methods required. Whatever the management option applied, human intervention seems ineluctable to maintain the long-term viability of the Arabian oryx population re-introduced in Mahazat as-Sayd. Rehabilitation of the Arabian oryx in Mahazat as-Sayd Protected Area has been completed in a decade, however nowadays the new challenge concerns its long-term survival.

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Arabian oryx monitoring at 'Uruq Bani Ma'arid protected area, Saudi Arabia: population size estimate

The 'Uruq Bani Ma'arid protected area occupies 12,500 km^2 of the western edge of the Rub' al-Khali desert, the largest sand sea in the world, located in the south of the Arabian Peninsula. The protected area extends from the southern extremity of the Jurassic escarpment of Tuwayq in the west, through a limestone plateau incised with vegetated wadis and gullies and towards large longitudinal dune areas in the east. From March 1995 to July 2002, a total of 149 Arabian oryx (*Oryx leucoryx*) were re-introduced into the 'Uruq Bani Ma'arid protected area (Mésochina *et al.*, 2003). Some were wild-born animals from the Mahazat as-Sayd protected area, Saudi Arabia (see update on page 29), but most were captive-born from the National Wildlife Research Center, Taif, Saudi Arabia. Monitoring of oryx range use in the protected area have shown a seasonal pattern of movement, animals retrieving to the western escarpment plateau in the hot season and returning eastwards into the sands in cooler months (Wacher, 1998). Since 2001 we have been using the fact that during summer the oryx population ranges over a relatively small area (i.e. 2,500 km^2) where trees and overhanging rocks offer presumably enough shelter they require to survive the hot season, to carry out population size estimates. We employ a mark/re-sighting method using the Lincoln-Petersen index calculation technique. This technique has proved efficient in estimating oryx population sizes in the Mahazat as-Sayd protected area (Seddon *et al.*, 2003).

In August 2003 we estimated the Arabian oryx population in the western edge of 'Uruq Bani Ma'arid at 203 individuals ..

The "total count" was carried out on 20th, 21st and 22nd August 2003. The protected area was divided into 13 sectors of approximately equal size, based on topography and limited by major tracks, hills, dunes, all readily observed permanent features. We counted during three consecutive mornings and one afternoon. Each count session was dedicated to a separate area. No set routes were defined and there was no time limits set for the census in each area. Surveying teams were composed of two to three observers equipped with binoculars and a GPS unit programed to record the track followed, in order to quantitatively assess the area covered. Observations were made during the week prior to the count showed that the oryx rarely migrated between sectors, suggesting that the probability to re-count the same individuals between days was low. In August 2003 we estimated the Arabian oryx population in the western edge of 'Uruq Bani Ma'arid at 203 individuals with a 95% Confidence Interval (CI) of 169–237. When excluding immature individuals (<18-24 month-old), the adult population was estimated at 157 oryx, 95% CI = 133–181.

The Lincoln-Petersen index estimations suffer a major flaw when the number of marked individuals in the population is inaccurately known. For this reason, up-dating the number

of marked oryx (collared) present in the protected area and increasing the proportion of marked animals in the population have been two important management / monitoring activities during the previous months. The population estimate we provide is derived from a number of marked animals recorded for the 12 months prior to the count, a reasonably accurate estimation of the total number of marked oryx present in the surveyed area during the census. Although 149 oryx have been re-introduced into the protected area, a number of them have died due to inefficient adjustment to the new environment, starvation during the 1999-2000 drought period, poaching, and intra-specific fights. We estimate that 75 (50%) of them have survived. The oryx population at 'Uruq Bani Ma'arid is therefore composed of 60% wild-born individuals, a great asset to the population if one assumes that wild-born individuals are better adjusted to the environment than captive-bred oryx and that their capacity to survive harsh conditions is presumably optimized. Population estimates were consistent with results of routine monitoring carried out throughout 2003. When comparing with previous population estimates carried out respectively in July 2001 and August 2002, the present estimate was slightly higher than in 2002 and similar to results of 2001. However, the relatively large 95%CI (i.e. 169 - 237) observed in 2003 compared to 2001 (i.e. 182 – 216) and 2002 (i.e. 164 – 202) limits our predications of population trends.

To the best of our knowledge the population has not suffered a significant decrease or increase since August 2002. The reasons for a lack of increase of the population could be several, ranging from an underestimation of death rate (undetected poaching or environmental stress deaths), the existence of an emigration trend, the presence of wild-born oryx in non surveyed areas, a population that has already reached a demographic equilibrium with the environment, a positive but slow growth rate difficult to demonstrate on the short term. Many more years of monitoring might be necessary to clarify this demographic issue.

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Re-introduction of black rhino to Zambia

Five black rhino (*Diceros bicornis minor*) were re-introduced into Zambia's North Luangwa National Park (NLNP) on 28th May 2003. The status of black rhino in Zambia prior to this re-introduction was 'Presumed Extinct', with the last confirmed sighting of an animal in the early 1990's. In historical times Zambia was one of the black rhino's most important range states, and the Luangwa Valley, with an estimated population of up to 12,000 animals in the early 1970's, one of its strongholds in the country. The Frankfurt Zoological Society (FZS) has been supporting the Zambia Wildlife Authority (ZAWA), in the management and conservation of North Luangwa National Park since 1986, through its North Luangwa Conservation Program (NLCP). This long-term partnership has resulted in effective security and management systems being in place and the re-introduction of black rhino was a logical next step in conservation activities in the park. A positive evaluation of the habitat and security of NLNP by the Southern African Development Community (SADC) Regional Program for Rhino Conservation in 2001 set the stage and a formal proposal by ZAWA and NLCP was presented at the IUCN/SSC Rhino Specialist Group meeting in May 2002.

Release site

An area in the central area of the park, straddling the Lubonga River, was chosen as the site for the sanctuary in which the re-introduced rhinos would be released. The site's location was based on historical distribution data for black rhino in NLNP, as well as security considerations. A low-impact, 4-strand electrified fence was erected to contain the rhino in this 55 km² area, while allowing for relative freedom of movement for other animals. Additional ZAWA wildlife police officers were seconded to the area, and received extra training to deal with rhino security.

Release

In an agreement mediated by FZS, South African National Parks donated 5 animals to the Zambia Wildlife Authority in exchange for two zoo-born black rhino calves from Frankfurt Zoo. The animals destined for Zambia were captured in Marakele National Park and Kruger National Park in March of this year, and the two males and three females were flown to North Luangwa National Park just over two months later. During their time in the bomas in NLNP, they were outfitted with radio transmitters in their horns, and received a trypanosomiasis inoculation, active for three months, to ease their introduction into a tsetse fly area. Tsetse targets and traps were also deployed at a low density throughout the sanctuary area, and at a high density around the boma site to initially reduce the tsetse population to allow the animals time to develop resistance to the tryps parasite.

Post-release monitoring

The animals were released into the wider sanctuary area from their bomas after a period ranging from 2 ½ to 4 weeks, and have settled down well and none have broken through the perimeter fence. Their movements were predominantly monitored by plane for the first 6 weeks after release to keep disturbance to a minimum, although monitoring by foot patrol will become more important in the coming months. Data on the animals and their movements are being entered into the WildB database, developed by the SADC RPRC program. This re-introduction of 5 animals is just the 1st phase of the project, which aims to achieve a

minimum of 20 founder animals within NLNP within 3 years. The project has been a big step forward for conservation in Zambia, as well as being a success for regional cooperation in black rhino conservation.

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Ecology of re-introduced Andean bears in the Maquipucuna Biological Reserve, Ecuador: conservation implications

One of the many gaps that still exist in the knowledge of Neotropical mammals is the Andean bear which is better known as the spectacled bear (*Tremarctos ornatus*). The few studies that have been carried out have been based on evidence of bear activity e.g. tracks, excrement, foot prints, scratches, etc. Although such evidence can certainly add to our understanding, records of visual observation are the most reliable data for interpreting spatial patterns and factors in habitat selection. The objective of the present study was to increase the limited knowledge that exists about the ecology of this species and to acquire experience in re-introducing the Andean bear. To fulfill this objective it was decided to rehabilitate and release three individuals in the Biological Reserve Maquipucuna and then track them after release by means of ground radio telemetry.

Methodology

This study was carried out in the Maquipucuna Biological Reserve, in the cloud forests of the western slope of the Andes, in northwestern Ecuador. The Reserve covers 45 km^2, surrounded by a protective forest of 140 km^2 and the altitude ranges from 1200 to 2800 m. Annual temperatures vary between 10 and 20°C. In 1995, three juvenile bears were selected, two females and a male named Chiquita, Tuta and Paddington respectively. The bears were born wild but their origins were unknown. At 4 to 5 months of age, the authorities confiscated them from people who had kept them as pets in southern Ecuador. The bears entered the program when they were approximately 17 months of age and following the procedures recommended by IUCN (1987) for re-introduction programs, and after 8 months of rehabilitation, the bears were released. Each released bear wore a radio-collar with a movement sensor and the primary purpose of the telemetry was to allow researchers to approach the animal.

During eight months of monitoring each bear was tracked 8 days per month for 12 hours a day, generally from 06:00-18:00 hrs. Only two bears were successfully tracked because Tuta took off her radio collar after release. When an animal was sighted the trackers kept a distance of approximately 30 m and watched through binoculars, although in some instances we surprised the bear at distances as close as 5 m. Each activity the animal carried out was recorded and with the exact time where it happened. The behavior was only documented when the bear did not notice our presence and we assumed that the animal had discovered the investigator's presence when it began to smell and scrutinize the area in search of intruders. We opted not to bother the animal and did not record this possibly slanted data of their behavior.

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Results

The study bears were followed for eight months which resulted in 127 sightings between 5 and 30 m, for a total of 1,440 minutes of direct observation, the study bears used 70.2% of their time eating, 19.7% walking and 9.1% resting. Paddington had a home range of 61 Km² and a core range of 24.9 km². These ranges are 15 and 7 times bigger, respectively, than those of Chiquita at 4.1 km² and 3.5 km². The olfaction of these animals is extremely sensitive and they can perceive from ground level when a tree is loaded with ripe fruits. Their hearing is moderate and vision is not good and on several occasions we observed them from the top of a 3 m high tree and they appeared restless, constantly sniffing in search of intruders, but they were never able to locate the observer. When threatened or surprised on the ground, the bears stood erect on their back paws or they stopped to look for the intruder. Once the danger was located, and if it was close, they ran away or climbed the nearest tree. The bears crossed torrential rivers with very little effort and this was recorded on four occasions for Paddington and two for Tuta. Six different types of sounds were also detected. Eight terrestrial nests and two arboreal nests were built by the study bears and were

usually located inside mature forests next to water sources.

Discussion

The bears of the present study were wild-born but their time spent in captivity had made them tame. When they were released they "forgot" their dependence on man and began to manifest wild behaviors which included an increase in natural escape behaviors (except Tuta). This behavior was observed in similar studies with black bears (*Ursus americanus*). Among bears, males are known to travel over large areas in an attempt to satisfy their high metabolic demands (Joshi *et al.*, 1995). This may explain why Paddington´s home range is 15 times bigger than Chiquita´s and moving over long distances after release is common in large translocated carnivores especially bears. Chiquita´s and Paddington´s core areas were superimposed at one point in time but they were not together although we occasionally observed them feeding simultaneously in overlapping areas, they remained at least 25 m apart and did not attempt to meet thus confirming the solitary character of this species.

The bears in this study used paths on mountain ridges to move long distances as do other large Andean mammals e.g. Andean tapir, confirming that the Andean bears use ridges as routes between the high and low parts of the mountain (Peyton, 1980). The Andean bear may be the least aggressive to man from all the bear species because when we encountered the study bears they preferred to flee rather than be aggressive. When threatened, they generally go as high as possible in trees looking for a place to sleep and take refuge. They emitted nervous groans and blows, broke and threw branches, leaves, and moss, and feigned building nests. Local informants reported that when the Andean bear is surrounded in the top of a tree he jumps to the ground to escape. The sounds heard from the study bears were also reported in mature bears of the Natural Reserve The Planada – Colombia and it appears that a communication system exclusive to the species exists. The low visual acuity observed in the study bears, the sniffing to search for intruders and the methods of escaping from danger were also noted in a wild bear in Cochabamba, Bolivia. The oral masturbation observed in Paddington has also been noticed in other Andean bears.

The study bears were followed for eight months which resulted in 127 sightings between 5 and 30 m., for a total of 1,440 minutes of direct observation.

Although there have been several reports of livestock depredation by Andean bears (Peyton, 1980; Suárez, 1985 & Mondolfi, 1989), this animal is not a true hunter and is more of a scavenger than predator. Since the Andean bear is anatomically designed to squeeze and crush the vegetation on which it feeds, it is the most herbivorous of all the bear species. Paddington hunted and killed three young calves one at a time and we deduced that he attacked the calves in the open fields and dragged them 30 m to his nest in the forest where they were consumed. He also took to his nest belongings like blankets, utensils, and provisions that he "stole" from loggers.

Conservation implications

The present study does not seek to impose criteria or discredit previous studies on the ecology and conservation of the Andean bear but rather tries to gather all possible information on its ecology before embarking on a national re-introduction program. The re-introduction of the bears in this study has been questioned because the origins of the animals are unknown and there is concern on the subspecies status of Andean bears but available data indicates that there are no subspecies of Andean bears. Thus, there is no valid scientific reason to impede studies on re-introduction and/or translocation of individuals. In fact, this study may have helped increase the alarmingly low genetic variability of wild bear populations and re-introduction seeks not only to increase the number of individuals in a population in decline but also to show that individuals can adapt to their natural habitat.

During this study the animals were nutritionally self sufficient and within two years of having finished this study Chiquita was observed with cubs indicating reproductive success. We can infer that Chiquita had not lost or had recovered important aspects of her social, sexual and feeding behavior that allowed her to interact like any wild bear.

The approaches of Tuta and Paddington to farms near the study area could be indications of an anthropogenic dependence. However, this behavior is not unique as there are also made by wild bears in the Andean region, black bears in North America and brown bears in Spain. This behavior is generally associated with anthropogenic changes within the historical range which results in a concentration of nutrition resources in relatively easily accessible fields of crops and livestock. Since farms basically surround the reserve the two bears were moved to the Sangay National Park, in Central Ecuador.

Conclusion

Before this study there was little scientific information available on the individual ecology of the Andean bear in Ecuador. Most available information was based on anecdotes, speculation, and extrapolations of results of population studies of other species of bears, resulting in inaccurate conclusions about important aspects of the Andean bear´s ecology and behavior.

The data collected and analyzed in this study provides accurate information about the individual ecology of this species and we hope that the experiences and results obtained in this study will motivate new efforts to re-introduce individuals in Andean countries. Programs of this type are the only way to save this species from extinction but they should be planned in a way that not only involves population recovery of the species but also the protection and/or restoration of their natural habitat.

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Post-release monitoring of brown-ruffed collared lemurs after translocation in the south eastern forest of Madagascar

The brown-ruffed collared lemur (*Eulemur collaris*) is currently classified as Vulnerable by the IUCN Red List Criteria (Harcourt & Thornback, 1990). It occurs only in the south eastern forest of Madagascar between Mananara River to Fort Dauphin (Mittermeier *et al.*, 1994). To conserve this species, Qit Minerals project captured eighteen individuals in a zone with high human pressure and translocated them into a new zone with non-existent anthropogenic pressure on 29th September 2000.

This translocation was done for two reasons:

- To contribute to the conservation and the protection of the species, and,
- to create new zone for developing eco-tourism in this region.

The aim of this study was to determine whether the brown-ruffed lemur is able adapt to its new habitat after the translocation. To determine this we monitored the daily biorhythm, diet and the substrata utilization by this species.

Methods

Continuous focal sampling (Martin & Bateson, 1994) was adopted and individuals were continuously surveyed for no less than 12 hours (between 06:00 hrs - 18:00 hrs or 18:00 hrs - 06:00 hrs). Fieldwork was done between November 2000-January 2001 and from November-December 2001. During this sampling the type of vegetation eaten was also recorded.

Results

Individuals maintained their biorhythm with a percent daily activity of 30.67% and 34% for nocturnal activity. Their daily activity was spent searching for food or moving to other localities. Translocated individuals also maintained their frugivorous diet (64%) and they also ate leaves, flowers and animals.

During November 2000, two females had offspring and one of them gave birth twice. During the next release in 2001 two females reproduced in the new habitat and two females died (due to hunting) and more than five individuals returned back to their original habitat (see Table 1). The female B1 with its offspring has been missing in the conservation zone since January 2001. This female returned into the original habitat and has lost its offspring and more than the half its tail.

Lesson learned

- The translocated brown-ruffed collared lemurs have adapted differently to this translocation. There is one group that has adapted to the release site and others that have returned back to their original site.
- The reason is probably not related to diet as the original forest is more degraded and contains fewer sources of food then the conservation zone.
- Brown-ruffed collared lemurs in the Madagascar littoral forest have suffered from human related factors so actions have to be taken to limit them.
- Reproduction of translocated individuals has taken place in the new conservation zone.

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Conclusion

Despite the mortality rate of 27.78% the translocation was considered a successful conservation exercise. The home range of the lemurs is between 0.2 km^2 – 0.98 km^2 (Donati, 2001) and the conservation zone in 2001 contained 38 individuals. It would be more important to start a forest restoration program adjacent to the conservation zone to increase its area. It has been demonstrated that brown-ruffed collared lemurs have adapted to this new zone and translocated individuals have reproduced and reproduction

Table 1. Release data between September 2000 — November 2001					
Group	Release (29/9/2000)	November 2000		November 2001	
		Individuals	Died	Individuals	Location
A 1	2-2-0	3-1-0	0-1-2	2-1-1	NH
A 2	2-0-0	2-0-0	-	2-1-1	OH
B 1	1-1-0	0-1-1	-	1-1-0	OH
B 2	1-1-0	3-1-0	-	2-1-1	NH
C 1	2-3-0	1-1-0	0-1-0	2-1-0	NH
C 2	2-1-0	1-1-0	-	-	OH
Total	10-8-0	10-5-1	0-2-2	9-5-3	
OH—original Habitat / NH—New Habitat					

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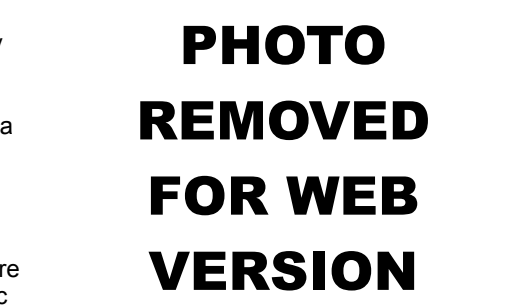
may be an indicator of their adaptation.

Re-introduction possibilities for endangered langurs in Vietnam

Vietnam lies entirely within the so-called “Indo-Burma Biodiversity Hotspot” and the country has one of the highest percentages of threatened species among its mammal fauna. According the IUCN categories 20% of its mammal species are threatened and thus placed in the categories Critically Endangered, Endangered or Vulnerable. Primates make up a considerable part of the threatened species and 23 taxa are identified for the country, five of them are endemic. Five of these 23 taxa are listed amongst the world’s 25 most endangered primates – this means 20 percent of the world’s most endangered primates occur in Vietnam. Due to habitat loss and a high hunting pressure the populations of several species have been drastically reduced and their numbers are now critically low. For some species the remaining populations comprise only a few hundred animals or are even below one hundred. Primates are hunted for traditional medicines, to be kept as pets and for their meat. National law protects all primates since 1992 and the country has established a good network of protected areas but even inside these protected areas hunting continues and primate populations are still declining rapidly.

Biodiversity Action Plan

Resulting from a cooperation project of the government and UNDP, the Prime Minister of Vietnam issued the Biodiversity Action Plan for Vietnam in 1995 (Government of Vietnam & Global Environment Facility Project, 1995). This document consists of a comprehensive strategy to protect the biodiversity resources within a sustainable framework. It includes the establishment and management of protected areas, the conservation of endangered wildlife, the raising of public awareness, capacity building, scientific research and socio-economic issues. The Action Plan also recommends the developing of *ex-situ* breeding programs for endangered species in order to maintain populations of captive bred animals that can later be re-introduced to re-enforce the populations in the wild. *Ex-situ* conservation can be a useful tool for crisis management. However it is difficult to identify the species qualifying for captive-breeding programs.



The Biodiversity Action Plan suggests three criteria to identify these species:

- Taxa, which are endemic and restricted to a range of less than 50,000 km^2.
- Taxa, which are critically endangered according to the IUCN categories.
- Taxa, where *in-situ* conservation is failing to stem the population decline.

At least five of the 23 Vietnamese primate taxa qualify for a captive breeding program following these criteria including four langurs: the cat ba langur (*Trachypithecus poliocephalus poliocephalus*), the Delacour's langur (*Trachypithecus delacouri*), the grey-shanked douc langur (*Pygathrix cinerea*) and the Tonkin snub-nosed monkey (*Rhinopithecus avunculus*).

The Frankfurt Zoological Society started in 1991 the first conservation program for one of the Vietnamese primate species, the critically endangered Delacour's langur at Cuc Phuong National Park in the North of the country. The project initially provided temporary housing for two confiscated Delacour’s langurs at the beginning of 1993 and this subsequently lead to the establishment of the Endangered Primate Rescue Center (EPRC). The center was given the task to care for the endangered primates confiscated by Forest Protection authorities within the country. Further responsibilities of the ERPC include the captive breeding of very rare taxa and the eventual re-

introduction of captive bred offspring. Thus, in concrete ways, the EPRC implements the recommendations of the Biodiversity Action Plan.

Re-introduction program

Animals

In the past ten years the number of animals at the EPRC has grown from two to over 100 and currently the center houses representatives of 16 Indochinese primate taxa. Langurs represent the majority of animals kept and a total of 44 langurs have been born at the center. The breeding success and the rapid growth of the captive population allows for the consideration of a re-introduction program. For example the largest captive population at the EPRC is the Hatinh langurs (*Trachypithecus laotum hatinhensis*) totaling 22 animals including 18 offspring that have been born in three unrelated breeding lines. In addition, the captive bred animals already include a second generation. Another large group is the red-shanked douc langur (*Pygathrix nemaeus)*, where 14 offspring have been born at the center and the total population presently includes 15 animals. Thus re-introduction possibilities will firstly be assessed for these two species.

Pre-release training process

The EPRC strives to operate according to the IUCN technical guidelines for the management of *ex-situ* populations for conservation (IUCN - Species Survival Commission, 2002). One of the postulates of these guidelines is to manage *ex-situ* populations in a way that minimize the loss of ability to later again thrive in natural habitats. The eventual re-introduction has always been a long-term goal of the rescue center and therefore the animals are kept under conditions as natural as possible in order to facilitate later adaptation processes. Adjusting to natural food sources is known to be a major obstacle in re-introduction programs. To avoid this critical problem langurs at the EPRC are fed solely on leaves that are collected twice daily in the surrounding forest areas. To assess the possibility to re-introduce langurs into a wild habitat the rescue center has established two “semi-wild areas”. Both of these areas comprise a limestone hill (0.018 km^2 and 0.04 km^2), covered with poor primary forest surrounded by electrical fencing. Gibbons were released into these areas in 1998 and 2002, Hatinh langurs were released into one of the semi-wild areas in 1999 (Nadler & Baker, 2000), and red-shanked douc langurs in 2002. These langurs had no difficulties in adjusting to the wild food sources and supplementary feeding was never required. Several offspring have been born in these semi-wild areas. Due to the close proximity of the National Park’s forest natural predators are present and they occasionally enter the semi-wild areas and offspring have been lost. On one occasion an adult male gibbon killed an infant Hatinh langur and consequently the gibbons had to be removed from the semi-wild area. Whereas Hatinh langurs had little difficulty in adjusting to the natural arboreal climbing substrates and “climbing accidents” were rarely observed, the douc langurs needed several weeks of adjustment before they moved confidently through the trees. Douc langurs differ in their locomotion from other langur species in frequently using forelimb suspension and are semi-brachiators and not solely quadrupedal as are most other langur species.

Though langurs have been re-introduced successfully without a comprehensive plan (Gupta, 2002) we consider a detailed concept for re-introduction to be essential to minimize potential losses.

Selection of release site

Field observations have shown that Hatinh and douc langurs, and probably most Vietnamese langur taxa, are not dependent on high quality primary forest but can thrive in secondary forest and fairly degraded habitat. If the forest is in good condition the space requirements of langurs seem to be moderate. For example, four langurs were able to live and breed in a 0.018 km^2 area without any supplementary feeding. Due to high hunting pressures langurs have disappeared from large areas of their former distribution range. Thus empty forests at various stages of degradation are available in the former distribution areas of each of the Vietnamese langur species where re-introductions might be considered. Surveys have been conducted in all major areas of primate occurrence and data on population densities are available (Nadler *et al.*, 2003). With these data it can be assessed, where a re-introduction program will be useful for linking presently isolated subpopulations or to re-enforce populations with sex ratio that is not consistent with healthy breeding. However, for an area to be suitable for a release site it must be completely free from hunting because animals that have been kept or born in captivity will not avoid the close proximity of humans and thus are easy targets for hunters.

Planning for a release

Though langurs have been re-introduced successfully without a comprehensive plan (Gupta, 2002) we consider a detailed concept for re-introduction to be essential to minimize potential losses. The selected release site will be surrounded by electric fencing and animals will be released into the area according to the same protocol as in the successful releases at the EPRC and the animals will live in this area with no direct human contact and without provisioning. An educational program will be conducted, raising awareness about conservation of endangered species amongst the local population. Integrating this stage of the re-introduction into tourism will also be contemplated, but this will depend directly on the approach of tourism in the area. To encourage any form of zoo or wildlife park situation must be avoided to ensure the likelihood of a successful re-introduction. Once the forest protection work at the release is ready to accommodate the release, the electric fencing will be removed. A study program with Vietnamese biologists to conduct post release monitoring of the animals is an essential part of this plan and this will include radio-tracking.

Discussion

Being established as a facility with three goals, the EPRC in Vietnam has started to look into the third and most challenging one of its responsibilities, re-introduction. Rescue proceedings are well established and captive-breeding has been very successful and in the very near future captive bred langurs will be ready to be re-introduced into the wild to restock depleted populations. The captive conditions at the EPRC particularly the feeding

management seem to prepare animals well for life in a natural habitat and knowledge about food sources is not considered to be an obstacle for the planned release even in the case of captive bred individuals. The center's semi-wild facilities have turned out to be a very suitable tool to prepare langurs for a potential re-introduction, particularly because they allow the animals to adjust to wild food sources, natural climbing substrates, selection of suitable resting sites, and predator avoidance. After a training period in such a facility, animals should be ready to be released into the wild.

There are plenty of potentially suitable habitats for release available in Vietnam. For example an area with sufficient good habitat for the Hatinh and red-shanked douc langurs re-introduction is the newly established National Park at Phong Nha – Ke Bang and this will be first place considered for this program. The area holds severely depleted populations of Douc and Hatinh langurs and has sufficient suitable habitat to hold large populations of both species. But safety from hunting cannot be guaranteed at present anywhere in the country, not even at this National Park. There is evidence that local authorities do feel a strong sense of ownership for re-introduced animals and are more inclined to protect them than the wild "anonymous" populations. Yet this does not guarantee complete safety from hunting.

In addition, tourism is a rapidly developing sector in the Vietnamese economy and the financial incentives for the establishment of tourist structures are considerable. Unfortunately, aggressive tourist development invades even the last strongholds of nature and the potential financial gains through tourism precede any consideration of protection. This absolute lack of wildlife management capacity results in false expectations of the tourism value of re-introduced animals and such tourism development plans are counterproductive for re-introduction programs.

Ex-situ conservation programs are an important tool for conservation. But they cannot be successful, if *in-situ* conservation measures are not strongly coordinated. However successful captive-breeding programs might be, they can not successfully fulfill their role in conservation if no safe habitats are available to eventually re-introduce captive bred animals.

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Re-introduction of pygmy lorises in Vietnam

The distribution of the pygmy loris (*Nycticebus pygmaeus*) is limited to Vietnam, Eastern Laos and a few locations in South Yunnan. Fieldwork in these countries has been limited and little is known about the lorises' ecology or status in the wild (Ratajszczak, 1998). In Vietnam lorises are hunted for traditional medicines and for the pet trade (Compton, 1998). The pygmy loris has been protected by Vietnamese law since 1992 at the highest level (The Government of Vietnam, 1996), but law enforcement is weak and forest protection authorities are little motivated to strictly pursue hunting and trading of this inconspicuous primate. In addition, while international trade of lorises is restricted by CITES, significant numbers are exported illegally. The Red Data Book of Vietnam and the IUCN Red List of Endangered Species list the pygmy loris as vulnerable, but as a result of the excessive hunting lorises are decreasing and apparently have vanished in large parts of their distribution range (Shi, pers. comm. & Thang, pers. comm.). Not only does the Vietnamese law prohibit hunting and trading of this species, it also postulates the release of confiscated animals back into their natural habitat.
In reality, confiscated animals are simply dumped into a forest close to the confiscation point without consideration on their taxonomic status, their state of health and their ability to survive. The same law also postulates the check for "health, plague and ecofeatures" but this is usually ignored and animals are often weak and ill from being transported, they always suffer from extreme stress, and many of them probably die shortly after the release and of course it is possible that these animals introduce diseases into wild populations. The Endangered Primate Rescue Center (EPRC) first received confiscated pygmy lorises in 1996 and has since received numerous animals. To address the current problem of uncontrolled releases, the EPRC decided to conduct a study to investigate how confiscated pygmy lorises are able to be re-established in a wild habitat. The results of this study will hopefully help to develop recommendations for authorities for the further placement of confiscated lorises.

Source of animals

Between November 2000 and November 2002, nine Pygmy lorises were selected for release. Considerations for their selection included geographic origin and taxonomic status, assumed age at time of confiscation and state of health. The selected animals had been confiscated from traders in northern Vietnam and the genetics of each specimen were profiled in order to be sure that they were identical with local pygmy lorises. All animals were adult at the time of confiscation and long-term storage of animals with a trader is not a common practice in Vietnam and since the animals were adult at the time of confiscation they were assumed to be capable of living in a natural habitat. Animals were

released as single individuals or simultaneously with a familiar animal, which had been housed in the same or in an adjacent cage.

Quarantine

Prior to release the animals were placed in quarantine for six weeks, where they were kept in isolation and their health was checked regularly. In addition, parasitological treatment was conducted and a Tuberculosis test performed.

Release site

The release site is in the former botanic garden of Cuc Phuong National Park. This garden consists of 1.2 km^2 area of old tree plantations with several large limestone hills, which are covered with poor primary forest. The edge areas, where the former plantations border the primary forest, are characterized by tall trees, numerous climbers and dense scrub. The vegetation in this area is particularly dense and does not form separate horizontal layers rather it forms a continuous three-dimensional network. The specific release site is located at the foot of one of the large hills in the primary forest and a pygmy loris was found in this area in November 1999 and thus it was assumed that the area was suitable for pygmy lorises.

Release time

Animals were released in March, April, September, October and November. The climate in northern Vietnam has quite distinct seasons with hot humid summers and cool humid winters. Spring and autumn have a comparable mild climate with little rain. The majority of trees flourish in spring and insects are abundant in the warm times of the year, whereas they are scarce in the winter months.

Observation methods

The animals were monitored by direct observation and telemetric methods. Pygmy lorises can be easily identified by their characteristic eye shine and since lorises are less able to detect the wavelength of red light, head torches with red-light were used for observation. For telemetry studies the animals were equipped with light-weight transmitters (PD-2C Fa. Holohil, 3.9 g) and the animals had worn the transmitters for several weeks prior to release without problems. Antenna and receiver (Telonics TR-4 and Telonics RA-14) are light-weight and could easily be carried when climbing in the steep and difficult terrain on the hills.

The releases

The releases were performed as “soft releases” following the definitions of *IUCN Guidelines for Non-human Primate Re-introductions* (IUCN, 2002). The cages in which the animals had previously been quarantined were moved to the release site and the animals were fed at the release site in the closed cages at the regular feeding time for several days. Then the cages were opened at dusk and feeding was continued until the animal moved far away from the release area and did not return to the cage site for several days and at this time the cage was removed. The animals were located by triangulation during daytime at their sleeping site and the exact location was ascertained by a direct sighting of the animal. The observer returned right before dusk and followed the animal by direct observation from the time it started to be active. Care was taken not to disturb the animal unnecessarily during the process of it establishing a home range and animals showed signs of habituation to the observer’s presence and periods of direct observation ranged between a few minutes up to several consecutive hours. The animals were not followed by telemetry at night since this proved to cause a lot of disturbance to the lorises and also proved to be dangerous due to the treacherous nature of the terrain. After April 2002, animals were only monitored by telemetry and data was still collected on their preferred sleeping sites, movements, and range distance.

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Results

Observation period

Significant variation existed in data collection for each animal - one animal disappeared the day after release. From the other animals data could be obtained for only 14, 16, 27, 34, 39, 51, 83 and 134 days respectively.

Feeding

During this study lorises were found to be truly omnivorous as they were observed feeding nearly equally on plant and insect items. Insect prey was searched for by moving slowly along a branch with the nose close to the substrate. Insects were caught using one or both hands and then put into the mouth. Large insects were eaten starting from the head, using the molars to break the hard skin, and pushing the prey into the mouth with the hands. On at least one occasion lorises were seen feeding on ants, which were licked from the branches. Gum and other plant exudates comprised the other main part of observed feeding events. Gum scraping -“ tree gouging”- was observed frequently (e.g. on *Spondias axillaris*) and animals returned to once identified gum sources. Different animals were feeding on the same location but not at same time. Intense licking without scraping was observed in a tree that was covered with large bundles of orange blossoms (*Saraca dives*) and the observations suggested that the loris was eating nectar. Licking on branches without scraping was also observed in *Vernicia montana* and *Sapindus* spp. Only one animal returned regularly to the cage site to feed for several weeks after release.

Sleeping site selection

The animals showed a preference for the hills, especially the edge areas, where the vegetation is very dense. Trees with climbers were preferred sleeping places and occasionally the animals slept in plantation trees but never far from the

edge areas. They frequently returned to the same sleeping site and different animals used the same sleeping site on different days. If an animal was disturbed at the sleeping site it would leave the site and never return to it again. The range of the sleeping sites for the animals in this study was between 1,000 m^2 and 31,000 m^2 (50% Kernell probability plot). The distance between two sleeping sites in two subsequent nights was up to 289.6 m but on average, the distance between sleeping sites in subsequent nights was 97.2 m.

Movement
Animals were more often observed using vertical than horizontal substrates. Animals tended to use the same pathways through the vegetation and in familiar trees thus managed to avoid dead ends. When exploring a territory, animals were hanging by the hind legs, turning the upper body and head in all directions to get an overview of an area. The animals frequently moved on the ground when suitable climbing substrates were missing, e.g. when the canopy was not closed, animals covered distances up to several hundred metres on the ground. Intense observation of the area from a tree and several short visits to the ground preceded the crossing of an open area. On several occasions the animals probably went to the ground for foraging but this could not be determined with certainty.

Social behavior
Though both male and female lorises were released at the same time and in the same area encounters were not observed. Animals used the same sleeping sites but not on the same day and they never established their range in exactly the same area. As noted above, animals also used the same feeding sites but not at the same time and scent marking was occasionally observed. Social interaction between animals was observed on a single occasion when one of the released animals established intensive whistling contact with a group of caged animals inside the rescue center. After this contact the released loris immediately moved towards the rescue center and it was found sleeping only 30 m from the cage the following day.

Causes of mortality
Predators killed two animals and one was predated on in a low sleeping place (bamboo, height 1.2 m) another one probably when it was on the open ground. In one case the predator was positively identified to be a marbled cat (*Felis marmorata*) and in the other case it was concluded from the bite marks on the collar that the predator might have been a small carnivore as well.

One animal, released in November, possibly died of hypothermia, when it slept in a very exposed spot and was drenched by a hard and cold rain. It was found dead at this location two days later and another one died of an unknown cause during the cold season (February).

Collar loss
One animal lost the radio collar and the collar showed loris gnaw marks and the diameter had been widened so that it had slipped over the animal's head.

Discussion

Because the sample size of this study is small the results must be considered preliminary. In this study healthy, adult animals, genetically identical to the resident loris population have been introduced into habitat that was assumed to be suitable. The animals were able to identify wild food sources and actively search for them. Within the observed time none of the animals showed signs of weakness or illness and none of the animals moved immediately out of the area, thus there seemed to be sufficient food sources in the release area. Only one animal returned to the cage site for feeding and this animal was the individual released at the latest time of year. It had been observed as well using a variety of wild food sources, though it was obviously able to identify those but food sources vary remarkably around the year. It is possible that this individual had to rely more on the supplementary feeding because of adverse environmental conditions at the time of its release such as low food availability and low temperatures. Pygmy lorises do occur in this area and their distribution stretches further north into areas where conditions are likely to be even more seasonal. Surely animals have to be familiar with seasonal processes in their habitat to survive times of food shortage but it is also likely that this knowledge varies in animals from different regions.

Based on their history animals were assumed to be familiar with predators as both predator kills occurred when the animals left the forested hill areas and moved to the more open plantations. Lorises cannot jump or leap and need a very closed canopy and it is possible the animals had to use the ground more often in this area and thus encountered predators more often. Hypothermia is the likely cause of death of the animal released late in the year (November) and one would expect an animal to be able to cope with the normal range of weather in its natural habitat but possibly the animal was not prepared to react to such low temperatures. Within the distribution range of the lorises there are different climatic regions and the climate in southern Vietnam differs remarkably from the climate in northern Vietnam. Genetic studies on Pygmy lorises have found less than 0.2 % DNA variation within the species and no subspecies have been identified (Roos pers. comm., 2001). The wide range of colour variations seems be related to the season rather than to the origin of the animal and thus it is very difficult to identify the exact provenance of the animals. It has been suggested that pygmy lorises in northern Vietnam show that animals have developed specific strategies to survive the northern winter season with low temperatures (Ratajszczak, 1998) and animals from the south might not have these adaptive behaviors.

The selected animals had been confiscated from traders in Northern Vietnam and the genetics of each specimen were profiled in order to be sure that they were identical with local pygmy lorises.

There is insufficient information to draw many conclusions on the role of the lorises' social system for re-introduction. As previously suggested (Fitch-Snyder *et al.*, 2001) they seem to be solitary with overlapping ranges. In this study, the individuals used the same sleeping and feeding sites but not at the same time. The observed scent marking as well as whistling, play key roles in the pygmy lorises' social system (Fitch-Snyder *et al*., 2001), but observations were

too scarce to draw any conclusion.

Conclusion

The study showed that it is very difficult to plan a re-introduction program for a species for which little is known about its natural behavior, ecology, and habitat preference. At the moment lorises are released often on a large scale and the lack of knowledge is replaced by these assumptions and a number of these common assumptions appear to be incorrect given the results of the study! More data on the ecology of pygmy lorises is needed for better designed re-introduction programs. However, data yielded by this study does provide invaluable information for future releases and this is of critical importance because applicable and acceptable solutions are urgently needed for the re-introduction of confiscated lorises in Vietnam and Southeast Asia.

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REPTILES

Giant Amazon turtle: eleven years of re-introduction in the Orinoco River, Venezuela

Out of the fresh water turtles in Venezuela and South America, the giant Amazon turtle (*Podocnemis expansa*) faces the highest risk of extinction. Thanks to the German naturalist Alexander von Humboldt, historic abundance records exist for this species. In 1800, Humboldt (1820) estimated a population of 330,000 females in the Middle Orinoco River, based on the number of egg-oil bottles collected that year. Presently only about 1,000 females are left in this population. Unsustainable use by humans has been the main cause for this turtle's decline. There is a long tradition of meat, egg and hatchling consumption along the banks of the Orinoco traceable to Pre-Columbian times. However the species could not withstand the level of commercial extraction imposed on it by the white-man's trade. For the past 40 years consumption has been legally banned, regardless the population has not ceased to decline. Apparently, additional management measures are required to ensure recovery of this species.

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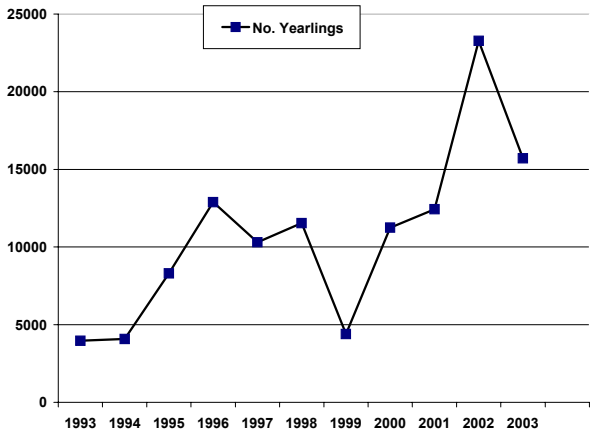
Among the protection measures, the "Refugio de Fauna Silvestre Tortuga Arrau" (RFSTA) was declared in 1988 as a wildlife refuge. This refuge is under the administration of the Ministry of the Environment and Natural Resources (MARN), includes the species' main nesting beaches in the Middle Orinoco River. The Environmental Enforcement Unit of the National Guard (GN) lend their support in the refuge providing continuous surveillance to avoid poaching of adults and nests. Their combined efforts have helped reduce the drastic decline of the adult turtle population in the area. In 1992, the MARN started a captive-rearing program for hatchlings in hopes to increase the population size. FUDECI joined this program in 1994 with its captive-rearing facilities in the Amazonas Experimental Station, 80 km south of the refuge in Puerto Ayacucho, Amazon State. Through captive rearing

Table 1. Giant Amazon Turtle re-introductions in the RFSTA, Middle Orinoco River, Venezuela, 1993-2003. (E. Marín, pers. comm.)



we expect to reduce hatchling mortality by increasing the size of one-year old turtles when they are re-introduced into their natural habitat in the refuge.

Captive rearing

Each year, between the months of April and May, hatchlings are collected at the RFSTA nesting beaches and later transported to FUDECI's station. The facilities consist of five 0.6 m deep, 100 m^2 pens and a 1.5 m deep, 920 m^2 artificial lagoon. Puripargo®, a 28%-protein commercial fish-culture product, is used as feed. This product has the advantages of containing vitamins and minerals and is accepted by the animals and easy to find in the local market of this rural area. We feed animals a 2% body weight rations five times a week for one year. Essays done with 10% body weight rations showed higher growth rates but did not justify increased feeding costs. We have found this species withstands high densities in captivity (up to 37.5 individuals/m^2) without showing health problems (Hernández *et al.*, 1998), however, growth decreases at high densities, we therefore maintain a density of 25 individuals/m^2 at the facility. With this, yearlings reach an average straight carapace length of 120 mm and they weigh 221 g after having consumed an average 400 g of feed during the year-long rearing period. FUDECI has carried out this program with support from the MARN for feeding, and from the National Fund for Science, Innovation and Technology (FONACIT) for captive-rearing optimization research, and follow-up of re-introduced animals.

Turtle re-introduction

Re-introduction takes place on the beach where the hatchlings are born; a small seasonal island (emerges during the dry season) called Playita in the RFSTA. Animals are trucked from Puert Ayacucho to RFSTA in plastic baskets with up to 100 individuals per basket. Mortality rate is very low during transportation (only 0.095% in 2003). The number of yearlings re-introduced by FUDECI since 1993 is shown in Table 1 above. Last April, 15,703 individuals were re-introduced which make a total of 118,750 in eleven years of continuous work. Between 1992 and 2003, FUDECI has reared 73% of the animals that have been re-introduced and this year we have decided to increase the total number to 47,600 hatchlings for captive rearing. MARN will do the same with 3,500 hatchlings thus making a total of almost 50,000 yearling's for next year's re-introduction.

Post-release monitoring

Before release, turtles are marked by cutting the tip of one finger on a front limb, thus avoiding the growth of a nail and allowing cohort identification. By marking the animals we can determine their origin (captive-reared or wild) and age (captive-reared). To try to establish survival we surveyed re-introduced animals in April (low river) 1998, 2000 and 2001. We surveyed near-shore sites, where locals indicated small animals could be found, by using a fishing net stretched-out from a boat to the beach. Larger animals were found with increasing depth and a total of 246 turtles were captured for all three surveys. Out of these 17% were one-year olds, 6.5% two-year olds, 11.38% three-year olds, 4.06% four-year olds and 1.22% five-year olds and just one individual was a 6 year-old. Our mark, a missing front limb finger-tip, was observed in 40.56% of captured animals. However, since 13,000 unmarked turtles were re-introduced during the first three years of the program, there is an under-estimation of certain age groups (1998, 4-6 years-old & 6 years-old).

Table 2 (page 42) shows the average size and weight of surveyed animals, and those of one 8 year-old turtle seized from local poachers by the GN in 2002. Because sexually mature individuals in this species have a curved carapace length (CCL) of approximately 600 mm, we would expect these individuals to reach that size when they are 15 years old, as suggested by Pritchard and Trebbau (1985).

Human predation

An important part of this recovery program is to determine the size of turtles consumed by local people. Between 2000 and 2002, we collected and measured 202 turtle carcasses, presumably hunted by locals in addition to others seized by MARN and GN. The average size locally consumed was 289.01 ±111.87 mm SCL, about the size of a 5 year-old turtle, and this did not vary between years (Hernández & Espín, in press). The smallest carcasses were around 140 mm SCL, which is alarming if we consider adults have a SCL of 600 mm and very few adult carcasses were found. On the other hand, we found adult yellow-headed side-neck turtle (*Podocnemis unifilis*) carcasses. In order to explain the differences between these two species, it is possible that the effect of captive rearing on *Podocnemis expansa* increases the number of young animals in the wild. The yellow-headed side-neck turtle is only found in natural abundance, being a species that has not been reared in captivity. Hence this observation could be used as an indicator of the success of the captive rearing program of *Podocnemis expansa*.

Last April, 15,703 individuals were re-introduced which make a total of 118,750 in eleven years of continuous work.

Conclusions

- Because *Podocnemis expansa*, withstands high densities and shows good growth rates using fish food this species seems suitable for captive-rearing and to fulfill the purpose of this program.
- Captive-reared 1 year-old *Podocnemis expansa* seem to adapt well to their natural environment, therefore re-

Table 2. Age, straight carapace length (SCL), curved carapace length (CCL), and weight of captive-reared giant Amazon turtles recaptured in the Giant Amazon Turtle Wildlife Refuge, Middle Orinoco River, Venezuela. Reported values for SCL, CCL and weight are means ± standard deviation.

Age (Yrs)	SCL (mm.)	CCL (mm.)	Weight (g.)	n
2	160.37 ± 11.47	170.68 ± 12.53	504.68 ± 90.03	16
3	199.78 ± 27.15	213.46 ± 27.85	950.00 ± 341.27	28
4	250.20 ± 46.62	262.90 ± 51.90	1,923.00 ± 1,237.70	10
5	285.66 ± 38.08	301.33 ± 41.08	2,683.33 ± 938.52	3
6	419.00	447.00	7,750.00	1
8	462.00	485.00	9,000.00	1

introduction could be a successful recovery strategy for its populations.

- Recapture data indicate that *Podocnemis expansa* probably reach adult size well beyond 8 years of age.
- The current local consumption pattern of *Podocnemis expansa* indicate that young animals are under the highest human predation pressure probably because they are the most abundant due to the re-introduction program.
- This population of *Podocnemis expansa* is still critically endangered and only about 1,000 adults survive and all age classes are under continuous predation pressure by humans. To ensure survival, laws must be enforced, surveillance must increase in the area and the captive-rearing and re-introduction program must continue.
- The success this conservation program has had until now is proof that it is possible to coordinate the efforts of public and private organizations in Venezuela. We hope to be an example for others.

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Head-starting of sea turtles: is it a viable conservation and management tool?

Populations of all sea turtle species in the world have decreased in recent years, and studies for their conservation have been launched all over their distribution range. Conservationists have implemented a number of recovery plans for threatened turtle populations, including experimental "head-start" (rearing) programs. Head-starting involves the captive rearing of hatchlings for several months to help them avoid high mortality in their first year. After reaching a prescribed age or size the head-started turtles are released back into the wild where they are assumed to survive and grow like wild turtles.

Head-starting programs

Head-started programs have been initiated on an experimental basis for several endangered sea turtle species (Heppell & Crowder, 1996). A program for green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) sea turtle rearing has been on-going for 30 years since 1960 in Florida (Huff, 1989). Similarly, in an attempt to speed up the recovery of declining populations of Kemp's Ridley sea turtle (*Lepidochelys kempii*), U S Fish and Wildlife Service initiated a head-start program in 1978. The hatchlings were raised on a high protein diet, then tagged and released. Later, the expense of the program and apparent lack of nesting by head-started turtles led to controversy over the value of head-starting and permit to egg collection and rearing were denied. In 1999, head-starting of hawksbills were tried by the Old Hegg Turtle Sanctuary at Park Bay on Bequia, West Indies. Questions were raised about this program – "do the advantages of raising public awareness and possibility of increasing the raised sea turtles' population outweigh the potential risk of introducing disease to the wild stocks?"

Almost at the same time, in 1999, a head-starting program for hawksbills was initiated in the Emirate of Abu Dhabi,

United Arab Emirates (UAE). While conservation efforts are underway to protect the nesting beaches in the UAE, rearing of hatchlings for conservation was thought as supplementary to increase the sea turtle population in the wild. This article discusses the head-starting program in the UAE and attempts to evaluate the program as a tool for conservation of sea turtles in general. In the Arabian Gulf, the most common and principal species of concern are the hawksbill turtle (*Eretmochelys imbricata*) and green turtle (*Chelonia mydas*) which are also focus of considerable conservation efforts by the IUCN's Marine Turtle Conservation Program. These two species extensively use UAE waters for foraging and the hawksbill nest in the sandy beaches of several offshore islands of the country. The hawksbill turtle (*Eretmochelys imbricata*) is listed as endangered by the IUCN since 1970 and its status has not improved. Sea turtles are affected by numerous anthropogenic factors such as degradation and loss of nesting habitats, water pollution and impact on hatching success. These threats not withstanding, the mortality of turtles during early stages of their life history is also relatively high. The hawksbill sea turtle rearing and release (head-starting) program at Jarnain Island off the coast of Abu Dhabi, UAE is an attempt at enhancing wild hawksbill turtle populations in the area.

The scope of this experimental program is to:

- to develop methods of rearing hawksbill hatchlings in captivity with minimum mortality, and,
- to undertake rearing and release of a small proportion of wild sea turtle hatchlings with the objective of enhancing sea turtle populations in the wild.

Approach

A rearing unit was established at Jarnain, an island 140 km NW of Abu Dhabi in the Arabian Gulf. The unit is covered by a thick mesh net to protect tanks from direct sunlight and a small proportion of hatchlings from natural nests of the island were collected for rearing. Tanks are in two sizes - small (0.60 m in diameter and 20 in number) and large (4.85 m in diameter and 10 in number) and they are placed in a linear fashion to facilitate easy inflow and out flow of seawater through underground pipes. Hatchlings are fed 2% of the body weight with high protein diets (floating 2mm pallets, 35% protein - TILAPIA 40 CP, ARASCO, Riyadh, KSA). Hawksbills are aggressive in captivity and bite on soft body parts, at times causing serious injuries to conspecifics which are then isolated in nursery tanks until they recover. Once the hatchlings reach a certain age (2, 4, 6 and 12 months) and weight (100 g, 250 g, 400 g and 600 g), they are released, preferably during the late evening at the same beach from where they were collected. A small percentage of hatchlings (5%) were reared for over 1 year (yearlings) and tagged before release.

A total of 2,460 healthy reared hatchlings including 48 tagged yearlings were released to the sea during the last four years and no tag recovery has been reported till date.

Results

A total of 2,460 healthy reared hatchlings including 48 tagged yearlings were released to the sea during the last four years and no tag recovery has been reported till date. Behavior and growth of hatchlings in captivity has been documented and procedures to minimize mortality during the experiment have been developed and standardized. Since the main objective of this experiment was to increase the sea turtle population in the wild, hatchlings (hawksbills) were retained for a maximum period of one year. However most (> 80%) of the hatchlings were released at the end of 6 months.

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Discussion

Most populations of hawksbills are known to be severely depleted and moderate population levels appear to persist around the Torres Straits Islands, northern Australia, in the Red Sea and Gulf of Aden, Palau group and Arabian Gulf islands, Oman, parts of Seychelles, possibly the Maldives and Madagascar. Hawksbill hatchlings are difficult to maintain under captive conditions because they are aggressive and bite each other causing injuries and infections. However, hawksbill is the right species for experimental head-starting as they sexually mature early (8 years) than other species of sea turtles (green sea turtle 25 years). Hence, the result of head-start will be obtained early on. No tag has been recovered till date from the turtles released at Jarnain and there is a plan to satellite tag a few yearlings to understand the post-release migration pattern of reared turtles. At this point we need to look into some vital questions raised by sea turtle biologists and conservationists (Ehrenfeld, 1982). The primary question that is raised most often is *does the possibility of increasing the endangered sea turtles population out-weigh the potential risk of introducing disease to wild stocks?* The second important question is *whether hatchlings raised in captivity have the capacity to become reproductive members of the wild population?*. Many conservationists feel head-starting is not the answer to restoring local population especially when their foraging and nesting habitats are not protected.

The value of captive rearing of sea turtles is a matter disputed between culturists and conservationists (Ross, 1999). Supporters for rearing say that the young hatchlings have a low survival rate in the wild and that it is more effective for conservation to feed and care for the young ones before releasing. On the other hand, researchers from other schools of thought question if such cultivation is a meaningful conservation method for sea turtles. Sufficient data to settle this difference of opinion have not yet been obtained. There have been no reports of turtles laying eggs after being released artificially. Besides, doubt remains as to whether turtles that spend the first months of their lives in captivity will have conditions of their natal beaches adequately imprinted in their adult behavior. Thus, the

opponents assert that it is more important to preserve nesting beaches to ensure the protection of turtles.

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In order to be a successful management tool, head starting must increase population growth significantly. Heppell and Crowder (1996) carried out a stage based matrix model and hypothesized that the head-starting is unlikely to work as a management tool for most long lived turtles for two reasons.

1. First, in a slow maturing species an increase in first year survival is unlikely to prevent population declines that are caused by reductions in the annual survival rates of the adult turtles. This is particularly true in sea turtles, which may take decades to mature and are subject to incidental harvest in the adult and sub adult stages.
2. Second, except in extremely small populations, it is unfeasible to head start enough hatchlings to have an impact on overall survival rate of a cohort.

The Jarnain experiment in the UAE has been a successful program as far as rearing is concerned but until we do not receive tag returns the objective is not achieved. It is difficult to conclude that the reared turtles have survived well in the wild and have become part of the reproductive population in the region. Hunting of sea turtles in the Arabian Gulf does not exist and the ban of drift net fishing has minimized the suffocation related death in turtles. Hence, direct pressure on species is minimal in UAE waters. However, the foraging and nesting habitats of sea turtles in the UAE are under natural and anthropogenic pressure. Survey and monitoring of sea turtle nesting and foraging habitats in UAE waters is underway according to a conservation action plan that is being implemented. If the habitats are protected, with the existing "no-direct-pressure" on species, we should have a very healthy wild population of sea turtles in this region. By releasing head-started hawksbills to the wild in larger numbers, we may create a situation where imbalances in natural resources arise and pressure on critical marine habitats, coral reef and seagrass beds is increased. This kind of natural imbalance may result in various problems pertaining to resource sharing among marine wildlife and habitat. Under this dilemma, results from tag return from the released stocks will provide vital information on head-starting as a conservation tool for hawksbills and other species of sea turtles.

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A population re-enforcement of the African spurred-tortoise in the Ferlo reserve, Sénégal

The African spurred-tortoise (*Geochelone sulcata*, Miller 1779) conservation program was initiated by SOPTOM in 1993. Since 2000, the organisation S.O.S. SULCATA was entrusted to run this program with the help of the Department of Water, Forestry and Game (DEFC) and the Department of National Parks (DPN) of Sénégal as well as local and international scientific advisers. This organisation then established and opened Noflaye "Village des Tortues" (tortoise village) (Mars, 2001) near Dakar to act as a public awareness facility to inform the public about the tortoises of Sénégal.

Distribution

The African spurred-tortoise inhabits the southern Sahara region of Africa and the range crosses the countries of Senegal, Mauritania, Mali, Niger, Chad, Sudan and Ethiopia. At the beginning of the last century, its distribution in the semi-arid parts of central Africa was linked to climatic conditions specific to the Sahel region. Villiers considered in 1958 that the species was still relatively abundant from Mauritania to Ethiopia but the situation is very different today. The few investigations carried out since 1994 show that the African spurred-tortoise is everywhere in decline or has completely disappeared (Lambert, 1996 & Devaux, 2000) and at the present there are only isolated residual pockets. This species is also listed in Appendix II of the CITES Convention.

The African spurred-tortoise is dependent on a specific

habitat described as Sahelo-Sudanian arid savannah (Devaux, 2000). Little is known of the ecology of wild populations of the African spurred-tortoise and in Sénégal, the Ferlo zone probably represents the last sanctuary of the species and the last observations are concentrated in the department of Matam (NE part of the country) an area which is already protected. In 1972, the DEFC intervened by turning the zone into a Reserve of Fauna and it covers 10,000 km^2. It was divided into two entities, 1) the Reserve of Fauna of Northern Ferlo (RFFN), around 4,870 km^2, and, 2) the Reserve of Fauna of Southern Ferlo (RFFS) around 6,000 km^2. The management of the RFFN was entrusted in 1996 to DPN and the RFFS remaining for its part under the supervision of the DEFC In order to plan appropriate conservation measures and to restore populations in the immediate future more research is required on the ecology and threats, and for this reason a large conservation program in the North and South Ferlo Reserves has been initiated.

Our objectives are:

- to constitute a team consisting of Ferlo residents, DEFC, DPN and scientists in the program
- to survey a large area as possible and use GIS to map the burrow locations
- to capture and mark individuals for a telemetric study
- to chart the distribution of human activities in the study area
- to identify precisely the reasons for the population crash

Survey

The zone that was searched during the first six months is 4,600km^2 (42.3 % of both Ferlo reserves) and 2,400 km^2 were explored in the RFFN (49.3 % of its surface) and 2,200 km^2 in the RFFS (36 %). During this survey, 42 wells were recorded spread out along temporary rivers and human populations and livestock is mostly concentrated along these wells. Between these seriously damaged sites, 113 burrows of African spurred-tortoise were recorded and they are all situated on dunes or graveled surfaces. Most of these areas show a strong degree of disturbance due to overgrazing by livestock which is mainly comprised of goats, zebu cattle and sheep. The herbaceous vegetation, mainly made up of graminae, has almost disappeared and only a few trees survive until the coming of the first rains. We observed *Pterocarpus lucen*, which constitutes the dominant species and other species like *Commiphora africana*, *Combretum glutinosum*, *Guiera senegalensis*, *Feretia apodanthera* and *Grewia bicolor*.

With the very low density of tortoises observed, this new program will also be to look at the necessity to start a re-enforcement program after veterinary and genetic screening.

By allowing the settlement of human populations, with the resulting high concentration of wells, has triggered an intensification of desertification. The shepherds take the herds to the bush every day and the vegetation is severely overgrazed for several kilometers around each well. The recorded observations of burrows and tortoises are located between the temporary valleys which are all covered by pastoral activities and high disturbance. Of the 113 inventoried burrows, only 15 (13.3 %) led to the capture of 19 individuals (8 males:9 females:2 juveniles). Ten individuals (5:5) were captured in the RFFN and 9 (3:4:2) in the RFFS. Eight tortoises out of 19 captured show mutilation scars from either burns or machete blows.

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The study carried out between February and June highlighted reduced activity of the tortoises during the dry season. Of the 17 tortoises studied, only 9 moved a substantial distance and two of these displacements were due to burrow destruction. The distances covered were short (100 - 200 m) and made it possible for the tortoises to find another burrow. Traps revealed that these movements are carried out at night when the temperatures are lower. The distribution between males and females on the sites shows that most of the time both sexes live in the vicinity in distinct but nearby burrows. At least 50 burrows (44%) were occupied by another animal species. Of these 50 "active" burrows, 23 were at least visited by one tortoise. The remainder of the burrows (56 %) always remained empty.

The following situations:

- aridity of the climate during the last century: 1901-1930: 409.6 mm, 1931-1960: 341.7 mm & 1961-1985: 262.9 mm (Raynaut, 1997)
- the creation of deep wells accompanied by an increase of villages
- increase of livestock
- intensification of poaching activities
- bush fires

has resulted in overall environmental degradation and reduction in biodiversity. In the face of such problems the targets of both the Northern and Southern Ferlo reserves are, a) restoration, and, b) safeguarding the Sahelien ecosystems.

Therefore, the authorities have two aims:

1. To regulate livestock through a village committee to decide on livestock issues, to fight against poaching, to organize gum arabica harvests, etc.
2. To restore the populations of species which were formerly observed in these ecosystems.

A re-introduction program of two sahelo-Saharan antelopes namely *Oryx dammah* and *Gazella dama* began in January 2003 and involved the release of individuals into a new protected area (6 km^2) with no outside disturbance. The

objective of this area is to regenerate the vegetation cover and to monitor the re-introduced populations and finally to increase the biodiversity of this area. The aim is to restore the vegetation layers thus restoring the vegetation of Ferlo before it was changed by the onset of intensive overgrazing in the past. The joint work of the DNP and the DEFC, helped by IUCN, will hopefully result in a better future for this area as the government of Sénégal wishes to ensure the restoration of its natural ecosystems. The tortoise conservation program is thus legitimate and blessed by the government but is also urgent if we want to avoid the disappearance of other species such as giraffes, ostriches and antelopes. Later this year we hope to formulate assumptions as to the possible causes of decrease in the number of individuals over the years, in order to propose protection measures for this species and its habitat.

Therefore, we have to:

- Study the last wild tortoise populations to find out more about distribution, density and population structure. Also look into other types of disturbances e.g. collecting, destruction of the habitat and food competition with domestic herds.
- Look further into our ecological and behavioral knowledge of the species e.g. activity rhythms, habitat selection and annual home range.
- Continue the sensitization of the local populations to the issue of tortoise conservation.
- Identify favorable areas without tortoises for future experimental releases.

Taking into account the lifespan of the transmitters (approx. 1.5 years) follow-ups will be maintained until 2004. With the end of this study, proposals for conservation will be formulated and a project analysis will be conducted with members of the scientific councils of SOPTOM and S.O.S. SULCATA. Initial protection measures will be discussed with the local communities to encourage ecosystem protection measures. With the very low density of tortoises observed, this new program will also be able to look at the necessity to start a re-enforcement program after veterinary and genetic screening. An experimental release of tortoises from the Noflaye Breeding Centre (all adults are from Sénégal or Mauritania) could be organized with telemetry follow-up of released individuals. This follow-up will make it possible to compare the activity of these tortoises with that of wild individuals.

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