CONSERVATION REFERENCE SERIES NO. 2

BACK TO THE WILD

STUDIES IN WILDLIFE REHABILITATION

Eds: Vivek Menon, N.V.K. Ashraf, Prajna Panda
and Kadambari Mainkar

PRODUCED ON THE OCCASION OF KAZIRANGA CENTENERY 1905-2005

Wildlife Trust of India

IFAW
INTERNATIONAL FUND FOR ANIMAL WELFARE
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A Conservation Reference Compendium
Published by the Wildlife Trust of India
Supported by the International Fund for Animal Welfare

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www.wti.org.in

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The Wildlife Trust of India (WTI) is a non-profit conservation organization committed to initiate and catalyse actions that prevent destruction of India's wildlife and its habitat. In the long run, it aims to achieve, through proactive reforms in policy and management, an atmosphere conducive to conservation. WTI works through building partnerships and alliances and its strengths lie in its willingness to work with innovative conservation techniques like acquiring land for wildlife and rescue and rehabilitation.

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ACKNOWLEDGMENTS

The Wildlife Trust of India (WTI) in partnership with the International Fund for Animal Welfare and the Assam Forest Department has been scientifically rehabilitating displaced wildlife through its wildlife rehabilitation centres, Centre for Wildlife Rehabilitation and Conservation, in Kaziranga, Assam and Centre for Bear Rehabilitation and Conservation in Pakke, Arunachal Pradesh. However wildlife rehabilitation as a discipline is still in its infancy in India. There is a lack of resource material on wildlife rehabilitation and to address this gap in knowledge, WTI decided to bring out a compendium that will facilitate rehabilitation efforts in the field.

Compiling the articles for this publication was a daunting task for all those involved. Bringing together rehabilitation experiences from across the world was not easy. However, the finished product is an enriching synthesis of the experiences of wildlife veterinarians, biologists and hands-on animal rehabilitators.

The list of people we would like to thank is endless. We would like start by thanking all the authors who have contributed the various articles for this compendium. We would like to also thank the several experts who have contributed the messages and the foreword for the compendium. Last, but not the least, we would like to thank IFAW, the Dept. of Environment and Forests, Assam and the Dept. of Environment and Forests, Arunachal Pradesh. Without their partnership and constant support and advice none of this would have been possible. The other institutions we would like to extend our gratitude to are the International Wildlife Rehabilitation Council (IWRC) for they have been our largest information bank, the Central Zoo Authority (CZA) and the Wildlife Institute of India (WII). We also appreciate the efforts of the Wild Rescue team and the entire team at WTI who helped us in putting the compendium together.

Editors

FOREWORD

E.P. Elliston,
President
International Wildlife Rehabilitation Council

The history of wildlife rehabilitation is undoubtedly as long as the history of mankind, for surely need and compassion have always coexisted. However, wildlife rehabilitation as a field has emerged only in the last century as small, scattered groups strove to assist wildlife in need. With incorporation of the International Wildlife Rehabilitation Council (IWRC) in 1972, and other early responses to threatened wildlife individuals and populations, rehabilitation in the Western Hemisphere became an organized, effective tool for conservation. Training seminars and conferences for wildlife rehabilitation are now regular events. Similar efforts in the Eastern Hemisphere saw the emergence of wildlife rehabilitation centers on every continent, and in almost every country. With the advent of the internet, international rehabilitators can easily exchange information.

Today, we are members of a profession with standards, training and a growing body of literature. As our numbers grow, so grows the demand and need for information throughout the world. Never before in the history of our species have other species been so endangered.

Networking, information sharing, research, cooperation with those working to rehabilitate individual animals, and with those undertaking rehabilitation of habitat and whole populations—are efforts that are crucial in the commitment to maintain diversity of species on this planet.

Much has been accomplished since my first visits to India in the 1960s. The professionalism and achievements of the Wildlife Trust of India and its efforts to encourage global cooperation promise increasing benefit to the conservation of wild animals of the subcontinent and the planet.

(Elizabeth P. Elliston)

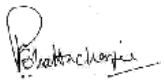
PREFACE

Dr P.C. Bhattacharjee
Trustee, Wildlife Trust of India

Since long, the people of north-east India have been handling injured wild animals and more so during the annual floods. They have often tried to treat a distressed animal and save its life with a piece of heart and partial science, albeit with great difficulty. Even if successful, they were unable to decide what to do next—to release it back to the wild or keep it captive. In most cases, the wild animals ended up as captives. Efforts and success were always partial. The region is blessed with high wildlife diversity and is just the place where science and the heart must amalgamate.

This compendium is an effort in the right direction, a much stronger tool for scientists and conservationists. This document was overdue and a large number of animals could have been saved.

I appreciate the effort from the core of my heart. The success of the compendium on “Wildlife rehabilitation” means a focussed direction to wildlife rehabilitators and a boost to the nascent discipline of wildlife rehabilitation in the field of conservation.



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MESSAGES

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M E S S A G E

It is heartening to see that the Wildlife Trust of India is publishing the much awaited compendium on wildlife rehabilitation under its Conservation Reference Series. Wildlife rehabilitation today is an integral part of long-term strategies for *in-situ* wildlife conservation and management. Conservationists across the world have realized that they need to think beyond the protection of a species in its habitat and ensure that animals that have accidentally strayed from such defined areas are also given equal importance.

Assam is blessed with diverse natural resources. This is much attributed to the rich alluvial deposits from the mighty River Brahmaputra and its tributaries. The resultant flood plain ecosystem supports some of the largest populations of mega-herbivores such as the great Indian one-horned rhinoceros, Asian elephant, swamp deer and wild buffalo. Several other charismatic species such as the Royal Bengal tiger and numerous species of migratory birds are also supported by this ecosystem. National Parks, such as Kaziranga, Orang and Manas are examples of areas that support high densities of such wildlife. However, due to natural calamities like floods, human intervention becomes necessary to prevent major losses to the animal population, some of which are already rare and endangered in the wild.

The Forest department of Assam with the help of the Wildlife Trust of India (WTI) and the International Fund for Animal Welfare (IFAW) has established a rescue and rehabilitation centre near the Kaziranga National Park, especially for animals traumatized by floods and road accidents. Elephant and rhino calves that were inadvertently abandoned by their herds and mothers due to stress or accidents require special care and attention. The centre has not only provided foster care to such juveniles but also ensured that there is minimum human imprinting so as to ensure their successful reintegration back into the wild. There is however, a need to establish more such rehabilitation centers all across the state of Assam. The city of Guwahati is itself facing the acute problem of straying animals, including leopards, that can sometimes lead to man-animal conflict.

I wish the WTI all the very best in their endeavour and congratulate them for this pioneering effort in the field of wildlife rehabilitation. There is a lot to be done, many more technical inputs and research required and centers established and this compendium is one of the ways towards achieving that.

Best wishes.

(Pradyut Bordoloi)
Date: 24th January, 2005

Minister of Environment and Forests
Government of Arunachal Pradesh

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M E S S A G E

Successful and meaningful conservation is a multidimensional effort involving the Government, citizens and NGOs. The successful partnership between the Government of Arunachal Pradesh and the Wildlife Trust of India is an indicator of such an effort.

It has been brought to my notice that the Wildlife Trust of India is working in partnership with the Department of Environment and Forests, Government of Arunachal Pradesh in scientific rehabilitation and release of rescued wildlife through its wildlife rehabilitation centre, Centre for Bear Rehabilitation and Conservation, set up in Pakke Tiger Reserve jointly with the Arunachal Pradesh Forest Department in 2003.

The Wildlife Trust of India have also distributed "anti poaching kits" to the staff of different wildlife divisions and imparted skill enhancement training to them.

I am glad to learn that the Wildlife Trust of India is publishing a publication called "Back to the Wild" which is a compendium on various aspects of wildlife rehabilitation that aims to reach out to conservationists far and wide.

I wish them all success in their endeavours.

(Newlai Tingkhatra)

Shri. M.C. Malakar, IFS
Chief Wildlife Warden
Government of Assam
Rehabari,
Guwahati - 781008.

December 27, 2004

MESSAGE

I am very glad to know that the Wildlife Trust of India is publishing a compendium on wildlife rehabilitation in its publication series called "Conservation Reference Series". This will definitely fill a long waiting gap of wildlife rehabilitation literature in India.

Scientific rehabilitation of rescued wildlife started in Assam when the Wildlife Trust of India and International Fund for Animal Welfare established the Centre for Wildlife Rehabilitation and Conservation (CWRC) at Kaziranga in association with the Assam Forest Department. The success of CWRC, specially during flood periods in Kaziranga, has proved the necessity of such a facility in Assam for rescue and rehabilitation of the wild animals. Now, publishing a compendium on wildlife rehabilitation literature will definitely boost the whole effort for the cause of rescue and rehabilitation, especially in Assam.

I offer my best wishes for the success of the publication.

(M.C. Malakar)

Chief Wildlife Warden, Government of Arunachal Pradesh

Shri. B. S. Sajwan

GOVERNMENT OF ARUNACHAL PRADESH

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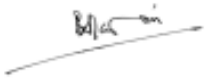
Shri. B. S. Sajwan
Chief Wildlife Warden
Government of Arunachal Pradesh

MESSAGE

The north-eastern region of India is a paradise for wildlife. With 82 % of land area covered with dense forests, numerous turbulent streams, deep gorges, lofty mountains and thousands of species of flora and fauna under a vast canopy of rainforests, Arunachal Pradesh has been an ideal home for wildlife. However, over the years, a significant rise in human activities resulting in man–animal conflict. This has increased the threat to wildlife.

The Department of Environment and Forests has taken a number of initiatives to promote conservation of endangered species, both within the protected areas and outside. One such initiative is a project on "Rehabilitation and Conservation of Himalayan Black Bear" which the Dept. has been implementing in collaboration with the Wildlife Trust of India and towards this end a Center for Bear Rehabilitation and Conservation at Pakke (Seijosa) inside the Pakke Tiger Reserve has already been set up.

It gives me great pleasure to learn that the Wildlife Trust of India is bringing out a compendium on wildlife rehabilitation focussing on their work in Pakke (Seijosa). I wish the publication all success and sincerely hope that it will provide valuble information to all wildlife managers so as to enable them to address conservation issues in a much more effective and scientific way.



(Shri. B. S. Sajwan)

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Director, Wildlife Institute of India

Shri P.R. Sinha

P.R. Sinha
Director
Wildlife Institute of India

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

20th January, 2005

MESSAGE

Wild animals live in natural ecosystems. The forces of nature regulate their life cycle. In a natural ecosystem which is not tampered by human beings they live in harmony within the precincts of their habitats. However, due to expanding human populations, habitats of wild animals are getting despoiled forcing these animals to leave their homes. These homeless animals get into human habitation thereby leading to conflict situations.

Rescuing such animals and rehabilitating them back into the wild require a deep understanding of their behavior, biology and skill in their capture and translocation. It, therefore, requires a multi-disciplinary approach and integration of knowledge from various disciplines. In this context, the publication of a compendium on wildlife rehabilitation by the Wildlife Trust of India is very timely. It would serve the cause of wildlife conservation.

I complement Wildlife Trust of India on their initiative in undertaking this publication and look forward to more publications under their "Conservation Reference Series".

(P.R. Sinha)

Member Secretary
Central Zoo Authority
Shri B.R. Sharma

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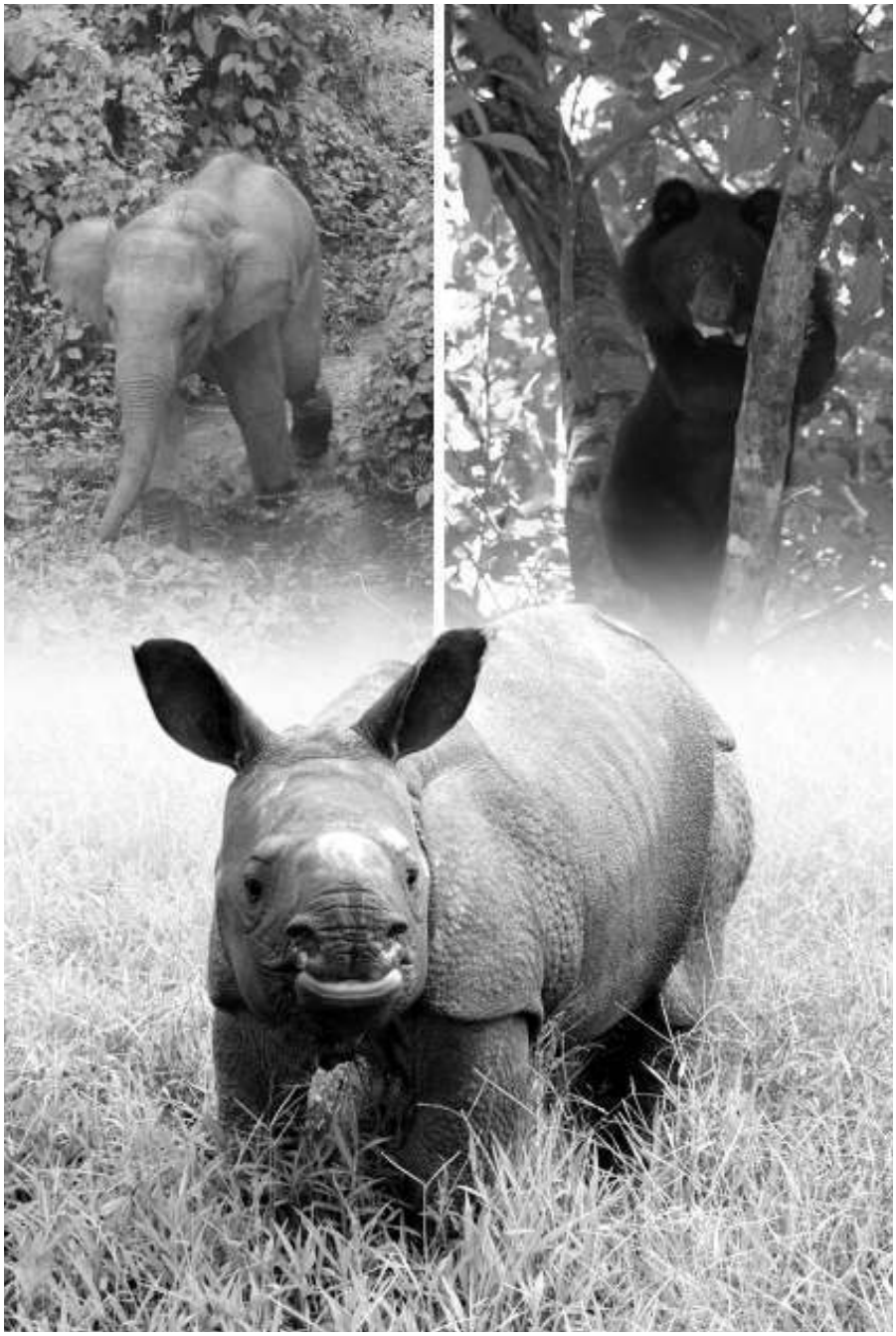
MESSAGE

The scientific approach to wildlife rehabilitation has emerged in recent times in the country as prime wildlife habitats are being reduced day by day due to increased human encroachments displacing animals from their natural home. Wildlife rehabilitation has tremendous importance especially during natural disasters (forest fires, floods, severe weather, earthquakes), accidents and 'natural' outbreaks of disease, causing sick, injured or orphaned animals. Many times young animals are confiscated from poachers who have captured them for the illegal wildlife trade, or from people who have captured them to keep as pets.

The present compendium on wildlife rehabilitation would go a long way in helping wildlife managers to rehabilitate animals scientifically following the guidelines and protocols stipulated by the IUCN for Reintroduction and Health Screening and thereby maximizing the conservation value of the animals without in any way endangering the health, behavioural repertoire, genetic characteristics, or conservation status of wild populations of the species.

(B.R. Sharma)



EDITORIAL

We as conservationists are caught in a paradigm of shift from the past to the present and the future. That is, the shift from traditional prescriptions of leaving wildlife unattended to the present concept of managing wildlife for conservation and the need for an interactive management in the near future to maintain viable populations. With most of our wildlife living in pockets of few individuals with virtually little or no prospect of movement outside, wildlife translocation and rehabilitation will be increasingly employed as management tools to maintain population viability and genetic diversity. For many of these populations, the old model of wildlife `preservation' and even the contemporary prescription of `conservation'– wherein there is a hidden component of `sustainable utilization'– is becoming less convincing and irrelevant to India. Wildlife rehabilitation as a conservation tool and a welfare imperative is a part of a new paradigm in wildlife conservation that is slowly coming into being.

One of the major problems faced by wildlife rehabilitators in India has been the lack of appropriate reference materials on Indian wildlife. All the reference materials available to the Indian wildlife rehabilitator, as of now, have been books, compendiums, workshop proceedings and manuals written for exotic wildlife. Therefore, the need for a reference material that will be a compendium of articles contributed by Indian authors reflecting the Indian scenario has been felt. Since wildlife rehabilitation in India as a scientific discipline has only begun gaining momentum in recent years, it was imperative that contributions be included from experiences of rehabilitators outside India as well who work with species that are taxonomically related to Indian wildlife. What began as a humble exercise in the beginning of 2004 has now ended up in this compendium of original articles on various topics of wildlife rehabilitation.

Kaziranga National Park (KNP), the pride of north-east India and one of the best managed wildlife parks in the country, is celebrating its centenary in 2005. A UNESCO declared world heritage site, the

KNP has come a long way since its inception in 1905. Considering the fact that almost the entire rehabilitation efforts of WTI and IFAW are concentrated in the north-east, it is only appropriate that this Conservation Reference Series in wildlife rehabilitation is brought out during the centenary of KNP, the jewel in the crown of protected areas in north-east India.

The articles in this compendium have been brought under four common heads: Need, Principles, Case studies and Protocols. Being a compendium of contributions from authors across the world working in different conditions and facilities, the reader will see articles of varying appeal and content.

In the section on "Need", there are three contributions of entirely different makeup. Wildlife rehabilitation is not only a developing branch in the field of conservation but also welfare oriented. This point has been taken up for discussion in these three articles, starting with IFAW's perspective on wildlife rehabilitation and the philosophy of wildlife rehabilitation and ending with the one on rehabilitation as an option for wildlife displaced due to man–wildlife conflict.

There are six articles under the section "Principles", all of them in one way or the other dealing with the management of animals under rehabilitation. There are articles focusing on wound management and nursing wildlife orphans. Two articles, one on the management of wildlife for conservation breeding and other on the establishment and management of a rescue centre are entirely based on the experience of establishing two captive centres of repute, both in north-east India. Wildlife rehabilitators will find the remaining two articles on the principles of rehabilitation of elephant, rhino, buffalo and gibbon appropriate and informative.

The section on "Case Studies" contains the maximum number of articles and rightly so. Authors working on different projects have put their findings together to produce a series of 15 information papers. The first two are on primates, the first one on prosimian husbandry and the second one on the rehabilitation of gibbon and siamang in Indonesia. Both these articles are of utmost importance to rehabilitators in north-east India as the slow loris and the hoolock gibbon are two of the most commonly rescued primates. This is followed by another set of twin articles on the rehabilitation of reptiles,

both on star tortoises. The first one carried out in Tamil Nadu is a laudable attempt to rehabilitate confiscated star tortoises with available expertise and the next one a more rigorously scientific method of rehabilitating the same species. There is yet another set of twin articles on the rehabilitation of bears, one on brown bear rehabilitation in Russia and the other on behavioral studies of Himalayan black bears undergoing rehabilitation in the state of Arunachal Pradesh. Globally, bears are one of the most commonly rehabilitated mammalian species and almost all these attempts have been in temperate countries. The rehabilitation attempt in Arunachal Pradesh is the first of its kind in India, after modifying the techniques followed for brown bears in Russia to suit Indian conditions. Perhaps the most important of the three articles, grouped under this category of `bears and pandas', is the paper on the successful release and monitoring of captive bred red pandas in the state of West Bengal.

The very fact that there are six case studies on elephant rehabilitation and husbandry goes to show the importance of this species to rehabilitators across the world. Two articles have appeared in the section on "Principles" making elephants the most commonly dealt species in this compendium. All these six articles but one, are on elephant calves. The first one is a preliminary analysis on the number of calves that get displaced from natal herds every year in India; the authors trace down the reasons for displacement and the outcome of captive raising. Only a fraction (10%) of the dependant calves are immediately reunited with natal herds with human help while the rest either spend their lifetime in captivity or die within two or three months of their rescue. Two articles, one from Coimbatore and the other from Kaziranga, tell us how to attempt reunion after temporary displacement. When such attempts of immediate rehabilitation fail, the next option is to hand raise them in captivity. The two papers on hand-raising of elephants that follow these articles tell us how elephant calves are hand-raised in captivity in India. These articles take us through the experience of two groups of wildlife managers, one working in Kerala for the use of hand raised calves as captive elephants and the other group raising them for eventual release back to the wild. The question often asked is whether captive held elephants can be reintegrated into the wild after rehabilitation. The principles of rehabilitating African elephants

based on the Kenyan experience have already been dealt in the previous section. The question then is if Asian elephants can be returned to the wild. The article from Elephant Transit Home in Sri Lanka describes how rehabilitated elephants have been successfully released and monitored.

Birds are easily the most commonly rehabilitated class of vertebrates in India. Apart from many instances of rehabilitation of birds of prey, there are typical instances of providing emergency relief to chicks of storks and pelicans fallen from nests. Such works become more relevant when endangered species are involved. The article on the rehabilitation of the endangered greater adjutant storks is an ongoing conservation program taken up by different individuals and NGOs in Assam.

The compendium ends with a series of four IUCN guidelines on the translocation of living organisms, placement of confiscated animals and the two protocols on reintroduction, one general and the other on non-human primates. The CZA guidelines on the establishment and running of rescue centres have also been included as it is important for those interested in taking up rescue programs in India.

The authors have put forward their experience, approach and research findings, all of which may not be solutions but provide us with the valuable direction to address the issue of displaced wildlife in the country. This reference material is expected to serve the rehabilitation community for a long time to come. This is only the second publication of WTI under its Conservation Reference Series, the first on wildlife rehabilitation and definitely not the last.

N.V.K. Ashraf
Associate Editor

THE NEED

Wildlife Rehabilitation as a Conservation and Welfare Prerogative

Ian Robinson[1]

Thirty years ago, the rehabilitation of wildlife was largely the domain of dedicated individuals. Often without funding or facilities, and with little knowledge of medicine or biology, these individuals struggled to learn the techniques required to rescue, rehabilitate and return to the wild, sick or injured wildlife casualties. As the skills of rehabilitators improved, the techniques they used became more sophisticated, embracing biological and veterinary science in search of greater success. From these early beginnings has evolved the entire discipline of wildlife rehabilitation. Today, sophisticated specialist rehabilitation facilities employ full-time staff. Both biologists and veterinarians are routinely involved in the rehabilitation process. Rehabilitation centres are now not only run by individuals but also by NGOs, government departments and universities, often as a co-operative venture between these diverse groups.

For many years ignored as an irrelevance by the scientific community, the increased profile of rehabilitation has brought it under the scrutiny of scientists and conservationists. Concerns have been expressed for the welfare of the individual whilst in captivity, and after release, should it fail to re-integrate into the wild population. Concern has also been expressed about the dangers to wild populations. The most commonly perceived hazard is that the released individual will introduce novel diseases encountered in captivity into a susceptible wild population.

However, much has been done to address these fears. Carefully developed protocols for care and release address the issues of the welfare of the animal under rehabilitation, and thorough monitoring of health status during rehabilitation and prior to release

[1]*Emergency Relief Manager, Wildlife Rescue, Rehabilitation and Sanctuaries, IFAW, UK. Email: irobinson@ifaw.org*

protect the populations to which these animals return. Detailed guidelines for the reintroduction of animals have been issued by IUCN, amongst others. These guidelines address the issues, with requirements for detailed pre- and post release monitoring of health and behaviour.

Rehabilitated animals are now seen as a useful scientific resource as well. This is not limited to the classical theories of individual animal welfare or endangered species conservation, although these are still the most important reasons for rehabilitation. For example, casualties taken into rehabilitation are seen as a valuable source of material for the monitoring of the environment, including the presence or prevalence of infectious disease and the accumulation of biotoxins such as pesticide residues. Reeve (2000) produced the following list of research subjects that can benefit from collaborations with wildlife rescue centres:

- Species distribution
- Population genetics
- Anatomical studies
- Reproductive biology
- Seasonal activity
- Obtaining 'normal' physiological values
- Dietary studies
- Veterinary pathology
- Studies of parasites and pathogens

As a generalisation, the commonest species are the most commonly rehabilitated, and the numbers of individuals released are unlikely to affect the dynamics of a healthy non-threatened population. Techniques refined on less threatened populations are often transferable to more endangered species. Without the rehabilitation of the less endangered individuals there would be a lack of practical knowledge and skill, which would take a long time to accumulate if rehabilitators treated exclusively the most endangered species. For example, the rehabilitation of critically endangered Mediterranean monk seals (*Monachus monachus*) benefits from skills refined on more common species. Highly endangered black rhino (*Diceros bicornis*) and Indian one-horned rhino (*Rhinoceros unicornis*) benefit from skills developed with less vulnerable white rhino (*Ceratotherium simum*), and endangered Asian elephants (*Elephas maximus*) benefit from the knowledge of successful rehabilitation of African elephants (*Loxodonta africana*).

Where a population is threatened, either globally or locally, released rehabilitated individuals can have a positive effect on the population. Under these circumstances, rehabilitation is seen to fulfill a valuable conservation purpose. A number of IUCN recovery plans for endangered species contain provisions for the rehabilitation of individual casualties (e.g. African penguins, Mediterranean monk seals). Species of specific importance in India are discussed elsewhere in this compendium. This paper concen-

trates on two examples, which display the value of rehabilitation not only to the welfare of the individual, but to the species as a whole, and how rehabilitation can be a useful tool for welfare, conservation and science. Elsewhere, this compendium also contains evidence that those involved in wildlife welfare and conservation in India and other parts of Asia have recognised these benefits.

An example of an organization applying rehabilitation to welfare and conservation: The International Fund for Animal Welfare (IFAW)

To take for example, the case of IFAW, the organization is committed to high standards of animal welfare at all stages of rehabilitation and actively encourages the projects it supports to develop protocols for rescue, rehabilitation and release. The involvement of scientists and conservationists from all disciplines is encouraged, to try and ensure that animals not only get the best veterinary and nursing care whilst in captivity but that they are returned to the wild in a program that takes into account their behavioural needs and the health and welfare of the other animals in the ecosystem to which they are released. IFAW not only supports rehabilitation through its support of individual rehabilitation establishments, but also actively supports the sharing and dissemination of knowledge and skills, to the benefit of wildlife throughout the world.

IFAW has its origins in seal welfare and was founded in 1969 to campaign against the cruelty of the annual Canadian harp seal hunt. Perhaps uniquely amongst NGOs, IFAW combines campaigns for conservation and welfare with practical 'hands-on' help for animals in crisis and distress. Consideration of seal rehabilitation illustrates many of the principles and practices of rehabilitation. In Europe, the two seal species most commonly rehabilitated (harbour seal, *Phoca vitulina*, and grey seal, *Halichoerus grypus*) are not endangered globally, and the numbers rehabilitated do not make a significant difference to the global population dynamics of the species.

However, locally declining or extinct populations can be helped by the release of rehabilitated seals. When seals in the Dutch Wadden Sea were in decline after years of hunting, attempts were made to supplement the local population by rehabilitation and captive breeding. Reijnders *et al.* (1995) found that rehabilitated seal pups survived after release better than captive bred seals and made a significant contribution to the recovery of the local population. Before the morbillivirus epizootic of 1988, up to 20% of harbour seals in the Dutch Wadden Sea had been released from Dutch rescue centres over the previous 15 years (Harwood and Reijnders, 1988).

The harbour seals of Europe have been struck twice by the Phocine Distemper Virus (PDV). PDV, a morbillivirus, is one of a group of emerging diseases responsible for significant mass mortality events among wildlife in recent years. The North Sea population has been devastated by epizootics of PDV in 1988 when 23,000 seals died, and

again in 2002 when 30,000 seals were lost (Harkonen *et al.*, in press). Rehabilitation centres set up to rescue and treat sick seals also provided much material for research into the epidemiology, pathogenesis and clinical progress of the disease.

But between outbreaks, the rehabilitation of individuals can do more than just reinforce decimated populations. It can be very difficult to monitor the health of animals in the wild. Seals arriving at rehabilitation centres can be a unique window to the health of the population from which they come. It is becoming more common to predict the future population dynamics of species and even whole ecosystems through mathematical modelling, and to base habitat management and protection measures on these predictions. The prediction of the effects of future mass mortality events on the population of harbour seals in European waters depends on reliable data for factors such as infant mortality and morbidity (Harding *et al.*, 2002). Rehabilitated seals could be an invaluable source of information on such factors, and the use of data generated in this way can greatly increase the robustness of the models used to predict population change, and in due course the success of the resultant management plans.

Rehabilitated individuals can also be ambassadors for their species, bringing to public attention the plight of their species in a personalized way that is often the key to successful media campaigns.

Techniques used for the rehabilitation of harbour and grey seals were used in the development of protocols for the rehabilitation of the highly endangered Mediterranean monk seal. With a global population of some 500, widely fragmented into small groups (Reijnders *et al.*, 1997), the survival of every individual counts and the IUCN Population and Habitat Viability Assessment Report (Gonzalez *et al.*) includes recommendations for rehabilitation of sick, injured or orphan individuals. Individuals from both the Mediterranean and Western Atlantic have been rehabilitated. Satellite tagging of released individuals has indicated good survival and adaption back to normal behaviour in the wild. (Androukaki, *pers. com.*, Gonzalez, *pers. com.*)

IFAW continues to support seal rehabilitation throughout the world. IFAW also supports the conservation and rehabilitation of Mediterranean monk seals through the work of the Hellenic Society for the Protection of the Monk Seal (MoM).

Another similar example is IFAW's work with oiled sea birds. As long as we continue to transport oil by sea, and extract oil from under the sea, there will be oilspills. Although we can try to minimize the risks to shipping and mitigate the effects of spills when they occur, we must accept that oilspills will continue to represent a threat to marine wildlife for the foreseeable future. The treatment and rehabilitation of oiled birds can be a controversial subject. Studies based on leg band returns have compared the survival of rehabilitated oiled birds with unoiled birds banded as part of ongoing research, and concluded that oiled birds survived for very short times, and the numbers of birds surviving over one year, post release, was very low (Sharp, 1996;

Wernham *et al.*, 1997).

This led to a rigorous assessment of techniques of oiled bird treatment and rehabilitation. Further studies, especially on the west coast of the USA have produced much more positive results. It appears that rehabilitation technique is critical in achieving post-release survival. However, when good techniques are used, and this must include careful pre-release assessment, good survival post-release can be achieved. Oiled Western gulls (*Larus occidentalis*) released after rehabilitation survived as well as unoiled controls. However, rehabilitated oiled common murres (*Uria aalge*) had a higher mortality than unoiled controls for the first 34 days after release. After this time, survivability was the same in the oiled and unoiled groups (Golightly *et al.*, in press; Newman *et. al.*, in press). Although there are still questions to be answered, in particular on why there are differences in the survivability of different species, and on what the most effective parameters for pre-release assessment are, these results show that when a professional approach is taken, oiled birds can be successfully rehabilitated and released to the wild.

However, there are resounding successes in the field of oiled bird rehabilitation and the most notable is the story of the South African penguin (*Spheniscus demersus*). Although still numerous (world population 150,000 in 2002) this species has a population reduced to 10% of what it was at the beginning of the 20th century. Approximately 80% of this population breeds in two centres off the west coast of South Africa, each within 50 km of a major shipping harbour. The first recorded spill affecting penguins was in 1948, but there has been a dramatic increase in oiled penguins since 1990, mainly due to two large spills, the Apollo Sea in 1994 oiling 10,000 birds, and the Treasure in 2000 oiling 20,000 birds. Techniques in rehabilitation of penguins have improved and now the success rate is remarkable. More than 80% of birds admitted for rehabilitation were released to the wild. Up to 87% of released birds have survived, and at least 60% of these birds have been recorded breeding (Nel and Whittington, 2003).

It is estimated that without the rehabilitation effort the population would be some 19% less than that at present. Depending on the probability of more major spills in the area, the population after 20 years is predicted to be from 17 to 51% lower without a continuing rehabilitation effort. Thus, rehabilitation plays a major role in the survival not only of individual birds, but also of the species as a whole, and is of major conservation significance (Nel and Whittington, 2003). The IFAW Emergency Relief team made a major contribution in the response to both the Apollo Sea and Treasure oil spills and in the latter co-managed the rehabilitation operation together with SANCCOB (The Southern African National Foundation for the Conservation of Coastal Birds). In addition to these oilspills in South Africa, IFAW has responded to oilspills in Europe (the Pallas, the Prestige) the Galapagos Islands (the Jessica), Ecuador, Norway (the Rocknes) and South America.

One factor often omitted when considering the effects of oil on wildlife is what is usually referred to as 'chronic oiling'. Often the results of illegal dumping, there are minor spills every year that cause casualties without there being a major tanker disaster. Although the numbers of birds affected in each incident may be small, the accumulated effect of chronic oiling is huge. In the UK, more oiled birds were admitted to rehabilitation centres each year through chronic oiling than from either of two recent major spills, the Braer and the Sea Empress (pers. obs.). IFAW actively campaigns for improved legislation and enforcement to reduce the incidence of chronic oiling, and has developed an initiative, 'The Penguin Network' to rescue and treat penguins that are predominantly victims of chronic oiling in South America. Additionally, this project will address the need for further data and data collection about the impact of chronic oiling of Magellanic penguins. The collection and identification of oiled feather samples will be pursued to identify the source of the oilings, when possible, but will also go into a data bank of evidence on chronic oiling.

In summary, IFAW believes wildlife rehabilitation can address the wider issues of species conservation as well as the welfare of the individual. Furthermore, we believe that wildlife rehabilitation fulfils an important role by informing and educating the public through stories of individual animals and supporting prevention campaigns that tackle the root causes of wildlife welfare problems. Also, rehabilitation can provide a window into the health of wild populations and be a useful source of data for a wide range of scientific disciplines. Rehabilitation has 'come of age' and is now a scientific discipline in its own right. IFAW is actively involved in the promotion and improvement of wildlife rehabilitation worldwide, and encourages a scientific approach, including the recording, evaluation and publishing of findings and results, and also actively encourages the sharing of information and techniques internationally.

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Kindness, Conservation or Keeping Alive? The Philosophy of Veterinary Treatment and Rehabilitation of Wildlife Casualties

James K. Kirkwood[1]

Introduction

Veterinary medicine has developed largely in response to demands to treat and prevent disease and to prevent the premature (as judged by the owner) death of domesticated animals. It has become very effective in this and, in recent years, there has been a growing interest in many countries in applying this technology for the treatment and rehabilitation of wildlife casualties (e.g. see Cooper & Eley, 1979; Tribe & Brown, 2000; Stocker, 2000; Best *et al.*, 2003). Veterinary science has the potential to contribute greatly to the conservation of species and to the welfare of individual wild animals (Kirkwood, 2000) but, if this potential is to be realised, the use of this technology must be focused carefully. There is a danger that its uncritical application—to save wildlife casualties for rehabilitation back to the wild regardless of the circumstances—may do more harm than good to both welfare of individuals and the conservation of populations.

To be kind? To conserve species? Or simply to keep alive?

The veterinary treatment of domesticated animals has developed in a context in which the patient's survival is, in most cases, felt very strongly—because of emo-

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tional or financial reasons—to be preferable to its death. The farmer wants his lamb to live on to fatten for the market or the pot and his chickens to thrive and lay eggs, and pet owners do not want to lose their beloved companions. But, if we are to apply modern veterinary science to free-living wild populations, we must be very careful to unearth any such biases and to take care not to unwittingly carry them over into wildlife work without examining them critically beforehand. For example, farm and companion animal veterinarians often have reasons such as those mentioned above for eliminating parasites and other infectious agents from the animals they treat. But, with wildlife, if part of the motivation is to help maintain biodiversity, no interventions should be made to tip the balance in favour of either side in a host–parasite relationship without good reason.

As Charles Darwin realised, and made clear to the rest of the world in the 'Origin of the Species' (Darwin, 1859), the mechanism that has resulted in the creation of the diversity of life and the remarkable adaptation of species to their natural environments is the survival of the fittest. Animals, and all other life forms, have the capacity to produce offspring at a rate that, in the absence of any constraints, would result in exponential growth of the population. The other side of the coin of survival of the fittest is that the less-fit (in the evolutionary sense of the word) do not survive to rear viable offspring. Whether casualties occur as a result of lack of food or other resources, or through injury or disease, and regardless of the stage in the lifespan at which they happen, they are an integral part of the process of evolution.

If we are to apply veterinary science for the care of wildlife, the aim cannot rationally be to increase the chances of survival of all wildlife casualties. Food, space and other resources available for animals are finite (e.g. the number of animals that the earth can sustain is ultimately set by the rate of transfer of energy from the sun into green plants—a resource totaling about 150 petagrammes per year (IUCN/UNEP/WWF, 1991). So saving some animals will generally be at the expense of others of the same or different species.

For the reasons outlined above, we should be cautious about intervening in the dynamics of entirely free-living wild populations without good cause (Kirkwood, 2000). If it is not appropriate to attempt to treat and rehabilitate all wildlife casualties, to which, if any, should the application modern veterinary technology be directed? What principles might be used to guide and focus efforts? The following courses of action are consistent with the objectives of conserving biodiversity in the face of anthropogenic challenges and with alleviating harm to the welfare (the quality of life) of individuals:

1. The euthanasia of sick or injured animals, which are unlikely to recover, in order to prevent unnecessary suffering

Editors' note: Euthanasia is to be practiced only when consistent with national

legislation and cultural and religious ethos.

2. The treatment and rehabilitation of sick or injured individuals of endangered species where there is a real chance that the survival of rehabilitated individuals may make a significant contribution to the viability of the population

3. The treatment and rehabilitation of casualties caused by human agency ('to right a wrong') providing that the treatment and rehabilitation do not further adversely affect the animal's welfare by causing or prolonging pain, fear or other forms of suffering

It is important to be clear about whether a casualty is to be treated to alleviate suffering (i.e. for its welfare) or for the benefit of its species (i.e. for conservation), as decisions about what treatments, if any, are justifiable, depend greatly on the motive. A detailed discussion follows.

Key principles in wildlife treatment and rehabilitation

In making decisions about the treatment and rehabilitation of wildlife casualties, two key points—cost/benefit analysis and refining procedures to minimise welfare risks—should be addressed in every case. These are outlined below:

1. Cost/benefit assessment.
First, the benefits of treatment and rehabilitation should be carefully 'weighed' against the welfare costs they impose upon the animal. If efforts to treat and rehabilitate are likely to cause or prolong fear, pain or other forms of discomfort, and there is unlikely to be any significant conservation benefit, then there is little, if any, justification for initiating treatment. If, on the other hand, the survival of the animal is crucial for the future viability of its population or its species, then it may be decided that the conservation benefits outweigh some adverse welfare costs of treatment and rehabilitation. Some of the factors that need to be taken into account and some of the difficulties in making cost/benefit judgements about wildlife treatment and rehabilitation are outlined by Kirkwood & Sainsbury (1996) and Kirkwood (2003).

2. Refining procedures to minimise risks to welfare.
When, on the basis of the cost/benefit assessment, it is decided that aims to treat and rehabilitate are justifiable, the next step is to plan carefully to minimise any possible adverse impacts on the animal's welfare through emphasis on high standards of husbandry and veterinary treatment including the use of analgesics when appropriate.

Treatment and rehabilitation of wildlife casualties for welfare

Where treatment and rehabilitation is undertaken for conservation reasons the threshold for deciding, on the basis of cost/benefit assessment that it is justifiable to proceed is likely to be higher than when treatment and rehabilitation are being undertaken for welfare reasons. This is because, if the aim is to benefit the animal's welfare, then treatment that may cause or prolong fear, pain or other forms of suffering is hard to justify. As suggested by Kirkwood and Best (1998): 'For an animal with little realistic chance of being returned to the wild in a fit state and facing a prolonged period in captivity and possibly stressful handling and treatment, euthanasia at an early stage may be the most humane course of action.'

Treatment and rehabilitation of wildlife casualties for species conservation

For the treatment and rehabilitation of casualties to be directly relevant to species conservation, efforts have to be focused on species for which such efforts will result in a significant contribution to population viability. This is likely to be the case only in (highly) endangered species. Much of the wildlife treatment and rehabilitation that has been undertaken around the world to date has involved animals of species that are not threatened or of species whose viability is unlikely to be significantly affected by rehabilitated animals (Tribe and Brown, 2000; Kirkwood, 2003). However, it may be that it could have a greater role in species conservation in the future.

Dealing with wildlife casualties, providing that accurate diagnoses are made and that full records are kept, also offers the opportunity for the development of an important role in detecting changes in the prevalence of, or novel, anthropogenic and other threats to the health and welfare of individuals and the viability of wild populations.

Concluding comments

The struggle for existence that Darwin referred to as the 'war of nature' has always, since life began over four billion years ago, led to casualties on a vast scale. Only in the last few decades has the possibility emerged for interventions by one species to cure the diseases or injuries of others. This development raises new dilemmas: under what circumstances is it right to intervene? And which types of problems should be tackled? These considerations are very important since they are relevant to decisions about the handling of wildlife casualties at every stage of the process (Kirkwood, 2003). It is suggested here that respect for life can be best served by adopting an approach to wildlife casualties that is guided rigorously by concern for species conservation and for the welfare of individuals rather than by aiming simply to save lives.

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Problems and Prospects of Rehabilitating Wildlife Displaced due to Man–Wildlife Conflict and the Wildlife Trade in India

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Introduction

Fragmentation, degradation, and destruction of India's wildlife habitats have reduced the living space for wild animals. Natural calamities like forest fires, floods and cyclones have further compounded their problems, hindering their movement to safer habitats. The result of such man-made pressures and natural calamities is animals getting displaced from their habitats, necessitating human intervention. Many of them end up in captivity under human care, often spending the rest of their lives in zoos or ill-equipped lifetime care centres. Poaching for illegal trade in live animals also contributes to displacement of wildlife.

Guidelines exist for the placement of such displaced and confiscated animals (IUCN, 2002). There are only three options that these guidelines recommend: `Release to the wild', `Lifetime care' or `Euthanasia'. Wildlife ethics and laws in India are such that the option of euthanasia in even a sick animal is impracticable. That limits the

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options to either `Lifetime care' or `Release to the wild'. While lifetime care has been provided to many displaced and confiscated animals, rehabilitation as an option has not yet been given its due importance. This paper describes the issue of wildlife displacement in India arising due to man–wildlife conflict and the illegal trade in wildlife, the possible options for the placement of different species, and the problems and prospects of taking up rehabilitation as a possible mitigation strategy.

Wildlife rehabilitation in India

India has a wildlife conservation and animal welfare history replete with many instances of displaced or injured animals being rehabilitated and released back to the wild. State forest departments have been engaged in treating wild mammals and releasing them back to the wild as part of their wildlife management program. Individual animal welfare groups have also practiced rescue and release programmes to such an extent that rehabilitation of individual animals is primarily considered an animal welfare issue in India. However, as a profession, wildlife rehabilitation is still in its infancy (Holcomb, 1995). The role of the Wild Rescue program of the Wildlife Trust of India (WTI) is not only to partake in wildlife rehabilitation operations but to also make wildlife rehabilitation an important discipline in the field of wildlife conservation in India. This may be a daunting task, since even in developed countries wildlife rescue is still undertaken mostly at an individual and local level (Tribe and Brown, 2002; Kirkwood, 2003).

Wildlife rehabilitation is no longer popular in developed countries alone, and is more common in developing countries as well (Karesh, 1995; Agoramoorthy, 1998). Keeping with this trend, in recent years, there is an upsurge in the incidents of rehabilition activities across the country. While a few have managed to establish rescue centres for carrying out the work, others continue to function as individuals and organizations working with makeshift facilities. In India, organised wildlife rehabilitation activities are undertaken across the country with some notable examples from the northeastern, western and southern regions. In the last decade there has also been a proliferation of government rescue centres to hold confiscated animals like lions, sloth bears and other wild animals.

Currently, most rescue centers across India are actually lifetime care facilities. “The Central Zoo Authority (CZA), the Central Government regulatory body for zoos and rescue centres, received 47 applications for the recognition of their centres, of which about 17 are involved in rehabilitation and release operations” (Brij Gupta, *pers. com.*). To create any meaningful impact to conservation, rehabilitation centres have to be established in and around key protected areas. The distribution of these rehabilitation centres could also use the bio-geographic regions of India as categorized by Rodgers and Panwar (1988) as a guideline for their placement. Because of high incidences of poaching and calamities like floods, north-east India probably has the maximum potential for rescue operations. Three centres have been established in

this zone, two in the Brahmaputra valley and the other in the foothills of the Eastern Himalayas. The Gujarat Forest Department has an ongoing rescue and translocation program for Asiatic lions in Gir National Park. The Orissa coast is another important area along the East Coast that has tremendous potential for rehabilitation possibilities. However, there are important gaps in a country-wide coverage as most of the work is not planned or co-ordinated centrally. For example, there is no rescue centre of mention in the Western Ghats, Shivaliks, Gangetic plains, Central Highlands, Chota Nagpur, Western and Central Himalayas, to name a few.

Some examples of wildlife that need rehabilitation in India

1. Animals confiscated from the trade or performing animals

Confiscated animals are often permanently displaced animals that cannot be released because of permanent behavioural impairments or due to the possibilities of having acquired infectious diseases when they were in captivity. However, in some cases, like that of the star tortoise (see Thirumurugan *et al.* and Choudhury and Rao in this compendium), rehabilitation is a distinct possibility. Sometimes animals confiscated abroad will have to be repatriated to the country of origin. In 2002, 1,830 star tortoises (*Geochelone elegans*), confiscated in Singapore, were repatriated to India in August 2002 for possible rehabilitation and release into the wild. They were kept in captivity at Kamala Nehru Zoological Garden, Hyderabad and released into the wild. In 2003, two more such confiscations of 600 and 495 individuals of the same species were repatriated from Kuala Lumpur and Singapore to Kamala Nehru Zoological Garden, Hyderabad and Arignar Anna Zoological Park, Chennai respectively. Recently in November 2004, 650 more star tortoises were confiscated before they were taken to the airport in Chennai for smuggling out of the country.

Star tortoises provide us the rare opportunity of implementing the IUCN guidelines on placement of confiscated animals. Once their genetic identity is established to determine the subspecies they belong, healthy individuals can be returned to the wild. Though repatriated start tortoises have been released in the past (see article by Thirumurugan *et al.* in this compendium), it was only in 2003 that the rehabilitation exercise was carried out with all the protocols in place (see Choudhury and Rao in this compendium).

A major problem being addressed in India today is the placement of sloth bears (*Melursus ursinus*) confiscated from Kalandars, who keep them as `dancing' bears. Like many species of wildlife held by specific communities, both the animals and the owners have to be provided with alternative options. Unlike in the case of Asiatic black bears (*Ursus thibetanus*) in north-east India, confiscated sloth bears are often adults with many behavioral and physical disadvantages demanding lifetime care in rescue centres. Very few bear cubs with rehabilitation potential are likely to be brought to captivity. Though lifetime care centres for sloth bears have been established in Bangalore and Agra, these are inadequate considering the fact that there

are more dancing bears outside to be confiscated and placed in captivity.

With the recently amended Wildlife (Protection) Act prohibiting the sale of elephants, many elephant owners are beginning to feel the 'burden' of something that they owned, cared and traded freely in the past. Many of them now demand that the government take over the elephants after paying them the compensation. This is unlikely to happen. Captive elephants, especially those under private ownerships, are often ill treated and kept tethered with no opportunity for social interaction amongst conspecifics. If confiscation is ever done then the right option appears to be lifetime sanctuaries where elephants have access to free-ranging areas.

2. Displaced young animals

Some of the animals that end up in captivity, such as elephant calves, bear and leopard cubs, etc. that are permanently displaced due to becoming orphans or straying or certain other circumstances, may have the potential of being returned to the wild after hand-raising.

During the last four years for example, from Jan 2001 to Nov 2004, 73 wild elephant calves found abandoned in the forests and villages were brought to captivity for hand-raising, (see Menon *et al*. in tis compendium). Unlike leopards and black bears, elephants find a place for captive use as there is still some demand for employing captive elephants in patrolling and tourism. Park managers are usually accustomed to "Rescue, Rear and Train" these elephant calves for department use (Kumar, 2002) and rarely make attempts made to manage elephants in social groups for eventual reintegration into the wild. With more and more elephant calves being displaced and brought to captivity across the country, they invariably end up in forest department elephant camps for hand rearing. The process of rehabilitation and release of hand-raised animals, especially of elephant calves can be a lengthy exercise. The comparative behaviour of captive and wild elephants has to be understood before reintroduction programs can be undertaken on a large scale (Sukumar, 2003). There is no dearth of information on the ecology of this social animal in India (Sukumar, 1989; Easa, 1989; Sivaganesan, 1991; Desai, 1995) for us to understand its biology, a prerequisite for any successful rehabilitation program. In Africa, elephants calves have been rehabilitated and released at the David Sheldrick's Wildlife Trust in Kenya (Sheldrick, 1990) and in Asia, elephants have been released to the forests in Doi Phameung Wildlife Sanctuary in Thailand (Sukumar, 2003) and in Udawalawe National Park Sri Lanka (Jayawardane *et al.* 2002; see also Jayawardane in this compendium).

In India, apart from stray incidents of captive elephants `escaping' into the wild, no systematic effort has been done to reintegrate elephants into the wild herds. For the first time in India, Wildlife Trust of India and IFAW (International Fund for Animal Welfare) have taken up the initiative of reintegrating displaced elephant calves into wild herds in Assam. The project is still in its initial stage to comment here on its success.

The other species that has tremendous potential for rehabilitation are bears. Adult black bears (*Ursus thibetanus*) are hunted and young cubs are either handed over to the zoo or confiscated from villagers. In Arunachal Pradesh alone, four bear cubs were confiscated in the year 2001-2002, adding to the already existing nine individuals in Itanagar zoo. Seven more bear cubs were received at the Centre for Bear Rehabilitation and Conservation (CBRC) in Pakke Wildlife Sanctuary, Arunachal Pradesh. The first set of rehabilitated bears will be released in early 2005. Unlike elephants and carnivores like leopards, rehabilitation of an omnivorous species like bear is a much more distinct possibility. Many species of bears have been rehabilitated back to the wild (Alt and Beecham, 1984; Wasserman and Clumpner, 1995) but all these have happened in temperate countries. When compared to the number studies on Asiatic black bear ecology in the temperate regions of its distribution range (Reid *et al.* 1991; Manjrekar, 1989; Saberwal, 1989; Huygens *et al.* 2001), studies carried out in its tropical or subtropical distribution range are few (Hwang *et al.* 2002).

Traditionally rehabilitated bears have been either soft released or hard released. Like in the case of elephant calves, there is a concern that rehabilitated bears will not survive or may prove to be a threat to people living in adjoining villages. But, published data on rehabilitation of bears suggest that only few hand-reared bears engaged in nuisance behaviour once independent in wild (Stringham *et al.*, 2003).

3. Animals displaced due to conflict

Of all the species of wildlife displaced due to man–wildlife conflict, leopards and elephants are the important species that need discussion. For two reasons, man–leopard conflict is more severe than man–elephant conflict. Firstly, the leopard has a very wide distribution range unlike the elephant and hardly any part of the country can claim to be free of man–leopard conflict. Secondly, leopards being more adaptable, they can even survive in marginal habitats and man-made environs like sugarcane fields. Due to lack of other realistic options, the most common practice followed to 'mitigate' the problem is to trap and translocate the leopard to distant places away from human habitations. However, this does not seem to solve the problem but ends up in creating new conflict at the site of translocation (Athreya *et al.* 2004). Besides adult leopards, a high proportion of leopard cubs also get displaced due to conflict. The numbers of cubs landing in captivity for hand-raising will probably be more than the number of elephant calves that end up in captivity. Considering the fact that leopard cubs are easier to hand-raise than elephant calves, a large proportion of them must be surviving to adulthood.

Very few feasible options are available for the placement of trapped problem leopards and hand-raised orphans. Since the elimination of conflict leopards by euthanasia is not a practical solution in India lifetime care has been suggested as the permanent solution to the captured leopards. Rehabilitation of carnivores, especially large cats like leopards that lead a solitary and territorial existence, is perhaps more

challenging than elephants. There is only a solitary case of successful rehabilitation of a leopard carried out in Bandipur Tiger Reserve in Karnataka where a female leopard after release has even raised a litter (Arun Venkatraman, *pers. com*.). However, such cases of carnivore rehabilitation seem to be very rare and thus lifetime care facilities appear to be the only permanent solution. Zoos are in no position to take leopards as they are already overburdened. Leopards being territorial and solitary, the expenses of keeping them in captivity would be high as their needs demand largely individual enclosures for adult leopards. With the CZA norm specifying a living space of not less than 500 sq.m. per leopard or 560 sq.m. for two animals, the cost of establishing a rescue centre for holding 20 to 25 animals will be phenomenal. As far as the recurring cost is concerned, feeding alone would cost Rs. 7,000 to 10,000 per leopard per month. With all these challenges, the idea of establishing and running rescue centres for leopards in different conflict zones will be a great challenge.

Challenges faced in wildlife rehabilitation in India

1. The definition of rehabilitation in the context of rehabilitation and lifetime care centres

Release of rehabilitated species belonging to Schedule I and Schedule II of the Wildlife (Protection) Act, 1972 requires the permission of the Central government (Central Zoo Authority). The permissions are given only after protocols are in place and the facility from which such releases are to take place is inspected.

The CZA regulations under the Wildlife (Protection) Act, 1972 are being amended to include a set of minimum standards for the establishment of rescue centres (see CZA guidelines in this compendium). Even in developed countries like UK that have rehabilitation councils and associations, there is no legislation that sets standards or regulates the running of wildlife treatment and rehabilitation centres (Kirkwood, 2003).

The inclusion of rescue centres under the mandate of CZA is a positive development for the field of wildlife rehabilitation in India. It is also encouraging that the government of India is permitting non-governmental organizations and such other agencies to participate, develop and manage such rehabilitation centers in India. CZA, along with state governments in India have also taken steps for the establishment of rescue or lifetime care centers to provide independent sanctuaries for confiscated animals and to prevent overcrowding of rescued animals in zoos (CZA, 2001). But, such lifetime care facilities are not rehabilitation centres since wildlife rehabilitation means putting the animal back to its natural habitat.

As of now, the CZA guidelines employ the phrase `rescue centre' which can mean either a rehabilitation or a lifetime care facility. The definition of a rescue centre, as per CZA guidelines, is an establishment for the care of animals specified in the

schedules of the Wildlife Protection Act and not open for exhibition to the public (see CZA guidelines in this compendium). Since the word `rehabilitation' has been frequently and often loosely employed to even species held in a lifetime care facility, there is an urgent need to differentiate centres that provide lifetime care from centres that hold displaced wildlife for rehabilitation to the wild. Rehabilitation by definition could only mean putting back displaced individuals after enabling them to live an active life in the wild. Wildlife rehabilitation, as defined by National Wildlife Rehabilitation's Association, USA, means “treatment and temporary care of injured, diseased, and displaced indigenous animals, and the subsequent release of healthy animals to appropriate habitats in the wild” (Miller, 2000).

The CZA standards specify that animals shall be provided food inside the feeding or retiring cubicle. The concept of having a feeding cubicle or night shelters do not hold true for most species of mammals held in a rehabilitation centre. Moreover, animals under rehabilitation are fed randomly in unspecified locations and cannot be conditioned to feeding in a night shelter or retiring cubicle so typical of a zoo or any other lifetime care facility. The minimum standards will be irrelevant in a rehabilitation centre where enclosures are built to hold temporarily displaced animals and when animals under long-term rehabilitation are moved to the field for *in-situ* acclimatization as part of any soft release program. There the question of night shelter and feeding in retiring cubicle does not arise. Similarly, the ruling that population control measures should be employed in a rescue centre can be applicable to only a lifetime care facility.

Therefore there is an urgent need to revise the standards and guidelines and issue specific ones for species under rehabilitation.

2. Problem of non-releasable animals

In any rehabilitation centre, there is bound to be some percentage of animals that cannot be returned to the wild due to disease, physical or behavioural disadvantages, or lack of appropriate release sites. Lifetime care centres are the only option in India as euthanasia of wildlife is still not considered an accepted practice. Euthanasia is a necessary part of wildlife rehabilitation (White, 1993; Kirkwood, in this compendium) and is often the only option for rescued animals that do not have rehabilitation potential and or placement options. Animal welfare standards get compromised when rescue centres become flooded with animals. The only acceptable option as of now appears to be creation of more lifetime care centres.

3. Availability of disease diagnostic support

Veterinarians have a significant role to play in the rescue and rehabilitation of wildlife, and specifically during release of such animals into the wild. In earlier times, many wildlife restocking and translocation projects have been undertaken with complete lack of awareness or little regard for disease risks (Kirkwood and Sainsbury, 1995). The principal role of a veterinarian in wildlife rehabilitation is to provide emer-

gency medical care and conduct disease investigation procedures. Veterinarians have also contributed significantly through published literature; especially on general principles on wildlife rehabilitation (see Williams, 1990; Porter, 1992; Karesh, 1995; Miller, 2000).

General quarantine and health-screening protocols for various taxa are available now (Woodford, M.H. 2001). Veterinarians can adapt these protocols and develop it to suit native species and local conditions. In general, confiscated individuals are subjected to rigorous disease investigation operations, while temporarily displaced individuals may only need emergency medical attention during the stabilization period before release. Of all the mammalian orders, non-human primates are subjected to the maximum number of rigorous disease screening protocols because of their affinity to humans (IUCN, 2003). However, primates in general are not subjected to the kind of screening procedures demanded of them before undertaking any reintroduction or restocking program. These investigations cannot be performed in the standard veterinary disease investigation laboratories in India as they do not have the expertise. The only option is to tie up with human disease diagnostic facilities, but valuable time is spent on identifying these laboratories and often rehabilitators compromise with locally available diagnostic support.

4. Availability of suitable release sites

Wildlife displacement happens where there is man–wildlife conflict. The irony in such cases is the availability of more suitable release sites for placing rehabilitated animals. Release is not possible if there is already prevalent local apathy towards wildlife, especially towards the species in question. Captured 'problem' leopards and lions are rarely released in the same vicinity for fear of inviting the wrath of local residents. However when released elsewhere, these animals have been shown to create additional conflict at the site of release (Athreya *et al.,* 2004). The prospects of finding suitable release sites are bright in the case of black bears and confiscated species like star tortoises as large tracts of intact habitats exist. Releasing rehabilitated leopards into already established leopard territories can lead to intra-specific conflict, while reintegration of elephants under rehabilitation into wild herds, if not properly done, can lead to man–elephant conflict due to crop raiding.

Conclusion

In the coming years, man–wildlife conflict will only escalate. The concept of rescue centres should shift from the prevailing notion of lifetime care facilities to also include wildlife rehabilitation centres. Wildlife rehabilitation as a discipline can get its due recognition if rehabilitation programs can take up displaced wildlife. Opportunity exists for certain species like bears and star tortoises, but for the rest, only research can establish their feasibility. For most confiscated adult animals, lifetime care in rescue centres and sanctuaries is the only possibility. The coming years will be a challenge to meet the demand of increasing number of wildlife displacements and for this

the recognition of wildlife rehabilitation as a crucial conservation and welfare tool is critical.

Acknowledgments

We take this opportunity to highlight the role of the International Fund for Animal Welfare (IFAW) in making wildlife rehabilitation as a discipline a realistic possibility in India. We acknowledge the contribution of our regional partners, the forest departments of Assam and Arunachal Pradesh and Uttaranchal without whose help the rehabilitation centres and mobile rescue units would not have been established. We also acknowledge the support or other organisation namely the World Society for the Protection of Animals (WSPA), Animal Welfare Division, Government of India and the British High Commission in India.

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THE PRINCIPLES

The Principles of Care and Rehabilitation of Orphaned Wild Mammals

Karen Trendler[1]

Introduction

Hand-raising a wildlife orphan is one of the most challenging and specialised aspects of wildlife rehabilitation. It requires commitment and needs to be approached ethically and responsibly, taking into account the longer-term implications and special needs of young animals. Hand-raised wild animals can become imprinted and develop behavioural problems if not handled correctly. Young and neo-natal animals undergo very rapid development and growth; correct handling, nutrition and facilities are critically important.

Four kinds of wildlife 'orphans'

Orphans can be broadly divided into four categories:

1. Animals that have been rejected or are unable to cope due to genetic problems. Such animals have a low chance of survival and ethical questions exist about hand-raising and rehabilitating such 'genetically compromised' animals. Humane euthanasia would be the most ethical option in this case.

2. Animals that have been removed intentionally (and often illegally) for live wildlife trade (pet keeping). These 'orphans' are usually compromised by inadequate nutrition and husbandry, poor disease control, taming and humanising, or may have been injured during capture and handling.

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Chances of survival of such animals are dependant on circumstances and the individual.

3. 'Orphans' that are injured, ill or weakened but not genetically deficient, or have been compromised by human interference, weather, good 'intentioned' rescues. With good handling these animals have a good chance of survival and release.

4. A genuine orphan where the parent has been killed, or injured and is unable to care for the orphan. Many of these have temporary setbacks, but again with suitable handling, have a good chance of full release.

Neonatal characteristics

Newborn or young animals differ from an adult of the same species in a number of ways. The blood–brain barrier is poorly developed and the neonate is more susceptible to toxins and infectious agents. Due to the surface to body ratio, neonates are more susceptible to changes in environmental temperature changes. Thermoregulation is poorly developed and thus the neonate needs to be monitored carefully to prevent overheating or chilling. Artificial heat should be provided as neonates are unable to generate heat. Foetal haemoglobin in neonates is different to adults. Kidney, liver function and enzyme system function are poorly developed: pharmacokinetic parameters are different and thus choice of drugs needs to be specific for neonatal requirements. Neonates do not initially develop a fever in response to infection, ironically this can change rapidly and there is the danger that fever can climb exceptionally high resulting in febrile convulsions. The gut wall is more permeable than in adults and toxins from gastro-intestinal tract infection seep through and lead to systemic toxaemia or generalised infection. Body water constitutes a higher percentage of body weight in neonates.

Colostrum

Colostrum is the first milk produced by the dam. It is high in proteins, maternal antibodies and active phagocytes. Neonates that do not receive colostrum are immune-compromised and at risk. The gut wall is permeable to the large protein molecules for only a limited period. Colostrum is doubly important in ungulates, marsupials and mink as the sole source of passive immune transfer is through colostrum——there is no transfer of immunoglobins in the uterus. Canids, felids and rodents acquire maternal immunoglobins both *in-utero* and after birth, from colostrum. Primates and lagomorphs receive maternal immunoglobins *in-utero* but get a vital boost from colostral proteins. Whilst the immunoglobulin transfer can only occur while the gastro-intestinal tract wall is permeable, the colostrum still provides protection against gastro-intestinal infections and the protein gives an additional boost. Orphans that have not received colostrum need extra special care in terms of hygiene and han-

dling. Serum from the mother can be injected or given orally whilst the gut is still permeable. Bovine colostrum is biologically transferable to other mammals, and can be frozen. Bovine colostrum can occasionally cause allergic reactions in other species.

Stabilizing the orphan

A newly arrived orphan should be stabilised first. Do not feed a chilled or dehydrated orphan. Warm it gently with an artificial heat source and offer an electrolyte and glucose solution. If hypoglycaemia is suspected, glucose powder or syrup can be rubbed onto the membranes of the mouth. In severe cases, and with experienced veterinary, and advanced rehabilitation assistance, fluids can be given intra-peritoneal, but this should only be a last resort due to the risks of infection, injury and stress. Experienced rehabilitators may also be able to gastric-tube a weak, or 'difficult to feed' orphan. (There are a number of risks involved with gastric tubing a neonate and this should only be done by an experienced person, with the correct techniques, tubes and precautions!)

The wildlife rescue and rehabilitation adage of 'the least invasive technique first' applies especially to wildlife orphans.

Umbilicus

This is a source of infection, which travels directly into the blood stream. The umbilicus should be dabbed (not rubbed) with an iodine or betadine solution and kept clean and dry. Do not handle a wet, inflamed or 'open' umbilicus except with 'sterile' hands or gloves.

Hygiene

Hygiene is critical in hand-raising. Young animals have undeveloped immune systems and in a rehabilitation situation, are further compromised. Husbandry and handling must be strictly controlled and managed in terms of hygiene and disease control. Facilities and equipment should be sterilised between cases. All bottles and teats should be boiled or steam-sterilised. Candidal overgrowth and irritation of the gastric tract can occur with chlorine-based sterilising fluids and steam sterilisation has proved to be more effective. Towels and blankets should be kept separate and washed at high temperatures or sterilised with nappy sterilising preparations. Keep separate towels for orphans and sick animals; it is further advisable to keep separate towels and blankets for carnivores and herbivores.

Handling

The neonate is delicate and can be easily injured. Handling must be gentle and by

experienced people only–do not allow children and visitors to handle or feed neonates. It is advisable to utilise a single keeper or handler with a back-up person. The advantages of this is that the animal associates only with these specific handlers and excessive taming is prevented. By having consistent handling and feeding, any changes or problems can be picked up easily; the orphan eats better and is more secure and with better weight gain. No fighting games or teasing should be allowed during hand-raising–this could develop into behavioural problems. Feeding and handling should be carried out in a quiet undisturbed area.

Comfort, security and appropriate 'mothering'

Neonates and young animals respond to and need comfort and physical contact appropriate for that species. Use of soft towels or rolled up blankets can increase comfort, security and hand-raising success.

Milk formulation and feeding

Diet is the biggest challenge in hand-raising and is critical, as this is the rapid growth and development phase. The milk-replacement formula should be as close as possible to the natural milk composition (Table 1). Excesses of sugars and fats cause osmotic diarrhoea. Lactose is a problem when using cow's milk as a replacer. When lactase is absent, for example in seal pups, osmotic diarrhoea occurs due to high levels of undigested sugars. There is also a danger of the build up of galactose and cataracts can develop. Household sugar should not be used. Too much protein causes bacterial overgrowth and kidney problems. Fat globule size should be considered in selecting milk formulations.

Neonates are unable to regulate intake of milk and therefore the volume and frequency of milk need to be carefully monitored and calculated. The general rule of thumb is 15% of the body weight over a 24 hour period but this varies with the species and condition of orphan.

Milk must be warmed to blood or body temperature as cold milk chills the orphan and can cause cramps. Small amounts and volumes should be fed frequently. Prolonged periods without milk will weaken the animal and increase the risk of bacterial overgrowth. Carnivores are prone to *E. Coli* overgrowth when the gut remains empty for prolonged periods. The size of the teat, of the teat's hole and shape are important and need to be species specific. Probiotics should be used wherever possible but never in excess.

Vitamin and mineral supplementation

Supplementation should be handled with extreme care. Too much is as bad as too little. This too must be species specific and given only when a deficiency or require-

ment has been confirmed.

Ano-genital stimulation

This is necessary in many species up to about three weeks of age. The muscles and control of the gastric tract are relatively undeveloped in many neonates. Stimulation of the lower abdomen and ano-genital area with a wet, warm cloth after every feed is essential to encourage urination and defecation. Failure to stimulate can result in constipation, bladder problems, uraemia, toxaemia and megacolon. Ano-genital stimulation is especially important in weakened animals or animals with calcium deficiencies. The ano-genital area needs to be kept clean and a barrier cream applied to prevent urine burn.

Exercise, sunlight and play

Young orphans need time and a secure place to exercise and get sunlight. Inadequate exposure to sunlight results in rickets. Exercise and play are necessary for good muscle development, co-ordination, gastro-intestinal tract functioning, temperature regulation and learning. Play and exercise should not be forced but should be encouraged by having suitable outdoor facilities and stimulation of natural behaviours and exploration.

Vaccinations

This is a controversial aspect in hand-raising baby animals and needs to be very carefully considered with wide consultation. Vaccinations should be specific for species and circumstances. Live vaccines should be used with extreme care in wild species that are usually vaccine naive and can die from use of live-killed vaccine.

De-worming

Only paediatric anthelminthics and parasiticides should be used for de-worming baby animals. These should be used with extreme care. Doses should be divided and spread over a five-day period for weakened heavily parasitised animals as a sudden die-off of parasites can cause toxaemia.

Weaning

A baby animal should never be weaned too early. Milk is an ideal source of protein and calcium. Early weaning can compromise growth and development. Bottle-feeding should not be extended beyond the time that an animal would normally suckle in the wild. Extended bottle-feeding will result in humanised animals. Weaning is the time that the human foster mother should start withdrawing and allowing the animal to 'wild' up. Natural foods should be offered from an early age. Many ruminants and

ungulates will chew roughage from as early as the second day—–some are born with teeth and this helps to develop rumen function. Carnivores start taking small amounts of meat from the parent from a young age, e.g. a cheetah will start taking meat as early as three weeks; wild dog pups will solicit regurgitated meat.

Ruminants need to have access to roughage from as early as day two in order to facilitate rumen development. Many ungulates are born with teeth and naturally start nibbling on grass and leaves within a day or two of birth. Milk temperature and consistency are very important in bottle-feeding ruminants–milk that is too hot, cold, acidic or thick results in the oesophageal groove failing to close and milk goes into the rumen and ferments. Care needs to be taken with tubing ruminants for the same reason.

Socialising

Orphans should be socialised with others of the same or similar species. This helps to develop social skills and reduces taming.

Aspiration pneumonia

Aspiration pneumonia is one of the most common causes of mortality in hand-raised neonates. This is due to foreign substances, usually milk in the lungs. Every precaution needs to be taken to prevent milk going into the lungs. Correct teat and teat hole size, careful, consistent and gentle handling, correct feeding position, correct milk temperature and avoiding overfeeding or force feeding can help to prevent aspiration pneumonia. If one suspects that milk has gone into the lungs e.g. if the orphan sneezes up milk or coughs following a feed, preventive treatment should be given with antibiotics, anti-inflammatory and nebulisation immediately.

Monitoring and record keeping

Careful monitoring and record keeping contributes to successful hand-raising with regular recording of weights, respiration, habits etc. Every feed should be recorded – including amount fed, urine, defecation, etc.

Rehabilitation and release

A ‘soft’ or gradual release is always better for a hand-raised orphan, where the animal is support-fed and protected as it learns how to adapt and fend for itself.

Table 1: Milk compositions of some mammalian species

Animal	% Fat	% Protein	% Carbohydrates	% Ash	% Dry solids	% Water
Ant eater	20	11	0.3	-	-	-
Antelope	9 -20	8 -10	2 - 4	-	-	-
Ass, Asiatic Wild	0.6	1.4	6.1	0.4	-	91.5
Baboon	3.4 -	1.5	7.7	0.3	-	86.0
	4.6					
Bear	18.5	8.5	2.3	1.5	-	66.4
Beaver	16	11.2	1.7	1.0	-	65.9
Bison	1.7	4.8	5.7	0.9	13.1	-
Buffalo,Asian water	6.5	4.3	4.9	0.8	-	83.2
Camel, Bactrian	5.4	3.8	5.1	0.7	15.0	-
Camel, Dromedary	4.5	3.5	5.0	0.7	13.7	-
Cat	4.95 -	7.15	3.7	1.0	-	-
	9.7	- 9.6	- 4.9			
Chimpanzee	3.7	1.2	7.0	0.2	12.1	-
Chinchilla	11.2	7.3	1.7	1.0	-	-
Cotton-tail	14.4	15.8	2.7	2.1	-	64.8
Cow, domestic	3.7	3.2 - 3.3	4.6 - 4.8	0.7	12.5	87.6
Deer, red	8.5	7.1	4.5	1.4	-	78.9
Deer, white-tailed	7.7	8.2	4.6	1.5	-	77.5
Dog	11.1- 11.8	7.7- 8.65	3.2	1.1	-	78.00
Donkey	0.9	1.7	6.5	0.5	9.6	-
Eland	9.9	6.3	4.4	1.1	-	78.1
Elephant, African	5 ?	4	5.3	0.7	-	82.7
Elephant, Asian	7.3	4.5	5.2	0.6	-	82.3
Elk	6.7	5.7	4.2	1.3	-	81.0
Fox, Arctic	13.5	11.1	3.0	1.0	-	71.4
Fox,silver	6.3	6.25	4.65	-	-	-
Fox, red	5.8	6.7	4.6	0.9	-	81.9
Giraffe	4.8	4.0	4.9	0.8	-	85.5
Goat, domestic	3.8 - 4.08	3.71- 3.8	2.9 - 4.3	0.8	-	88
Gorilla	2.2	-	-	-	-	-
Guinea pig	5.3	6-.1	4.6	0.8	-	-
Hare	10.5	19.5	0.9	-	-	-
Hedgehog	10.1	7.2	2	-	-	-
Horse	1.6	2.2 -	6.2 - 6.4	0.4 - 0.5	11.0	89.1
		2.7				

Human	3.8 - 4	0.7 - 1.3	6.5 - 7.0	0.2	11.7 - 12.00	-
Jackal	13.2	10	3	-	-	-
Kangaroo	4.0 - 4.9	3.9 - 6.7	4.7 - 2.0	0.8 - 1.4	13.4	77.2
Lama	3.2	3.9	5.6	0.8	13.5	-
Lemur	2.3	1.9	6.7	0.3	25.8	-
Lynx	6.8	10.2	4.5	-	-	-
Mink	8.6	8.7	5.5	1.0	-	74.9
Monkey, rhesus	3.9	2.1	5.9	0.3	12.2	-
Monkey, tamarin	3.0	2.1	7.2	0.3	-	87.7
Moose	10	8.4	3.0	1.5	-	78.9
Mouse	13.1	9.0	3.0	1.5	-	70.7
Opposum	4.7-7	4.0-4.9	4.1-4.5	0.8	14.00	-
Orangutang	3.5	1.4	6.0	0.3	11.2	-
Pig,domestic	5.3	4.9	5.3	0.9	16.4	-
Porcupine	12.6	12.4	1.8	-	-	-
Possum	6.1	9.2	3.2	1.6	-	75.6
Otter	24	11	0.1	-	-	-
Rabbit	15.2 - 19.3	10.3 - 15.2	1.8 - 1.95	1.8	-	68.8
Raccoon	3.4	7.8	-	1.1	-	81.4
Rat	8.8	8.1	3.8	1.2	-	77.9
Reindeer	10.9	9.5	3.4	1.3	-	73.7
Rhino, black	Trace	1.4 -1.5	6.1 - 6.6	0.3- 0.4	7.9	91.2
Rhino	0.1	-	7.2	0.4	-	-
Seal, harp	42.2	8.7	0.1	0.7	-	48.3
Seal, northern elephant	35.5	48.8	7.6	8.7	-	35.5
Sheep, Dall	9.5	7.2	5.3	0.9	-	77.1
Sheep, domestic	7.1 - 9.0	4.7 - 5.0	4.9 - 5.8	0.8 - 1.0	20.5	81.8
Squirrel	10.45	9.2	3.4	-	-	-
Tahr	9.8	5.8	3.3	-	-	-
Wallaby	4.6	4.0	4.5	0.8	13-9	-
Warthog	8	12.2	4.8	-	-	-
Whale	33.2	12.2	1.4	-	-	-
Wolf	9.6	9.2	3.35	-	-	-
Zebra	3.5	2.4 -3.0	5.3 - 6.1	0.7	13.8	-

The Principles of Wound Management in Wildlife Rehabilitation

John R. Huckabee[1]

Introduction

The goal of wound management in wildlife rehabilitation is to restore the injured tissue to its normal anatomy and function as quickly as possible so that the animal can be returned to the wild with normal prospects of survival. The survival of an individual largely depends on its ability to function physically in a manner normal for the species, including normal vision, fully functional mouthparts, feet and legs, and wholly intact wings and flight feathers.

Wound healing is influenced by many factors (Johnston, 1981; Swaim and Henderson 1997) including the type, size and location of the wound, circulation to and from the affected tissues, proximity to joints and any movement associated with the wound, as well as tension forces on the wound. Additional influences include the level of contamination, presence of infection, nutritional status, immunocompetence, seasonal variations, molting status, and reproductive status. The basic principles of wound management, however, remain the same in all species despite the specific cause of injury (see Figure 1).

Wound assessment

A full physical examination must be performed to ensure that injuries or aberrations are not overlooked. On initial examination, internal and subtle injuries are often difficult to detect. Many considerations must be made when initially evaluating injuries and determining the prognosis of successful rehabilitation and release. Euthanasia should be considered and elected (depending upon national laws and cultural ethos) as soon as it is determined that a wildlife casualty has a poor prognosis of full recov-

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ery and release. If the animal has a reasonable prognosis for release and survival, it is important to provide prompt and appropriate care.

Initial first aid is essential to rapidly control hemorrhage and ensure a patent airway. Shock treatment and fluid therapy may be necessary prior to beginning wound treatment procedures. If the cause of injury is present (e.g., foreign body) it should be removed or addressed. Further care includes management of contaminated and infected wounds, preservation of soft tissue structures and circulation, rigid immobilisation of fractures, maintaining full range of motion in all joints, and rapid return to normal function (Martin and Ritchie 1994).

Wound management

The first aim of wound management is to establish a healthy vascular bed free from necrotic tissue, debris and infection. Wounds can be managed by first, second or delayed first intention healing. First intention (or primary union) healing of wounds involves primary closure of a wound that is under eight hours old and is not contaminated. Primary closure involves suturing or closing the wound so that the skin edges are in direct apposition thus minimising healing time and scar formation. Large and contaminated wounds should heal by second intention healing allowing for granulation, contracture and re-epithelialisation. In some instances delayed first intention healing is appropriate in which wound edges are freshened, re-apposed and sutured once a healthy granulation bed is established. Tissues should always be handled gently. The skin of lagomorphs, for example, and that of many avian species is easily torn when manipulated or when adhesive dressings are removed.

Distinction between infected and contaminated wound should be made prior to wound management. Infection should be considered in any open wound and is often present in wounds more than 24-48 hours old. Wild patients frequently present with wounds contaminated with foreign material (sand, gravel, plant material), projectile foreign bodies (bullets, arrows) that carry fur or feathers into deeper tissues. Only surgical, non-traumatic wounds would be considered as clean wounds. Primary wound closure is contraindicated if the wound is inflamed, infected, heavily contaminated or involves extensive tissue damage. Contaminated wounds are not necessarily infected. One should consider allowing bite and other contaminated puncture wounds to heal by second intention healing, allowing for drainage. Myiasis (infestation of body by larvae of flies) is seen frequently in tropical areas and in warm seasons in more temperate areas. Maggots should be removed manually and by irrigation to the extent possible; treatment with Ivermectin may be indicated (Bailey 2000).

Wound cleaning

The extent of contamination, tissue injury and vascular compromise are all critical factors in healing and the selection of wound management strategy. To promote a

viable vascular bed and granulation of tissue it is important to remove any foreign debris and contaminants and dying tissue to prevent further infection, and provide drainage from the wound. These steps prepare the wound for optimal healing.

Because of the stress and pain to which the animal is subjected it is often best to employ sedation or anesthesia when cleaning the wounds of a wild animal. Manual restraint is generally appropriate for superficial or minor wounds but extensive or painful wound cleaning and debridement should be done under sedation or anesthesia.

Wounds should be covered with clean, saline-soaked gauze, and the area around the wound cleaned. With birds, the contour feathers should be carefully removed (gently plucked or trimmed with scissors to prevent further skin trauma) around the periphery of the wound. A small (few mm) feather-free margin should remain around the wound. Feather removal should be very conservative in wild species to preserve insulation and waterproofing properties. In mammals, removing hair from wound margins should also be done conservatively.

Bacterial cultures may be indicated and samples should be taken before extensive wound cleaning is performed. Once the area surrounding the wound is cleaned, the wound can be irrigated using a gentle stream of warmed isotonic saline to remove gross contaminants. A Chlorhexidine (1:40) or Povidone Iodine (1:20) solution diluted with isotonic saline can be used to lavage the wound.

As a rule, irrigation fluids or solutions should be warmed. A pulsing stream will help dislodge foreign material. Copious volumes of fluids are often needed for effective lavage of wounds (May 1998). Care must be exercised to avoid driving debris deeper into the wound or surrounding soft tissues. Soaked gauze sponges can be useful for gentle debridement.

With extensive, complicated or older wounds this cleaning and debridement process may need to be repeated over several days. Necrotic tissue should be surgically debrided. In open fractures the viability of exposed bone must be evaluated. If exposed bone appears to be nonviable or necrotic, euthanasia must be an option. If exposed bone appears viable, the soft tissue wounds should be managed, the bone replaced under the skin if possible, and a moist, occlusive hydrogel type dressing (BioDres® DVM Pharmaceuticals, Miami, FL) applied to prevent the bone from desiccating until the fracture is evaluated for repair. NB: Do not flush fluids proximally into a pneumatic bone of a bird (e.g., humerus) or into a wound penetrating into a body cavity.

Providing drainage

Wounds that are heavily contaminated, infected or exudative may need effective

drainage to prevent formation of abscess or excessive accumulation of fluids at the wound site. Deep wounds, those with extensive damage, and any in which there is significant dead space are likely to need additional drainage consideration. It is important to keep the plumage or pelage around the wound from becoming matted with wound exudates. The type of bandage used is particularly important in draining infected and contaminated wounds; placement of drains or setons are useful ancillary procedures.

Preventing further infection

Asepsis is very important in the management of any open wound and every effort must be made to prevent further infection during the cleaning, closure and bandaging of wounds. Bandages must be kept dry and free of fecal and urine contamination. If a bandage inadvertently becomes wet it must be changed immediately to prevent further tissue damage, maceration and infection. Nosocomial (originating from hospital) infections caused by organisms resistant to antibiotics and disinfectants are often difficult to cure. Husbandry, hygiene and captive management procedures are very important to prevent further infection of the patient and its wounds. Systemic antibiotics are indicated for treatment of most open, contaminated wounds and are essential if infection is present.

Topical therapeutics

The use of topical, water-soluble antibiotics, such as one per cent silver sulfadiazine cream (Silvadene® Monarch Pharmaceuticals, Bristol, TN; SSD®, Par Pharmaceuticals, Spring Valley, NY) or a triple antibiotic (Bacitracin, Neomycin, Polymyxin) preparation may be beneficial for some superficial wounds. However, many topical petroleum- or wax-based ointments and creams can cause delayed wound healing by acting as a foreign body, blocking circulation and retarding the proliferation phase of wound healing. Topical medications containing corticosteroids should generally be avoided as they inhibit granulation tissue formation and cause delayed wound healing, unless the wound is in an area in which scarring or stricture should be minimised (e.g., preputial injuries). Live yeast cell derivatives (Preparation H®, Wyeth, Madison, NJ) help to promote epithelialisation and collagen synthesis (Degernes, 1994; Redig, 1996). Exercise care to prevent feather matting when using topical medications on birds.

Bandaging

Practice, experience and knowledge of the basic anatomy of the species under care are very important for proper and effective bandaging. The type of injury, fracture or wound must be evaluated to determine the best type of bandage to use for a particular patient. Bandages should be comfortable for the patient, otherwise excessive worrying (picking, chewing or preening) of the bandage may be observed. Bandages

perform a multitude of functions and many are specific to the problem for which they are designed. Bandage function includes: wound protection from further trauma, contamination or desiccation; securing splints, dressings or catheters; providing compression to control hemorrhage and tissue edema; providing anatomic support, stability and immobilisation for soft tissues and bones; restricting motion and reducing stress to healing tissues; and preventing weight bearing (Degernes, 1994; Howlett, 2000).

Bandages are typically composed of three layers:
A primary (contact) layer generally should be sterile, remain in place despite patient activity, provide a moist environment for initial stages of healing, assist with debridement, absorb exudates and promote epithelialisation.

A secondary layer functions as padding for protection, support and immobilisation, as well as to absorb hemorrhage, tissue exudates and discharges. Conforming gauze and cast padding or cotton wool are suitable for most bandages.

A tertiary (outer) layer is protective: serving to keep the bandage in place, providing additional support and preventing soiling, contamination and damage to the bandage. Conforming stretch tapes, with or without adhesive (Vetrap™, 3M, St. Paul, MN; CoFlex®, Andover, Salisbury, MA; Elastikon™, Johnson and Johnson, New Brunswick, NJ), work well for the tertiary layer of most bandages. Adhesives of many tapes should not contact feathers as they leave a residue that can damage feathers. Many of the paper-type tapes, (Micropore™, 3M, St. Paul, MN), and plastic ventilated tapes (Transpore™, 3M, St. Paul, MN) are generally fine for short-term use on feathers.

Wounds need to be cleaned and properly prepared prior to application of a bandage. A bandage that is applied too tightly can impair circulation and result in serious damage to soft tissues. Bandages should be checked frequently for limb swelling, skin discoloration, coolness and abnormal odour. All bandage materials should be applied as smoothly as possible because ridges and bumps can lead to irritation and skin necrosis. Porous materials allow air circulation and escape of moisture. When removing any bandage or dressing adhered to a wound or to wound margins, cautious and gentle handling will prevent trauma to tissues.

Dressings

Adherent dressings, wet-to-dry and dry bandages are used as the primary layer where there is significant discharge or necrotic debris. Wet-to-dry ball bandages are often useful in bumblefoot treatment. The purposes of an adherent bandage are to draw exudates away from the wound and to provide a surface to which debris and necrotic material adhere when the bandage is changed or removed. The wet-to-dry bandage increases this drawing effect through evaporation and capillary action. This

type of bandage is contraindicated for open fractures where bone contact with the bandage may result in bone desiccation. Wet-to-dry bandages should be changed daily for contaminated wounds and possibly more frequently if infection is present. Dry bandages are changed frequently depending on the nature of the wound and presence of infection or discharge. When removing an adherent bandage, moistening the primary layer of the bandage with saline may help reduce trauma to proliferating capillaries in the healing wound.

Non-adherent dressings should be used during the proliferation (granulation and epithelialisation) phase of wound healing to protect delicate tissues. These dressings allow excess fluid to be absorbed into the secondary layer while maintaining a moist wound surface. Occlusive non-adherent dressings should not be used if infection is present.

Synthetic, non-adherent dressings have been found to increase the rate of re-epithelialisation of many wounds. Hydrocolloidal dressings such as Duoderm® (Convatec, Princeton, NJ) and Granuflex ® (Convatec, Uxbridge, UK) are impermeable to moisture and oxygen, and absorb draining fluids while maintaining a moist wound surface. They are used with slow healing, granulating lesions including decubital ulcers and pododermatitis lesions. Despite their adhesive tendencies, additional bandaging material is often needed to hold them in place. BioDres® contains a moisture vapour permeable gel that maintains hydration at the wound site, encourages rapid epithelialisation and is helpful in rehydrating desiccated tissues. As these dressings are not translucent they should be changed frequently to monitor for infection or healing progress. BioDres® should be replaced at 24-48 hour intervals. Telfa® (Kendall, Mansfield, MA) pads are moderately absorbent and are useful particularly for granulating, non-exudating wounds.

Semi-occlusive dressings, such as Tegaderm™ (3M, St. Paul, MN), are moisture and oxygen permeable, yet impermeable to liquids and bacteria, allowing fluid to accumulate and may need to be changed frequently. When applied to an aseptically cleaned wound, Tegaderm™ maintains a sterile wound surface while the dressing margins remain adhered to healthy skin margins. Additionally, transparent dressings facilitate wound monitoring. In general the dressing should be changed every one to three days during initial healing stages, and then less frequently once a healthy granulation bed is established. Their use should be discontinued if there is evidence of gross infection.

Summary

The basic principles of soft tissue wound management are applicable to all species. An understanding of wound healing is critical in providing optimal care. Proper captive management, including wound management, requires an understanding of natural history. Without proper captive management of wildlife patients, appropriate

wound management is of little value.

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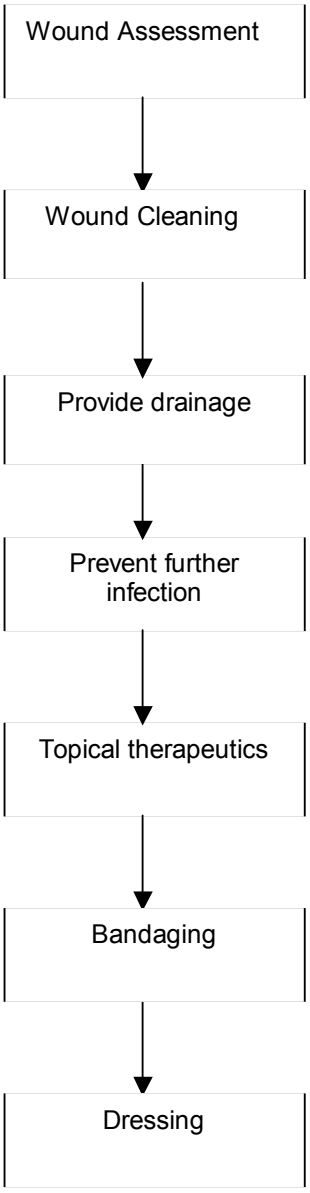
Figure 1: A systematic flow chart for wound management



The Principles of Establishing and Managing a Wildlife Rescue and Rehabilitation Centre

Rathin Barman[1]

Wildlife rehabilitation is a recent chapter added to wildlife conservation in India. In the mid 90s, displaced, orphaned or injured wildlife were rescued by individuals, non-governmental organizations (NGOs) and the government as an animal welfare activity with very little scientific planning or supervision. After rescue, the animals were either placed in a lifetime care facility, reared as pets or released to the wild without adhering to any scientific principles. There are cases when animals were released outside their natural distribution range, jeopardizing the natural balance. This kind of operation often invited legal action from authorities for illegal and unscientific rescue and rehabilitation thus belittling genuine and systematic rehabilitation work carried out elsewhere. Therefore, before attempting any rescue and rehabilitation work, one should be equipped with technical expertise and the minimum infrastructure to handle the whole process.

Before conceptualising the establishment of a rescue and rehabilitation center, three questions should be first answered.

Why is there a need for such a center?

It will be useful to check whether the area has a history of continued animal rescue cases. All the available information on rescue records of the area, such as, the species of animal rescued, time of the year of rescue, survival rate of previous rescues if any etc. should be collected. Further, the proximity of the rescue site to a Protected Area, the conservation status of the species that are likely to be rescued, whether they are migratory or resident etc. are also important information to be collected. Once convinced that the area has sufficient rescue history for the last five to ten years and that the facilities currently addressing the problem are not sufficient to

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address the cases, the need for establishing a rescue and rehabilitation facility in the area can be justified.

Where should it be established?

Site selection can involve a number of steps following certain basic principles that the facility should be located near the possible areas of rescue so that the rescued animals are subjected to minimal stress while they are taken to the facility.

The success of animal rehabilitation centers depend very much on proper selection of the location, minimum human interaction with rescued animals and the survival rate of released animals. In India some rescue and rehabilitation centers are being established in cities, away from the original rescue locations. Animals are subjected to tremendous stress during transport and from noisy vehicular traffic, which subsequently leads to other problems. In these centers, getting expert veterinary help is easier compared to a center located in a remote area. Media attention, which is an important factor to raise funds for the center is also easier in a center located in a city. The initial planning committee should first short-list a few locations for the facility. Members should visit the areas to evaluate the pros and cons of setting a center

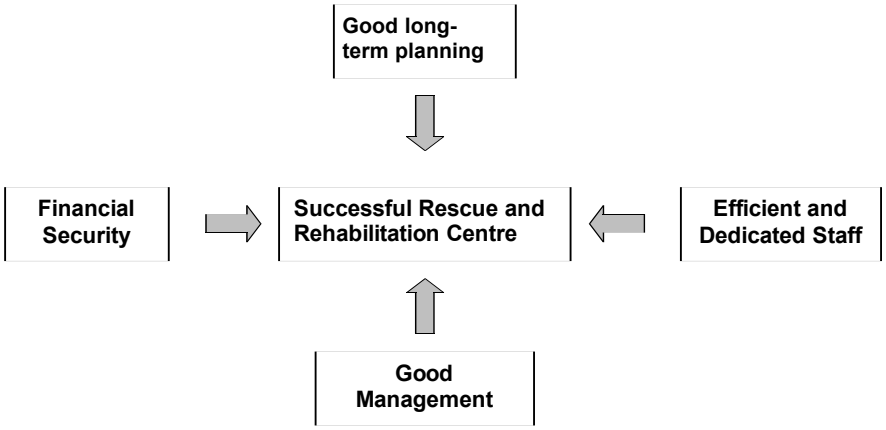

Figure 1: Four key factors of a successful rescue and rehabilitation centre

in such a locality. Expert comments may also may be invited for considering such areas. Previous rescue records of the area, availability of natural water sources, human disturbances, communication facilities, conditions of the approach road, availability of natural wildlife habitat nearby, electricity and support facilities like Forest Department establishments are some of the major factors to be considered for selecting a suitable site.

How should it be established?

This is the most complicated question and many issues are to be addressed at this stage. How should it be established? Who will be the key player for running and managing the facility? How will the funds be generated for establishment and running costs? How will technical expertise be garnered for a completely scientific program? How will the manpower be made available for various *in-situ* and *ex-situ* activities round the clock? Financial planning for the center, keeping in mind the long term goals and objectives must be made. A rescue and rehabilitation center can be rated as a successful one only when it maintains the quality of the work over a longer period (Figure 1).

In the Indian situation, NGOs working on wildlife conservation, animal welfare activists and the government should jointly work for establishing rescue and rehabilitation facility with inputs from experts. Various legal procedures and permissions from the Government of India and state governments have to be procured before handling an animal. This is a very complex procedure and at times the enthusiasm of the NGOs or individuals may die out because of such set-backs. However, if the government is a party to the management of the facility, these procedures become a little easier. Again in the Indian context, for a successful long-term management of such a facility, NGOs would be more efficient because of their result-orientated working style.

While local expertise should be involved on a regular basis for advising on regional issues, international organizations and individuals should be consulted for internationally accepted norms. Involvement of local volunteers for various activities should be ensured from the inception of the facility.

If an NGO wishes to establish a rescue and rehabilitation facility then it should first contact its local forest officials for knowing their views on such a facility. A 'joint planning committee' has to be formed to deal with the initial work till the signing of a formal understanding between all parties. The joint planning committee should also make the formal Memorandum of Understanding (MoU) between GOs and NGOs for efficient management practices of the proposed center. This MoU should clearly state the role of a Governing Council, responsible for formulating all rules and regulations of the center. Important rules like financial responsibilities, legal permissions, appointment of project personnel, tenures of the project, etc. should be mentioned

in the MoU and duly signed by all the parties concerned.

In the following paragraphs the important steps to establish and run a rescue and rehabilitation center are discussed.

Designing and planning the facility

Based on the location and terrain of the proposed facility, a proper design should be prepared considering all standards to be met. The most important section are the enclosures and paddocks to house different animals. If the proposed facility is open to all types of animals, then the enclosures should be planned based on the record of rescued species. If the facility is meant mainly for a single species or a single group of animals then the enclosures should be designed accordingly. Enclosures and paddocks should be situated away form the main building of the facility, and should be natural or "natural looking" with plenty of greenery around. Only in unavoidable situations like treatment, cleaning or food supply, should humans enter this area.

Enclosure deign is a matter that requires inputs from professional experts. But such experts should be supplied with all basic information like weather, soil conditions, temperature ranges in different seasons and availability of specialized materials required for construction of such enclosures etc. The expert has to deal with flooring, net/mesh size, roofing, minimum size of the enclosure, etc. In the case of a carnivore enclosure a squeeze cage should be connected so that animal can be handled easily whenever there is a need. There should not be any sharp edge or sharp corners in the enclosures, which may injure the in-house animals. Drainage is very important especially when the centre is in a high rainfall area.

The next important need is a room for examination (clinic) of injured animals. The clinic should be equipped with all the necessary equipment. If funds permit, keeping a closed-circuit camera in the all paddocks and enclosures to monitor the animals from the office premises would be a very useful tool. A weighing balance to weigh the animals is a necessity in any scientific rehabilitation facility. Adjacent to the clinic there should be a small facility for minor surgical procedures. A space for keeping injured animals for daily handling and for cleaning and treatment of their wound should be made near the clinic. Infrastructure should be made available in the facility to house infants.

A small office place, away from the clinic and operation theatre as well as from the animal holding areas of the facility should be planned. Communication facilities should be planned in the office including telephone, fax and internet to receive rescue calls and to get all the information about such events happening elsewhere. In Indian situations, a power back-up system should be present. A small hall adjacent to the office may be included in the plan, which may be used for organising small

meetings. There should be a good waste disposal system especially for medical wastes. Residential quarters for animal keepers, on-duty officers should be planned far away from the animal holding areas but within the campus of the facility. After finalizing the design and planning, the document should be placed before the governing council. In the governing council meeting, the planning committee should present the design and plan of the proposed facility supported by all relevant docu-

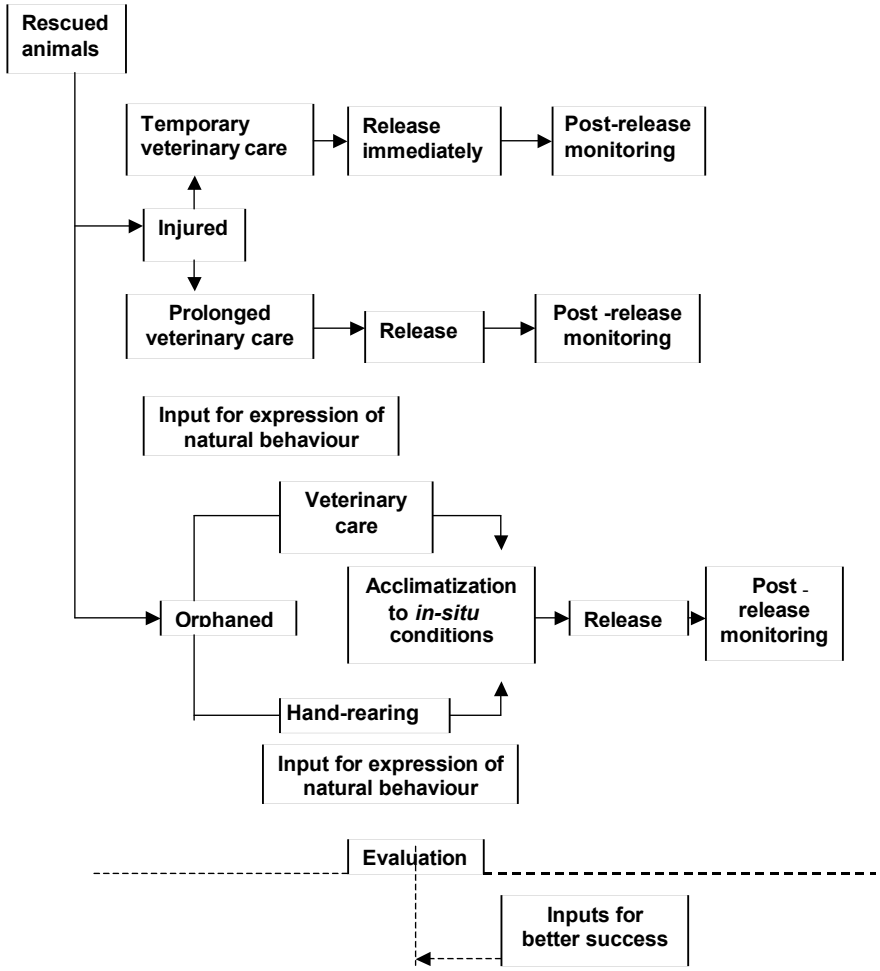

Figure 2: Flowchart for rehabilitation of rescued animals in a rehabilitation centre

ments. Once it is passed by the Governing Council, the executing agency may go ahead with the construction work.

Permissions for rescue and rehabilitation

If the proposed facility is fully managed by the Forest Department then the issue of permission for rescue and rehabilitation does not arise as they are the custodians of wildlife. However, an NGO is the executing agency for management and animal handling, then proper permissions should be obtained from the Chief Wildlife Warden of the State. For handling Schedule I species, permissions may be necessary from the Union Ministry of Environment and Forests as per the Wildlife (Protection) Act, 1972. After the recent amendment in 2002 of this Act, it is mandatory to register all rescue and rehabilitation facilities, including those run by Forest Department, under the Central Zoo Authority (CZA). Even though it is illegal to handle wild animals without proper permissions, forest officials might not interfere unless any malafide is established.

Transport facilities for the animal

There should be a suitable vehicle to transport the animals to and from the facility. The vehicle should have adequate padding to prevent injuries during transportation in case of large animals and for small animals transportation cages should be arranged. Ideally a separate vehicle should be kept for the mobility of the staff.

Record keeping

No wildlife conservation effort is complete unless the various stages have been duly recorded. Every single case has to be recorded in full detail mentioning the condition of the animal, medicines administered, food provided, etc. Efforts can be evaluated better by going through these comprehensive records kept over the years. A uniform record-keeping system should be developed for each and every case and should be analysed and published for external evaluation.

Relationship within partners

Coordination and cordial relationship between management parties should be ensured to sustain such facilities for a long time. In many aspects of wildlife management, issues and policies, both the parties may have some differences of opinion. In such cases it is the duty of the NGO, to come forward for a compromise and not to interfere with the policies of the government. Such initiatives from the NGO will add to maintaining a good relationship with the Government. It is always advisable to have all the concerned representatives of both NGO and government present when either party is planning to release any news on the centre or rehabilitation success. In case of a press release, both the parties should sign the release

before it goes to the press. Giving credit to the government for any good happenings of the centre is very important when the NGO is the executing agency.

Efficient and dedicated staff

The selection of staff is a critical issue for any rescue and rehabilitation efforts. Ideally, there should be four categories of regular recruits in rescue and rehabilitation centers in India, viz. wildlife biologists, veterinarians, animal keepers and support staff. To handle emergency situations when the center receives a large number of rescue cases, there should be a group of trained volunteers who can help the rehabilitation operations. All these recruits and volunteers should show their dedication for the cause and possess efficiency in their jobs. When they work, their brain should dominate over hearts and not the other way round. In India, non-veterinarians cannot treat animals and this rule should be reflected in the rescue and rehabilitation center also. The job of a wildlife biologist has different dimensions and his responsibilities are to deal with the behavioral, biological and ecological considerations of species. Staff should be properly trained and should be exposed to facilities in other parts of the country or abroad. Back-up manpower for any rescue and rehabilitation facility is a must to ensure the proper functioning of the center during the absence of regular staff.

Financial security

NGOs should have a proper plan for getting funds for running the centre. Fund raising in the Indian context is completely different from that in developed countries. NGOs have to depend on grants from Government agencies, corporate sectors and most importantly from foreign funding agencies. Many corporate sectors may not be willing to provide funds for such centers as for them priority areas might be different within the field of wildlife conservation. The NGO must therefore prepare a good 'vision document' of the center to attract funding. This vision document should consider the mandates of different potential donors including government agencies. Ideally, the fund raising officer should only plan for attracting funds for the center and he/she should not be given any other responsibility for the day-to-day running of the center. Financial security has to be ensured for the long term functioning of the center.

Networking with rehabilitators

It's important to share experiences with the other parties working for the same cause in India or around the world. A good network of like-minded organizations as well as individuals helps in many ways and has definitely an important role in the day-to-day

functioning of the facility. The mistake of one may be the lesson for another group or the success story of one party may provide a guiding path for the others. So it is very important to have a relationship with other organizations or individuals working for the same cause.

Media relations

A good working relationship should be maintained especially with the local media personnel and they should be invited during important rescue operations. The center should ideally prepare a press release and give this to the media personnel rather than giving out information bits to media personnel to write a story on their own.

As the subject of rescue and rehabilitation applying scientific principles is relatively new in India, many refinements have to be made at every stage to make it comparable with similar works in developed countries like South Africa and United States. Without having proper infrastructure, expertise and legal support, one should not attempt any rescue and rehabilitation as it may jeopardize the normal ecological processes. Some aspects of animals such as social behavior, territoriality of carnivores, etc. if ignored, might lead to immediate elimination of the released animal by a conspecific. Releasing animals outside their natural distribution range and releasing diseased animals can be detrimental to both the release animal and the resident population. Wildlife activists have a major role in preventing novices from getting into such activities. In India, wildlife habitats and species are under constant threat due to habitat destruction. The incidents of wild animals raiding human property are becoming more frequent and subsequently the number of animals reaching the rescue centers is also on a constant rise. The establishment of rescue centers in problematic areas on a priority basis is already ongoing in India and sincere efforts on the part of government and NGOs will certainly improve the fate of displaced animals.

The Priciples of Managing Wild Animals for Conservation Breeding with a Brief Note on the Pygmy Hog Conservation Programme

Goutam Narayan[1] **and Parag J. Deka**[2]

Wild animals have to be maintained in captivity for various reasons. Sometimes they have to be accommodated temporarily during translocation, for treatment and quarantine, and sometimes in appropriate enclosures for a considerable period of time for the purpose of rehabilitation, acclimatization to the release area and for the purpose of exhibition and captive breeding. No matter what the objective is, the captive environment should be able to fulfill at least some of the physical and psychological (behavioral) needs of the animals in captivity. In this article, the principles of captive management of wild animals, particularly those maintained for conservation breeding have been discussed. The articles ends with a brief note on pygmy hog (*Sus salvanius*) conservation as a case study.

Requirements of wild animals in captivity

Intense and prolonged stress often induces unfavourable response in captive individuals. These may include shyness or defensive posture (e.g. hiding), vocalisation, attempts to escape, physical struggle (e.g. running) and/or aggressive behaviour that may result in injury. Undesirable behaviour such as coprophagy (eating feces), regurgitation of food, hair-pulling, self injury, or stereotypic movements are also seen in captive animals under stress. Prolonged stress makes the animal susceptible to diseases. They may also fail to reproduce successfully.

The Farm Animal Welfare Council of United Kingdom has recommended that the captive animals have the following rights. India and other countries too are develop-

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ing similar laws.

- Freedom from thirst, hunger and malnutrition
  - ready access to fresh water and a diet to maintain good health and vigour
- Freedom from discomfort
  - suitable environment including shelter and a comfortable resting area
- Freedom from pain, injury and disease
  - prevention of injury and disease, rapid diagnosis and treatment
- Freedom to express normal behaviour
  - sufficient space and proper facilities for social and behavioural interactions
- Freedom from fear and distress
  - conditions that avoid mental suffering

Captive management

There are number of variables in captive environment that can be manipulated by the managers to fulfill above requirements

1. Physical environment
It is important to maintain optimal levels of temperature, humidity and light to simulate an atmosphere similar to the animal's wild habitat. Light fulfills psychological (the animal could be nocturnal or diurnal) and physiological (e.g. heliothermic animals, Vitamin D synthesis) needs of the captive animals. It also influences the reproduction of many animals. Temperature control and provision of shade or shelters, particularly during extreme seasons, is essential. High temperature in combination with high humidity may cause depression besides discomfort in animals. Temperature and humidity play a significant role in the reproduction of certain groups such as reptiles and amphibians.

2. Confinement
While designing barriers, enclosures, etc. certain points should be kept in mind:

i. Enough space for free movement of captive animals and for them to get adequate exercise.
ii. A barrier that is suitable and safe for the species.
iii. 'Private' areas where the animal can retreat whenever it wants to (if a shy animal needs to be displayed, adequate measures should be taken to watch it without disturbing it. The flight distance, or how close the animal would allow a stranger to come without getting alarmed, should be considered).
iv. Scope for visual and vocal contact with conspecifics and/or other species.
v. Suitable vegetation or 'furniture' that facilitate natural movement and behaviour (climbing, swimming, running, burrowing, digging, etc.). A substrate that is safe

and suitable as well as easy to clean.

3. Hygiene

Wild animals live neither in a dirty nor in a sterile environment in nature. Although it is essential to maintain good hygiene it is also important to accustom the animal of the maintenance routine. Thus it is a good idea to strike a balance between the privacy needs of the animal and level of management interventions. The objective should be to reduce the number of pathogens in the environment (animal areas, kitchen, etc), reduce the possible pathogen breeding grounds and reservoirs (e.g. animal excreta, leftover food) and break the potential contamination routes through food, water, feeding vessels, utensils and other equipment. Good hygiene procedures reduce risk of attack from vermin and stray animals.

4. Diet

For operational reasons, it is not possible to keep the diet of a captive wild animal the same as its diet in the wild. To formulate a substitute diet, the following information is required:

i. Information about the diet of the species collected by direct observation in the wild in different seasons.

ii. Gut content analysis of dead wild animals.

iii. Information on diet given to the species or similar species in captivity by others (e.g. zoos).

iv. Diet of similar species living in the same ecological niche or diet of similar domesticated species.

The substitute diet, as similar as possible in content, taste and nutrition to the wild diet is given after making trials about the animal's preferences. Unlike in the domestic animals where the diet is prepared for maximum production, in conservation breeding an effort is made to retain as many natural components of the natural diet as possible to maintain the feeding habits of the animal. A good substitute diet is palatable, nutritionally balanced, uncontaminated, toxin-free and easily and cheaply obtained.

4.1 Quantity

The quantity of food varies according to the animal's status and environmental conditions but some allowances are given for wastage and insufficiency in assimilation. However, it should not result in unwanted increase in weight and the animal should always remain fit and active. While basic minimum requirement is enough to maintain non-breeding animals with limited physical activity, increased quantity of food with high energy and protein contents may be required for growing and breeding ani-

mals as well as those indulging in vigorous physical activity. Richer diet may also be required for animals kept in very cold environments.

4.2 Presentation

Adequate emphasis should be given following to factors when delivering food to captive wild animals:

i. Appearance and smell: Food must be recognisable and acceptable to the animal otherwise, regardless of its nutritional value, it may not be consumed. Different species have specific feeding methods; so the shape and size of food items are important. In order to elicit response in animals difficult to feed, it may be necessary to provide live food (e.g. in reptiles), feed them items which are flavoured or masked in some way by other food (e.g. dead mice rubbed in fish or snail mucus for crocodilians). Sometimes the food is allowed to decompose slightly before being offered (e.g. to mustelids, or felids). Acceptance to simple food can also be achieved through training and persistent offering.

ii. Accessibility and sequence: It may be necessary to stagger the delivery of different types of food in order to maintain the nutritional balance. The least preferred but nutritionally important food could be given first in a fixed feeding area as a hungry animal would consume it readily. Highly preferred food items can be offered later and made less accessible, hidden or scattered so that the animal works (searches and forages like in the wild) to get them. If the less preferred and favoured items are offered together, the former may be discarded in search of latter. The strewn or discarded food items have greater chance of getting contaminated and the animal may even eat these when nothing else is left.

iii. Distribution: The spatial distribution of the food must be carried out according to group size and social structure of the species so that each individual in the group gets a balanced and adequate diet. Problems of dominance and competition can usually be avoided by dispersing food, establishing routine feeding areas, or in some situations, by separating individuals at the time of feeding.

5. Social grouping and breeding

i. Keeping social animals in proper social group is an important aspect of conservation breeding. Social animals should always be kept in compatible social groups with dominance hierarchies, age and sex determining the size and structure of the groups. Even solitary animals should get some opportunity to interact with other individuals of their own species or conspecifics.

ii. Breeding of animals is not always as straightforward as simply putting a

male and female together and leaving them to mate. Animals are not so cooperative and other things may need to be considered so as to increase the chances of reproductive success. It is a well-known fact that some animals will respond to captive conditions better than to others and over time these settled animals will produce many offspring whereas others will produce very few or none. At one time it was felt that this was a reasonable state of affairs for conservation because, provided more young were born in captivity to replace individuals that died, it was not necessary to capture new animals from the wild and the captive population was maintaining itself. However, this is not necessarily the case because it is not only numbers of animals that is important but also their quality (genetic makeup). It is very important at the planning process to carefully assess the ability of the captive stock and the captive facility to meet the requirements of breeding. As mentioned under the rules for breeding captive animals, some of the important points are:

- Good understanding of reproductive biology, physiology (identification of species and sub-species, determination of correct sex, age and fertility status, and signs of pregnancy and parturition) and behaviour (correct social grouping, pair compatibility, and signs of courtship and mating)
- Careful selection of breeding stock to avoid inbreeding and to avoid production of an undesired animal
- Adequate space to house the young and growing population, undisturbed and secure space for mating and pregnant animals, minimum possible disturbance from visitors and animal keepers.
- Best possible diet and good health care for the breeding animals, particularly the females and young.

6. Handling, restrain and transportation

Since the day-to-day activities of keepers may cause stress to animals, feeding, cleaning and other management actions need to be established as routines in order to reduce this stress to a minimum. Routines do not have to be inflexible so long as the animals understand what they have to do in response to a certain request or action.

In captive facilities when wild animals are kept for the purpose of conservation breeding, it is important for the animal keeper to know the groups or individual animals, understand their needs, and in case of higher vertebrates, form some sort of a bond with them to gain their confidence so that they are calm and relaxed in the presence of their keeper. This will make the task of observing, restraining, transporting and carrying out some veterinary procedures easier and less traumatic for the animal.

Unlike domestic animals, it is very important that handling and restraint of wild animals is done only when absolutely necessary for management and veterinary needs. A strict policy and protocol for capture, restraint and handling should be developed and these should preferably be undertaken by experienced keepers. Appropriate techniques and equipment should be used to minimise the stress, trauma and risk of injury to both animals and people. If the duration of restraint is likely to be more than a few minutes or if the animal is large and potentially dangerous, an appropriate sedative or tranquiliser should be used under expert supervision.

Transportation should be as comfortable and rapid as possible and the travelling crate or container should be of appropriate design and size. It should be well covered and shielded and well ventilated. The size should be large enough for the animal to just lie down, stand up, move or turn around without getting hurt. As far as possible each individual should have a separate travelling container unless it is necessary to carry the animal in a social group. For long trips, provision for food, water and health care should be made.

7. Environmental enrichment

Confining a wild animal to an enclosure reduces the complexity of its environment, and gradually the surroundings become predictable and uninteresting to the animal. As a result it stops exhibiting the full range of behaviour as it would normally do in the wild and this affects its natural activity pattern. The physical and psychological health of the animal suffers and instances of unhealthy and undesirable behaviour increases. In preserving wild animals in captivity it is important to encourage natural behaviour to make their day-to-day life as interesting and meaningful as reasonably possible. Environmental enrichment plays a major role in reducing the boredom of captive animals by improving their physical and social environment.

Environmental enrichment could be natural or artificial. In the natural approach, an attempt is made to recreate the natural environment (social, physical and psychological) using components similar to those found in the original wild environment. Artificial approach uses mechanical devices or behavioural engineering to promote natural activities in the animal, e.g. a dispenser that requires certain action by the animal to deliver food. Although the natural approach is preferred, its application often requires large area, and artificial devices are useful even in relatively small enclosures. Some of the psychological interventions are described below:

a. The spatial and temporal predictability of environment may be reduced by modifying management routines and making them more flexible.

b. Since feeding or related behaviour make up a larger portion of the natural activity for most species, efforts must be taken to vary these routines in captivity by:

- Variation in food items offered and in their presentation
- Variation in the temporal distribution of food through the day
- Variation in spatial distribution of feeding sites and employing techniques to elicit searching behaviour in the captive animals and raise their energy use

c. Animals should be given materials to manipulate. For example, some mammals may be offered twigs, straw or leaves, termite-infested tree logs, tree branches as scratching posts, or compact straw bundles so that they may shake and tease them.
d. The element of curiosity may be encouraged in the captive animals. For example, to stimulate the smelling behaviour in some mammals:

- Scent of sterilized faeces could be used as sent trails.
- Scents of natural origin, e.g. eucalyptus oil, may be used to get an animal curious about a new object in its enclosure.
- Spices such as cinnamon or pepper may be hidden in logs, straw bedding, paper bags filled with straw.
- Stimulating objects such as boomer balls or spools smeared with banana or sprayed with peppermint can be used.

8. Captive births, monitoring and care of newborns
As the needs and methods for taking care of pregnant females and young ones differ considerably between different groups of animals, this section is restricted to captive wild mammals. But the general principles remain the same.

a. General considerations: Since parturition is a time of vulnerability for both the mother and young, besides being an anxious period for the keepers, certain amount of advance planning and extra care is required:

i. The expectant female should either be kept in an appropriate social group where she feels safe or isolated, depending upon what she does in the wild.

ii. The management routine could be normal but as little intrusive as possible, with regular but minimum supervision. Maximum possible privacy and security should be provided to the female.

iii. Consider changing the diet, if necessary. Provide nutritive and favoured food items appropriate for a less active and pregnant female.

iv. Make preparation to hand-rear any young rejected by the mother.

One of the greatest dangers to newborn animals is the curiosity and over-protec-

tiveness of the keepers and managers. It is a good practice to let the female do the job she is adapted to do on her own in the wild.

b. Safety considerations: The general behaviour of many animals change at the time of giving birth and they usually become unpredictable, defensive and, in some cases, very aggressive. At these times even normally well - behaved and tame animals may become hazardous to the keepers or observers who may treat them like they have always done. Thus, all new mothers or parents should be treated as potential hazards and extra care should be taken for the sake of keepers as well as the animals.

c. Points to observe in mothers before and after the birth: Although the disturbance to the pregnant females and new mothers should be minimal, any opportunity to observe and record the following should not be missed:

- General health and behaviour, including vulval discharge and condition of teats
- Any birth injury or paralysis after giving birth
- Discharge of placenta (the mother usually deals with placental membranes)
- Feeding of babies; colostrum and milk production
- Care and grooming of babies by the mother

d. Points to observe in newborns: As a rule newborn animals should not be inspected or observed to satisfy our own curiosity. It may be done after the mother is comfortably settled, preferably a few days after the birth. The following points may be noted among the babies:

- Any sign of abnormal behaviour
- Any health problem, e.g. navel infection, gut protrusion, nasal discharge,diarrhoea, eye infection, or any abnormal swelling or injury
- Ability to stand or walk on the existing surface after a reasonable period
- Weight gain at an acceptable rate

e. Monitoring feeding: While monitoring feeding by mothers, it must be kept in mind that the frequency differs according to consistency of the milk in different mammalian species. In mammals producing dilute milk, e.g. deer, monkey, bear, etc., the mothers constantly stay with babies and can feed on demand. In species producing concentrated milk, e.g. cats, the mothers feed the babies less frequently, and in those producing very concentrated milk, e.g. otters, the mother feeds the babies at much longer intervals. One should not be hasty about deciding the status of an unattended infant as having been abandoned as the mother may be well aware of what is required. It is

better not to interfere unless one is absolutely sure of the situation. In case of any doubt about a possible problem with newborn or juvenile animals, it is very important to urgently consult an appropriately experienced person as prompt action may save the animal's life.

f. Hand-rearing: Hand-rearing should usually be the last resort to save a young wild animal that is facing near certain death as result of being abandoned, ill or orphaned. It is an intensive process which, in some species, can get prolonged and use a lot of time (round-the-clock care) and resources. The attempt to hand-rear a wild animal is not always successful due various reasons; so great discretion should be used before taking the decision. The main reasons to hand-rear a wild animal are:

i. Failure of natural rearing: Mothers fail to rear newborn due to behavioural reasons, which may be natural in primiparous or young females. Similarly, she may have some physiological (lack of milk) or physical disorder (needing medical attention). In some cases the baby may have been born prematurely, or is too weak and sick. In the wild such babies may become a liability and endanger the mother, the siblings or the entire social group by attracting predators or spreading an infection. Thus, wild animals naturally abandon such babies for the well-being of other members. Careful consideration is needed to decide whether one needs to save such babies in the captivity.

ii. Genetic value of the individual: A birth in a captive facility may be a significant addition to the very limited population and gene pool of a highly endangered or rare species, and the managers may want to ensure survival of the individual by not risking an uncertain rearing by natural mother or parents.

iii. Management or research purpose: Hand-reared animals tend to be relatively calm and approachable by humans and can be utilised for research or educational purposes. Sometimes it is done for developing appropriate alternative feed or formula, or for monitoring physical and behavioural development in a species to help in establishing protocols.

The survival rate of mammalian infants removed intentionally for management or research purposes, after they have fed sufficiently on colostrum and are strong enough, is high. But those rescued after being abandoned are often starved, cold, dehydrated, sick and even injured. A large percentage of these inevitably die despite best possible care, but some do manage to survive. It is important to decide when one needs to pull the infant out after leaving it unattended hoping it would be accepted by the mother again and reared naturally. One must consider the climate while doing so as an infant will quickly get dehydrated in hot weather and may not survive long in cold conditions.

Accommodation: The animal undergoing hand-rearing should be accommodated in an undisturbed and secure location with adequate space and clean and compatible surroundings suited to the species. The temperature and type of bedding or substrate must be decided carefully depending upon the species. Additional items such as a hot water bag wrapped in a towel may be kept in a corner for the animal to use it if it needs. Incubator may also be useful in some cases. Use of surrogate mothers may be considered after determining the safety of the animal.

Diet and feeding: Diet and feeding frequency must be decided based upon the composition of mother's milk and natural feeding frequency in the species. Appropriate milk or feed formula must be developed, prepared with fresh ingredients and offered at correct temperature and consistency. An infant pulled for hand-rearing may not have got enough colostrum to accrue passive immunity from mother and could be vulnerable to infections. Therefore strict hygiene is essential. The feeding implements need to be sterilised before each feed. It is important to ensure correct posture of the animal when hand-feeding to avoid choking or complications due to milk or food entering the respiratory tract. It is always preferable to encourage self-feeding or suckling from a bottle. The size of the belly must be noted while feeding and subsequent feed given accordingly. If the baby tends to suck air, the wind is removed by gently massaging it along the side of the belly. If the infant has a problem defecating or urinating, this may be also be stimulated by gently rubbing their anal area. Diarrhoea is a common problem among infants undergoing hand-rearing. Though it is simple to treat, it can become serious if not treated immediately.

Weaning and integration: Time of weaning for different species varies according to their growth pattern. Integration of a hand-reared individual into its group is a slow process. Gradual integration lessens the chance of injury and increases the developing normal behaviour. A hand-reared wild animal may have the following problems:

i. Imprinting and species recognition: As hand-rearing is an intensive and invasive process, an infant usually develops a close relationship with its handler. It may also develop an emotional attachment to the handler and may fail to recognise its own kind. They may also have problems in breeding and rearing young later in life.

One way of reducing this problem is to rear two or three animals together so that they will have companionship. This may not always be possible, so they should get a chance to have some (visual, olfactory, or aural) contact with their own kind from an early age. More than one handler will also reduce the problem of imprinting.

ii. Aggression: Hand-reared individuals lose fear of humans and this could be a problem for the animal's survival in the wild and for people if it is a large carnivore. Thus, with these species it is better to reduce the human contact as much as possible and try to integrate them at the earliest.

Conservation breeding programme for pygmy hogs (*Sus salvanius*)

The pygmy hog (*Sus salvanius*) is the smallest and the rarest wild suid in the world. Today, it is at the brink of extinction, as only a few isolated and small populations survive in the wild. In the past, it was found in the tall, wet grasslands in the area south of the Himalayan foothills from Uttar Pradesh to Assam, through Nepal *terai* and Bengal *duars*.

Present distribution

Currently, however, it is restricted to a few pockets along Assam's border with Bhutan and Arunachal Pradesh. In fact, the only viable population of the species exists in the Manas Tiger Reserve and nowhere else in the world. The World Conservation Union (IUCN) has accorded the highest priority rating (Status Category 6 - Critically Endangered) to the species putting it among the most endangered of all mammals. It is also listed in the Schedule I of the Indian Wildlife (Protection) Act, 1972.

Distinctive characters

The pygmy hog measures about 65 cm (25 inches) in length and 25 cm (10 inches) in height and weighs 8 to 9 kg. Females are a little smaller and the newborn babies weigh only 150 to 200 g. A vestigial tail (2.5 cm or 1 inch in adults) and only three pairs of mammae distinguishes it from the wild boar (*Sus scrofa*) which, despite being much larger, often gets confused with pygmy hogs. The pygmy hog is locally called Nol Gahori or Takuri Borah in Assamese, Oma Thakuri in Bodo, and Sano Banel in Nepali.

Threats and importance

The main threats to the survival of pygmy hog are loss and degradation of habitat due to human settlements, agricultural encroachments, flood control schemes, and improper management. Some management practices, such as planting of trees in the grasslands and indiscriminate use of fire to create openings and to promote fresh growth of grass, have caused extensive damage to the habitats the authorities intend to protect.

The survival of pygmy hogs is closely linked to the existence of the tall, wet grasslands of the region which, besides being a highly threatened habitat itself, is also crucial for survival of a number endangered species such as the one-horned rhinoceros (*Rhinoceros unicornis*), tiger (*Panthera tigris*), swamp deer (*Cervus duvauceli*), wild buffalo (*Bubalus bubalis*), hispid hare (*Caprolagus hispidus*) and Bengal florican (*Eupodotis bengalensis*). The pygmy hog is one of the most useful indicators of current wildlife management practices in these habitats as it has disappeared from grassland which still support some other species. It is therefore important to understand why it is disappearing faster than other less sensitive species and take remedial actions if we wish to preserve the original habitats in their pristine state and with optimal diversity. This will eventually benefit all species of these threatened habitats. Preserving these important habitats, which are one of the richest in the Indian subcontinent in terms of their biodiversity, will also help in maintaining long-term ecological and economic well being of the region.

Conservation action plan

It is therefore essential to formulate a properly structured action plan to save the species from extinction. This includes:

- Conservation breeding of the species with aims to reintroduce them to selected sites from where they have disappeared as well as an insurance against the possible early extinction of the species in the wild;
- Upgrading the (legal as well as actual) protection status of the above sites; field research to plan ideal management practices for the maintenance of optimal diversity of these habitats and mechanism to implement the recommendations of such studies;
- Reintroduction of viable number of pygmy hogs for their long-term survival in the wild, monitoring the reintroduced populations; and
- Monitoring and modifying management practices to promote survival of all original inhabitants of such habitats.

The ongoing programme

The Pygmy Hog Conservation Programme (PHCP) is a broad-based research and conservation programme which aims to fulfil at least some of the above requirements. This important recovery programme for the highly threatened species and their equally endangered habitats is being conducted under the aegis of a formal International Conservation Management and Research Agreement (ICMRA), signed between IUCN/SSC Pigs, Peccaries and Hippos Specialist Group, Durrell Wildlife Conservation Trust (DWCT), the Forest Department, Government of Assam, and the Ministry of Environment and Forests, Government of India; later renewed through a Memorandum of Understanding (MoU). Following the signing of the MoU, a local governing body consisting of Indian experts and government officials has been formed for management of the Programme. The DWCT is the main financial spon-

sor for the Programme and funds for the first three years were largely provided by the European Union through the Trust. Currently, donations to the Trust by individuals and organisations are helping the continuation of this programme.

The main aim of this collaborative programme is the conservation of pygmy hog and other endangered species of tall grasslands of the region through field research, captive breeding and reintroductions after adequate restoration of degraded habitats. The above agreement stipulates that ownership of all pygmy hogs bred in captivity would lie with the Government of Assam, till perpetuity. Translocation and reintroduction of any such animal is possible only with mutual consent of the agencies involved.

Conservation breeding

One of the main objectives of the programme is to establish a well structured conservation breeding project for pygmy hogs as an insurance against the possible early extinction of the species in the wild and as a source of animals for reintroductions projects. In 1996, six wild hogs were caught from Manas National Park and transferred to a custom-built research and breeding centre at Basistha near Guwahati. Five more hogs were caught and released at the capture site after fitting three males and a female with radio harnesses for radio-telemetry studies.

Increase in captive population: The six hogs settled down well in Basistha and three adult females, which were pregnant from wild, produced healthy litters in 1996. All but one of the 13 young (7 males and 6 females) were reared. Seven more litters were born in 1997 and 24 (15.9) young were reared. However seven adult/sub-adult hogs died, six of them due to a mixed bacterial-fungal infection which was effectively controlled with local and international help. Nonetheless, the hog population almost doubled in 1997 from 18 to 35, which constituted a 580% increase in 21 months period.

In the 1998 breeding season, five captive sows farrowed at Basistha adding 22 (11.11) more hogs to the population. In 1999, 11 (7.4) young from five normal litters were reared despite several babies dying of piglet diarrhoea, and in 2000, 14 (8.6) new hogs were reared taking the captive population to 65. This unanticipated and rapid increase in the captive population had created an accommodation problem, but extension enclosures and a quarantine facility have been constructed with funds provided by the Assam Valley Wildlife Society.

Later, increasingly rigorous curbs were imposed on the reproduction of these animals and by 2001, the captive population was allowed to rise to 77, which constituted a 13-fold increase in the stock in 6 years. A population of about 70-80 hogs is being maintained at the Research and Breeding Centre since then.

Like any other modern captive breeding programme, it is necessary to carry out DNA studies to determine relatedness among the wild caught and the wild sired individuals to maximize the genetic heterozygosity in captive population for its long-term survival. Such studies were first mooted in 1997 but due to various reasons these studies could begin only in 2002 with the help of the Centre for Cellular and Molecular Biology, Hyderabad.

Field surveys and future plans

In addition to the concluded first phase of radio-tracking studies in Manas, a wide ranging survey of known and suspected sites of pygmy hog distribution has been carried out. Grassland ecology studies are being carried out in collaboration with Gauhati University to provide grassland management guidelines for conservation of natural floral and faunal diversity of the grassland habitats. Field work is underway in Manas where a camp has been established.

Surveys to locate possible reintroduction sites were carried out and a couple of sites in Assam were shortlisted. As the current captive population of the pygmy hogs at Basistha, Guwahati, comprises the global population of captive pygmy hogs, it was important to shift some of hogs to a second site. Site for a pre-release centre was identified and it is now being established at Potasali near Nameri National Park. This facility will include large pre-release and holding enclosures with near natural habitat, where hogs earmarked for trial release to the wild would be reared. Since the world's only captive population of pygmy hogs at Basistha may constitute 10-20% of the total population of the species, the second centre will also be an insurance against any catastrophe at the present location. Since the size of the initial founder population was very small (six) it may be necessary to introduce a few more wild hogs in to this population to improve the heterozygosity and survivability of the future reintroduced populations.

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The Principles of Rearing and Rehabilitation of Orphaned African Elephant Calves

Daphne Sheldrick[1]

Introduction

The David Sheldrick Wildlife Trust (DSWT) was established in 1977 in the memory of David Sheldrick, the first warden of the Tsavo National Park. It was set up to take care of the increasing number of orphaned baby wild animals, among them elephants. The trust is committed to rescuing, nursing, rehabilitating and ultimately releasing orphaned elephant calves back into the wild. The Trust headquarters is in Nairobi, which is where the nursery is also located. This is where the calves are hand-raised until the age of two years and then moved to Tsavo National Park for reintegration with the wild herds.

The nursery stage

The rehabilitation of African elephant calves back into the wild community begins at the nursery stage itself, because it is essential to nurture the psychological and physical aspects of a baby elephant so that it will be accepted into a wild community. Wild elephants will not wish to accept a calf that has developed psychotic or neurotic abnormalities due to incorrect husbandry practices while young.

The most important thing in the world to a baby elephant is its mother and its herd. Female elephants are particularly vulnerable to psychological despair having lost their family. Young bulls are more resilient, mainly because female family members are bonded together for life by emotional attachments that are lasting and strong.

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Young bulls leave their natal herd at puberty, preferring the company of other young bulls and emulating the dominant males within the elephant group.

The psychological aspect of hand-rearing elephants is more crucial than anything else. The keepers must make up for the lost family of the baby elephants all through the day; moving around with them during the day and sleeping alongside them at night, maintaining physical contact at all times. To avoid the development of a strong attachment to just one person, keepers should work on a rotational basis, attending to a different elephant every other day. Elephants are affectionate and highly social animals, and therefore humans who take care of them should treat them as their own children and such warmth from the heart will help the calf to feel at home.

Elephants have a rapid gut-passage time and need regular feeding throughout the day initially. After the age of five months, they should be introduced to a milk feeding routine at three-hour intervals. This should continue throughout their first year of life when they are fully dependent on milk. From the age of five months they should also be offered natural browse hung in their night stable. But the browse will become important only during the second year of life, when a gradual weaning-off of milk can be practiced as the calf's intake of vegetation increases. The milk diet can be completely stopped after the second birthday of the elephant calf but they still need fat supplementation, which can be got from coconuts, for another three years and even beyond that age during extremely dry periods.

When the orphaned baby elephants reach the age of one year they are transferred to the Tsavo National Park, to be united with an older group of orphans and to begin their long and gradual process of re-integration back into the wild community. It must be understood that at every age an elephant resembles humans in terms of physical maturity and mental development. For two years an elephant can be called an infant; a child till the age of ten; a teenager between ten and twenty years, a young adult in its twenties; mature in its thirties and forties, and becoming elderly by the age of fifty. Longevity is influenced in one way or the other by factors such as stress, diet, clean air and water. Like human beings and under favourable circumstances, an elephant should normally live up to its seventies and even eighties. The orphaned elephants in Kenya are not usually ready to leave the care of the keepers until they are about the age of ten.

Elephants communicate with a language that they need to learn from other elephants, and a body language that comes by instinct. The younger the orphans are at the stage when they are exposed to the company of older elephants, the easier is the learning and transition back into the wild. Furthermore, acceptable behaviour must be encouraged initially by the human beings during the nursery period, then by the older orphans in Tsavo and ultimately by the wild community. Elephants are born with knowledge important for their survival as well as a genetic memory, which gets honed by exposure to a wild situation. All these are reasons to return the infant ele-

phants to wild conditions at the youngest age possible and to make them complete the second milk-dependent year amongst older elephants with exposure to the wild community. In Kenya, the nursery elephants are transferred to Tsavo East National Park, which is Kenya's largest Protected Area of 8,000 square miles. This Park holds Kenya's single largest population of elephants, currently numbering around 9,000.

The re-integration process

Elephants are highly social animals and are instinctively fond of their young. Consequently they are one of the easiest species to be returned to the wild. But if wild herds have been severely harassed and traumatized by humans, the human scent on an orphan might trigger antagonism and lead to difficulties in accepting the newcomer into their herd. The older orphans in Tsavo always welcome any newcomers and escort the youngsters into wild herds already known to them in their daily wanderings.

The length of time it will take for an orphaned elephant to become a 'wild' elephant, comfortably positioned amongst members of the wild community is influenced by various factors:

- At what age the elephant was orphaned. Also, how well it can remember its herd and other elephants.

- The personality of each individual. This varies just like humans. Some elephants are outgoing, independent and adventurous; others timid, shy, and retiring–more dependent on their keepers.

- Friends, i.e. other orphan elephant friends. Just like human children, the elephants are more comfortable when they can count on the backing of their friends during exploring the unknown. Those calves that have been raised in the nursery without the company of other orphans feel more vulnerable and insecure than those that are bonded by friendship and who move around as a group.

Each orphan decides when to leave human guardianship and become a 'wild' elephant again. The choice of time rests with each and every individual and is usually dependent on having befriended wild calves of their age. They are never tipped out to the wild population at once but are exposed gradually over an extended timescale. Once put back into the 'wild', many calves may not accept wilderness as their home immediately. Some of them return to visit their human keepers and orphaned 'family of juvenile orphans' when they feel so. An elephant never forgets, and each orphan will remember and love those particular individuals who comprised its human family during infancy and adolescence. This passion does not extend to all humans but only to specific individuals who constituted the human members of the orphan's

family and they will be recognized instantly even years later. To mention an instance, "Eleanor" aged 42 instantly recognised the keeper who cared for her when she was five.

The females

All female elephants long to nurture and love younger and smaller elephants. Female elephants are "maternal" by instinct, a feature that manifests itself in the nursery, with older female babies caring and protective of the younger calves. All female elephants long for a family, and orphans who have lost their original family grow up as self-appointed "matriarchs". They often try to snatch babies from the wild herds, something that is not popular with the wild matriarchs and breeds dissent and resentment within elephant society, which in a perfect world where families are intact for life, should not exist.

For the team at DSWT, the ultimate destiny of the large group of orphaned female elephants that are still captive remains an unknown learning curve, because never before has anyone had to cope with so many young elephants under the care of older self-appointed "matriarchs" with juniors taking on the role of "nannies". Matriarchs and nannies are responsible for the wellbeing and safety of the herd. They keep the peace, instil discipline to the unruly, and opt to care for any newcomers. Previously, the orphaned females that survived during the fifties, sixties and early seventies were all orphaned much older than two years of age and remembering their elephant families clearly, became absorbed into wild herds when still young. The current situation in Tsavo is unique, as elephants are orphaned as newborns or in early infancy, and the attachment to the human family is stronger and very different to earlier times. Time will tell, but it is suspected that the female orphans will remain together as a herd into adulthood, always caring for the youngsters who are transferred from the nursery. They will therefore retain contact with their keepers for as long as there are youngsters that need stockade-protection at night from lions. For those humans who are regarded as "family" it is, indeed a great privilege to have earned the love and respect of an elephant.

The bulls

Just as human boys and girls are different, so are bull and cow elephants. The baby bulls are more independent, more competitive within their peer group, always eager to dominate and become "top-dog"; a position that others constantly and continually challenge. Young bulls wrestle a lot and tend to be much "rougher" in play than their female counterparts. They tend also to be more "unruly", more mischievous and adventurous and sometimes more badly behaved, deriving pride out of generating admiration from their peers for exploits that cross the boundaries of acceptable behaviour. It is very normal for young bulls to develop a "hero-worship" of the dominant males within their society, emulating their example and learning from them

what elephants need to know to limit conflict. In the wild, elephants fight seriously only with matching age, rank and tusk size; such encounters usually ending in death of one or both parties. It is important, therefore, for a bull elephant to know his position within the male hierarchy, a learning process honed whilst growing up and being exposed to the wild elephant community.

It is also not unusual for young bulls to suffer from a feeling of inferiority if they happen to be of a more submissive nature and cannot dominate their age-mates. This will also become evident if they have had a rough time from wild elephants of the same age as well. During this phase, they tend to throw their weight around subjecting those that they are able to dominate, i.e. the younger elephants and the keepers. An example of this is a teenage bull orphaned the day he was born who had never suckled his mother and deprived of the colostrum, had a defective immune system. He also had no recollection of his elephant family and needed extra nurturing and attention during infancy. An infusion of blood plasma taken from an older elephant saved his life and thus DSWT had been able to successfully hand rear another immune-deficient candidate.

The bull mentioned above shared his nursery year with our young matriarch, "Emily", who he is extremely fond of. In Tsavo, he grew up amongst other young bulls all of whom were older and more dominant, so it is Emily with whom he is most comfortable, assigning himself the role of guardian, by chasing off buffalo and other intruders he views as a threat to the younger orphans. He is at an age when he is not welcomed into the female wild units by wild matriarchs. Although he should be seeking the company of other bulls, his deep love for Emily has retarded this attachment. Within the orphan group he is a 'big fish in a small pond' whereas out in the wild with other bulls he is a 'little fish in a big pond'. His behaviour during this phase of his development can be likened to any human teenager, with the same set of hang-ups but it is a transitional phase in his development which will pass by.

DSWT has the benefit of hindsight when dealing with orphaned bull teenage elephants. There were others in the fifties, sixties and early seventies who also enjoyed chasing cars, and scaring human by-standers through a display of aggression and arrogance. As bulls, this gives them a feeling of power and makes them feel "good" and it is a behaviour that can be expected from teenage elephants as well as teenage humans. Now it is older wild elephants that must discipline the young ones, not the human keepers and in the course of time this will undoubtedly happen.

The solution

The orphaned elephants raised in Kenya are not trained to do anything they would not normally and naturally do except during their nursery year when they are taught not to knock down human onlookers through tone of voice by their keepers and the waggling of a finger. If they deliberately act disobedient after they begin to under-

stand the words of keepers, a tiny two- torchcell powered prod can be used but very discretely and sensitively. However, it is essential to make amends later so that the elephant understands that it has been disciplined for a misdemeanour and not because it is not loved. This is very important because elephants harbour grudges. The cattle prod cannot be used once the elephants are past their nursery year.

When a young bull becomes a teenager, he must be respected as would a wild elephant bull. There must be no attempt made by human attendants to dominate him in any way, and prevent him from going wherever he wishes. This will only result in resentment and exacerbate the situation. He must be ignored completely by both the keepers and all human onlookers who must, at all times, keep a safe limited distance as they would if he was a wild elephant. If he charges a moving vehicle, the vehicle must get out of the way as it would have done when wild elephants charge. In a National Park, animals have right of way and humans are mere visitors and onlookers. All tour drivers should understand this, because elephants can be dangerous and must be given space. It is never a good idea to place oneself in a compromising position where escape is impossible.

The aim of DSWT's Orphans' Project, is to rear the orphaned elephants in such a way that they grow up psychologically sound so that in the course of time they can be returned where they rightly belong, amongst the wild elephant community of Tsavo National Park, to enjoy the quality of life as wild elephants that is their birthright. Once fully rehabilitated and living wild amongst the wild community, it is important for humans to understand that an elephant that once trusted and loved humans, may not be quite as accommodative after having been "told" about the experiences of others at the hands of humans. It is wise therefore always to allow a returning and grown ex-orphan to make the first approach, for he or she may not be quite as accommodating as before and may not want very close contact with anyone other than those who represented its "family" in infancy.

The David Sheldrick Wildlife Trust has successfully hand reared from early infancy about 55 orphaned African elephant calves, nine of which are still in the Nairobi Nursery, and 31 still dependent but growing up in Tsavo East National Park in the process of rehabilitation. Fifteen others are now fully independent and reintegrated back into the wild community, some having wild born young, which have been brought back to be introduced to the other orphans and the erstwhile human family.

The Principles for Rehabilitation of Large Mammals (Asian elephant, Asiatic wild buffalo, Asiatic black bear and greater one-horned rhinoceros)

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Introduction

Guidelines, standards, protocols or management plans are an integral part of any wildlife management exercise. If we take the field of wildlife rehabilitation, standards exist for wildlife of the developed world, American and British wildlife in particular (RSPCA, 1994; Miller, 2000; BWRC, 1994) but none exist for Indian wildlife. Rehabilitators need not only these sets of general rehabilitation principles but also species specific guidelines. Currently rehabilitators in India bank on these wildlife rehabilitation guidelines, besides the two time tested IUCN guidelines on reintroduction and placement of confiscated wildlife (IUCN, 1998 and 2002). Moreover, hardly any published or unpublished information is available on the rehabilitation

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scenario in India to enable one in the preparation of standards and protocols. This paper is an attempt to place on record some of the rehabilitation principles followed for large mammals at two rehabilitation centres in north-east India.

The Department of Environment and Forest, Government of Assam and Wildlife Trust of India (WTI) in partnership with the International Fund for Animal Welfare (IFAW) have been involved in the rehabilitation of displaced, injured and orphaned animals in Assam through the Centre for Wildlife Rehabilitation and Conservation (CWRC) near Kaziranga National Park of Assam, India. The centre was established in the year 2002 following a Memorandum of Understanding signed between WTI and the Department of Environment and Forests, Assam (MoU, 2001). The centre has returned to the wild many temporarily displaced animals, especially during the annual floods, during the past three years. Amongst large mammals, the centre now has four rhinos (*Rhinoceros unicornis*), eight elephant calves (*Elephas maximus*) and two buffalo calves (*Bubalus arnee*). All of them are ready to be moved into the field for in-situ acclimatization for eventual reintegration or release to wild.

The other rehabilitation centre established by WTI focuses almost exclusively on the Himalayan black bears (*Ursus thibetanus*). Considering the tremendous potential that exist in returning rehabilitated confiscated bear cubs back to the wild, WTI signed a Memorandum of Understanding in March 2002 with the Department of Environment and Forests, Arunachal Pradesh, to establish a rehabilitation centre that will address the issue of displaced or orphaned bear cubs (MoU, 2002). Both these centres have been established with the support received from the Animal Welfare Division under the Ministry of Environment and Forests and IFAW. As on 31 December 2004, the centre had six bears undergoing rehabilitation, of which four are due for release in February and March 2005.

The species being dealt with in this paper are the Asiatic black bear, greater one-horned rhinoceros, Asiatic wild buffalo and Asian elephant. The stages of stabilization of new arrivals and hand-raising in the nursery are not dealt with in this paper as it has been dealt with in detail by different authors in this publication (see Easwaran; Bhaskar and Mainkar; and Mainkar *et al.* in this compendium). The principles laid down here are based on the information available on the rehabilitation of comparable taxa outside India, on the lessons learnt while visiting rehabilitation centres in other countries, on the expertise made available during the expert rehabilitators' visit to the above facilities, on the experience gained in reintroduction programs of species like rhino in India and most importantly, the authors' own experience in managing these species at the above centres.

Previous studies on rehabilitation of these species

There is a general assumption in India that permanently displaced elephants cannot be returned to the wild. However, elephants (both calves and adults of varying age

groups) have been routinely reintegrated into wild elephant herds with varying degrees of success at the David Sheldrick Wildlife Trust in Africa (Sheldrick, 1992) and rehabilitated elephants have been hard-released for eventual reintegration in Sri Lanka (Jayawardane, *et al*., 2002). Though stray incidents of captive elephants going back to the wild has been reported, no concerted effort has been made so far to rehabilitate and reintegrate displaced elephants with wild elephant herds.

Bear rehabilitation is a major conservation and animal welfare activity practiced throughout the world. Bears have been successfully rehabilitated and released back to the wild in many countries including Russia, USA and Canada (Alt and Beecham, 1984; Wasserman and Clumpner, 1995; Pazhetnov, *et al*., 1999). There is evidence of killing of bears in northeast India, for meat and the sale of body parts in medicinal preparations. Orphaned cubs are kept as pets for some time before they are handed over to the Forest Department for lifetime care. However, none of these bears have ever been rehabilitated for return to the wild in India.

The case of the greater one-horned rhinoceros and wild buffalo is also no different. Though not many individuals are displaced like the young ones of elephant and bear, every individual of these endangered species is important to the surviving population in the wild. Of all the four species of large mammals being dealt with here, it is only in the case of the greater one-horned rhino that there is information available on translocation, *in-situ* acclimatization and reintroduction (Singh and Rao, 1984; Suwal and Shakya, 2000). These reintroduction programs taken up by the Indian and Nepal Governments have shown us that the species is an ideal candidate for taking up release programs either for restocking or reintroduction.

Stages of rehabilitation

Rehabilitation of most mammalian young has the following stages of rehabilitation, namely stabilization of new arrivals, hand-raising until weaning, rearing at the centre after weaning, acclimatization at the release site, release, and monitoring following release or reintegration.

Stages of Asiatic black bear rehabilitation

Depending on the age of the bear cubs received for rehabilitation, they can be subjected to different stages of rehabilitation at the centre. This has been schematically presented in Figure 1. Unlike rhino, buffalo and elephants calves, bear cubs do not need to be intensively nursed beyond the age of two months. They can be isolated from human contact and fed remotely even before they are weaned from milk. While human contact is minimized to significant levels during nursing in cub enclosure (Stage 2), it can be reduced to negligible levels during the subsequent stages.

The habitat inside the pre-release orientation yard should be similar to the habitat

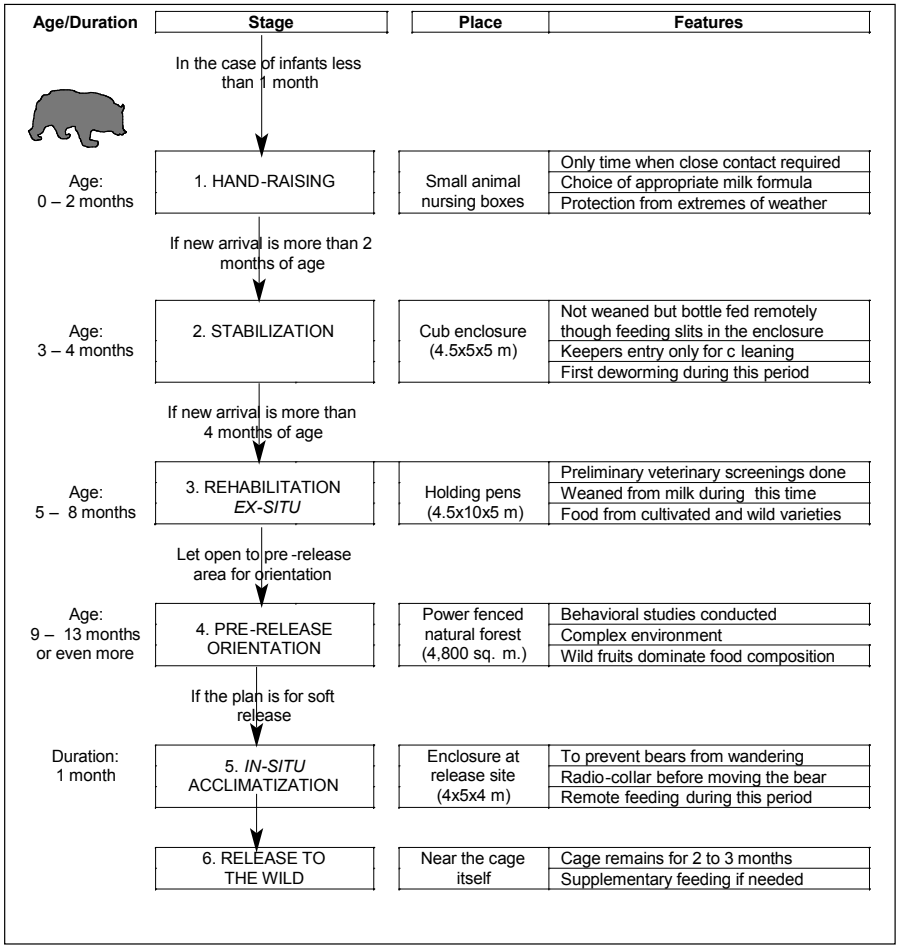

Figure 1: Rehabilitation flow chart for Asiatic black bear

type chosen for release. Asiatic black bears have a wide distribution range, occupying a varying altitudes and vegetation zones. If bears are meant for release in the higher temperate distribution range, it is imperative to orient them to the habitat conditions before considering them for release.

One of the most popular ways of hard-releasing bears in temperate and high-altitude regions is to release them into dens while they `hibernate'. If the bears are meant for release in high altitude temperate forests of Eagle Nest WLS, they may be released in winter after induction of `hibernation'. Simple withdrawl of food is known to induce `hibernation' in bears (Sergey Pazhetnov, *pers. com.*).

The dens in which the bears are habituated during pre-release orientation can also be shifted to the hard release site. In this method, radio-collaring should be done well before hibernation is induced in the bears.

Stages of rhino and buffalo rehabilitation

Rhinos and buffalos are species of tall, wet grasslands and their rehabilitation stages are similar. Unlike in elephant calves, human contact can be withdrawn from rhino and buffalo calves at an early stage. They can be left on their own after one year, especially when there are conspecifics in captivity for social integration. The period of stabilization is followed by *ex-situ* rehabilitation for two years, by which time they are ready to be moved to the wild for *in-situ* acclimatization for a period of one to two years (see flow chart in Figure 2). For both these species, it has been proposed to confine them for a period of one to two years in individual large power-fenced enclosures (called boma) of not less than three acres each. While the rhino is expected to remain at or near the site of release establishing a home range of its own, the buffalo should eventually get reintegrated into wild herds.

One of the most important exercises in rhino and buffalo rehabilitation is their translocation from the rehabilitation centre to the release site as they cannot be walked down to the release site. Invaluable experience has been gained from chem-

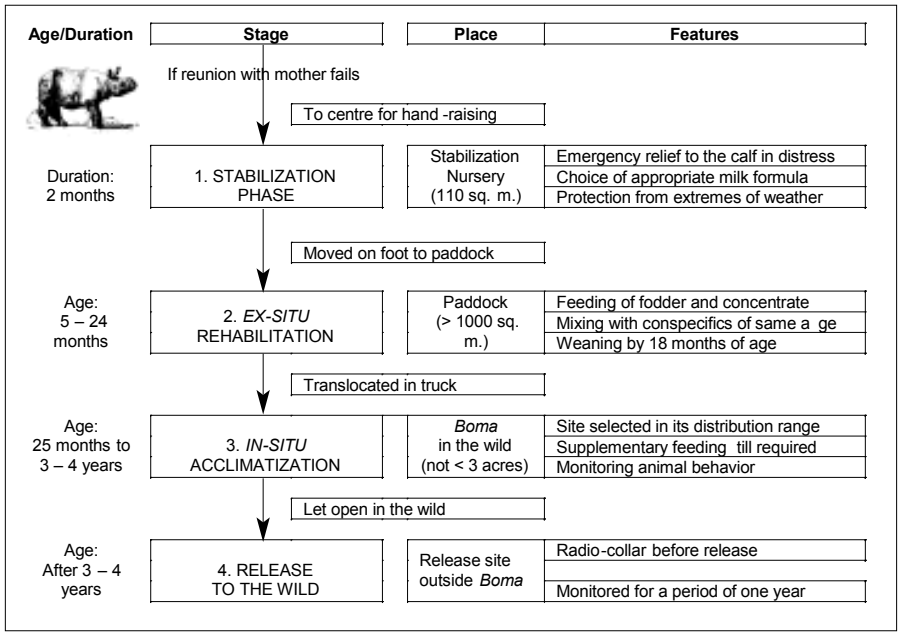

Figure 2: Rehabilitation flow chart for the greater one-horned rhino

ical capture and translocation operations in India and Nepal (Singh and Rao, 1984; Suwal and Shakya, 2000). The translocation of captive rhinos for restocking programs, however, does not demand chemical capture as they can be habituated to walk into a truck. Nevertheless, the operation still requires meticulous planning and preparation.

Stages of rehabilitation of elephants

Rehabilitation of permanently displaced elephant calves would include a period of stabilization, hand-raising until weaning, formation of social groups and the most important stage of *in-situ* acclimatization for reintegration into wild herds (Figure 3).

- Unlike in any other species, human contact is maintained throughout the rehabilitation exercise. It is not withdrawn until the elephants reintegrate with wild elephant herds.

- Elephant calves can be nursed at the center itself for two years and then moved to the re-integration facility or alternately, the calves can be moved to the reintegration site soon after stabilization.

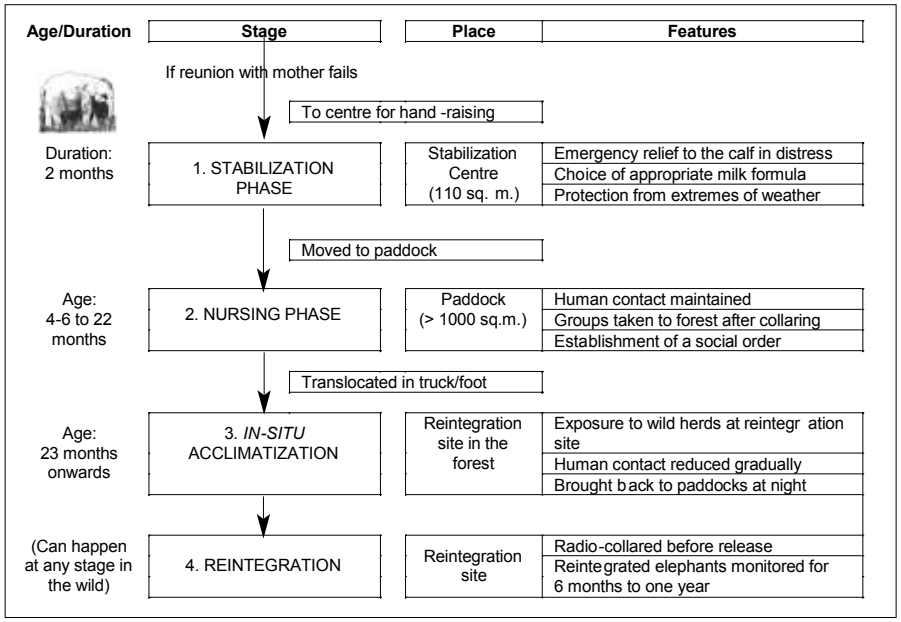

Figure 3: Rehabilitation flow chart for Asian elephants

- Since visual contact with calves is often lost in the forest and calves sometimes get `lost' in the wild, all calves should ideally be radio-collared by seven months of age when they are taken to the forest in groups.

- Once the calves are two years old, they are ready to be moved to an area isolated from human interference in a suitable elephant habitat which has a large resident wild elephant population. The young calves need to acclimatize to the wild environment where they come in contact with their wild counterparts and socialize with them. Unlike other rehabilitation procedures, like bears and rhino for instance, the process is more of a "reintegration into the wild" as opposed to "acclimatization in confinement".

- Eventually the elephants are expected to get integrated into wild herds as individuals or into the surrounding wilderness as isolated herds of their own.

- In this process of gradual reintegration which is a kind of soft `release', elephants may or may not be able to assimilate into a wild herd due to rejection by the herd or excessive attachment to their human family. However, at no point should the elephants be pressurized into going `wild' or be alienated for the sake of honing their wild instincts.

- Elephant calves need not be released at the same area of acclimatization. As the Sri Lankan experience shows that they can be released far away from the place they were raised in social groups (Jayawardane, *et al.*, 2002).

Selection of release or reintegration sites

Factors to be considered while selecting a suitable release site include overall habitat suitability, food availability, presence of predators in the area and public attitude towards the species in the area (Verdoorn, 1995; Miller, 2000). Following general guidelines should be followed while choosing the site for release:

- All sites chosen for release should fall within the natural distribution range of the species. It should ideally fall within a protected area and enjoy a good level of protection.

- The area should be free from anthropogenic pressures like human encroachments, cattle grazing, history of hunting or man–wildlife conflict.

- The site should also be easily approachable by road for easy release and post-release monitoring.

- The project being reinforcement in nature, the site chosen will have minimum number of resident animals in the case of bear and rhino, but a good population

of animals in the case of social animals, such as the elephants and buffalo.

- The proposed site of release should be assessed– for habitat suitability, food availability and other minimum requirements mentioned above– by a committee of rehabilitators, biologists and representatives from the government.

- The site thus chosen should be conveyed to the Chief Wildlife Warden (and the Ministry of Environment and Forests for their approval in the case of species belonging to Schedule I and II of the Indian Wildlife (Protection) Act, 1972) and approval sought.

Veterinary considerations before release

General quarantine and health screening protocols for wild animals prior to release to the wild is now available (Woodford, 2001). However these guidelines have to be adapted to suit specific species and local conditions. Most of the instructions in this paper are based on the African experience.

Veterinary intervention or advice is required during three stages of rehabilitation:

(i) During quarantine and stabilization,
(ii) During the process of rehabilitation for routine veterinary procedures
(iii) Screening and immunization procedures before considering the animal for release.

- Animals with permanent physical deformities and chronic disease shall be moved to appropriate captive facilities for lifetime care.

- The health of animals at the release or reintegration destination shall be assessed by consulting the local veterinarians to determine if any disease of concern are know to be endemic in the area.

- Two to three months before any animal is transported to the release site, either for release or *in-situ* acclimatization, blood smears and whole blood should be collected for conducting basic hematology, blood chemistry (if necessary), haemoparasites and serological investigations against infectious diseases.

- The decision on whether to add or omit a test, treatment or vaccination shall be made by the attending veterinarian in consultation with the veterinary expertise available on the particular species.

- Animals that fail to pass through these veterinary considerations shall not be moved to the *in-situ* acclimatization yard.

Asiatic black bear

- Rehabilitated bears should be screened for infectious disease like mange, tuberculosis and, if necessary, infectious canine hepatitis (ICH) before release. Evidence of pruritis and alopecia are signs of possible mange, multiple dermal tuberculin tests is one way of determining the presence of tuberculosis, and fecal samples can be screened for ICH virus.

Asiatic wild buffalo

Of all the four species under discussion in this paper, the wild buffalo is the only one that has a domesticated equivalent (*Bubalus arnee bubalis*). The populations of wild and domestic buffalo intermingle in the fringe of Kaziranga National Park and the possibility of inter-population transfer of pathogens and parasites is a possibility. In fact the entire population may have to be considered a meta-population while considering the formulation of health monitoring protocol for the wild buffalo. Therefore, the buffalo calf should be subjected to all regular veterinary procedures for maintaining a disease free and healthy captive period.

- Buffalo calves are very prone to worm infection especially Ascarid worms. The calf should be dewormed with Fenbendazole or any other suitable anthelmintic once within a month of its age, and subsequently every two or three months till it is 10 months. Fecal samples should also be analyzed for parasite ova every two months.

- Two to three months before the animal is transported to the in-situ acclimatization yard, the animal should be drug-immobilized to collect blood samples and blood smears for conducting the following disease investigations:

  a. Basic hematology (PCV and CBC), and also blood chemistry if found necessary by the attending veterinarian.
  b. Blood smears for haemoparasites
  c. Serology for some of the bovine infectious diseases like brucellosis, blue tongue, bovine rhinotracheitis and anaplasmosis.

These tests could be carried out if considered essential by the attending veterinarian and if facilities are available. Some of these diseases like Brucellosis, for instance, occur naturally in the free ranging populations (Choudhury, *unpubl.*).

- Tuberculosis is an important disease that should be ruled out before considering the animals for release. Serological tests for tuberculosis through ELISA, gamma-interferon, etc. (Cook, 1999) should be performed. Any decision on further screening against infectious diseases like tuberculosis should be based on the hematological results.

- Some part of the samples collected should be frozen for genetic studies in future. Considering the fact that most of the present populations of wild buffalos are not genetically pure as they are suspected to have bred with domestic populations (WII, 1994; Kikkawa, *et al.*, 1997), it is important to preserve biological samples for subsequent laboratory investigations.

- All buffalo calves, if living in areas where HS, BQ and FMD are endemic, should be vaccinated against these infectious diseases before being taken for *in-situ* acclimatization. The veterinarian may also decide on immunizing the buffalo against anthrax before moving the animal to the field. Vaccinations should be instituted several weeks prior to the movement of the buffalo to the release site in order that adverse reactions, if any, could be detected in advance (Woodford, 2001).

Asian elephant and the one-horned rhinoceros

Elephants and rhinos do not have corresponding domestic equivalents and thus the possibility of transmission of infectious disease from domestic animals to the wild does not exist. Captive elephants can be a threat to elephants being rehabilitated at rehabilitation centres but this can be ruled out in a situation where rehabilitation centres are located away from captive elephant camps. Since parasitism is a possibility in all captive animals, the fecal samples of all elephants should be regularly screened for parasite ova. All elephants, at the discretion of the veterinarian should have received one dose of dewormers against nematodes, trematodes and cestodes before they are taken to the forests for reintegration. Vaccinations for elephants would include, if necessary, against haemorrhagic septicaemia and anthrax.

Traditionally rehabilitated animals have been either soft released or hard released. Sometimes a combination of these two methods may also be considered depending on the field realities. The soft-release method follows the assumption that animals must feel at home when they are released in an area. Here they are provided adequate exposure to the habitat at the release site.

As far as bears are concerned, monitoring should start during stage of pre-release orientation itself. The bears have to be monitored while they are in the *in-situ* acclimatization cage and after release. Though bears are territorial, it is said to be advantageous to release them in pairs or in groups (Sergey Pazhetnov, *pers.com*.). Efforts should be made to release in pairs or groups of more than two as far as possible. However, in the case of elephants and to some extent wild buffalos, the question of `release' does not arise but only a slow `reintegration' into the wild.

It is crucial that animals being rehabilitated after release during initial stage are monitored for determining the success of the operation. Eventually not every animal released will require the full expense of evaluation (Karesh, 1995). More important

than collaring temporarily displaced animals is to monitor the permanently displaced animals that have been released after long period of rehabilitation.

All radio-collared animals have to be monitored for a minimum period of six months and up to one year where feasible. Every animal meant for release should go through five stages of "Decision Chain" duly signed by representatives from the project team (manager, biologist, or veterinarian) and representatives from the state government or central government. These four stages of decision making include:

(i) Subjecting every animal to the complete prescribed protocol (especially veterinary)
(ii) Testing the animal for behavioural soundness
(iii) Approval of the release site chosen for release
(iv) Confirmation of the legal permits obtained for release of the animal.

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RHINOS

Rehabilitation of Hand-reared Rhino Calves in Southern Africa: Implications for the Greater One-horned Rhinoceros

Bhaskar Choudhury[1] **and Kadambari Mainkar**[2]

Introduction

Once distributed all along the Terai grasslands in the foothills of the Himalayas, the greater one-horned rhinoceros (*Rhinoceros unicornis*) is now restricted to few pockets in India and Nepal (Singh and Rao, 1984). According to IUCN/SSC Action Plan on Asian rhinos, the Indian rhinoceros has declined over the years due to habitat loss and poaching (Foose and Strien, 1997) thus being placed in the 'Endangered' category by IUCN and in Appendix I of CITES.

Wildlife rehabilitation is an emerging science contributing to both welfare and conservation issues in India. Under the present circumstances, supplementing the existing population of the greater one-horned rhinoceros in the wild will definitely benefit the long-term conservation of the species. The Centre for Wildlife Rehabilitation and Conservation (CWRC) situated in the state of Assam at the Kaziranga National Park was established in the year 2002. Since then the CWRC has been involved with the rehabilitation of indigenous wildlife of the north-east, including successful hand-raising of three greater one-horned rhinoceros calves, which were displaced during the floods in Kaziranga National Park. The hand-reared calves, which are potential candidates for rehabilitation are undergoing a process of long-term rehabilitation at the centre.

The two authors visited Wildcare Africa Trust (WAFT), a rehabilitation center in

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South Africa, as part of this project in order to train with them on rehabilitation of African rhinos so as to bring back the lessons learnt there for application in India. The following paper discusses that learning curve.

The African rhino rehabilitation programme

Nursery

A rhino, newborn or still below one month of age, on arriving at the center is placed in the nursery, away from human habitation, for initial stabilization. The initial stabilization facility is an 8 x 8 feet room with good ventilation, provision of room heaters and coolers. Restricted entry is maintained inside the nursery and only the keeper is allowed to go in. Before entering the nursery, special clothing is worn and the boots disinfected with an antiseptic spray (Hibitane). The nursery is disinfected prior to housing an animal and a viewing window is provided to inspect the animal frequently without disturbing it. An UV lamp is always placed inside the nursery so that the animal is accustomed to it and actually feels warm and comfortable inside. The bedding of straw is changed twice a week or more frequently to avoid development of an ammonia-like smell inside the room.

Feeding

The most important factor for initial stabilisation of an orphan is the hydration status and every attempt is made to rehydrate it as fast as possible. Unlike elephant calves, rhino calves are easier to bottle-feed. Simply putting the rhino teat in its mouth whenever it demands milk does the trick. Milk formula is provided at a two-hour interval in the nursery. To increase the intake, they are fed on apple juice, which is found to work well with rhino calves and they relish them.

The commercially available artificial milk formula for rhinos is Nestle Rhino milk (low fat and high lactose content) but formulas like human fat free milk, 'Denkavit' is also found to work well with rhinos. About 75 gm of the powder is added to a litre of lukewarm water and 26—28 liters is fed every day initially to a newborn calf. Depending upon the age and body weight of the calf, initially it is fed on demand every two hours and later given approximately 15—20% of its body weight (Table 1). Probiotics like Protexin/Biorem (Bayer) are added to the formula and with every feed initially. For feeding the baby rhinos, a 1.5 litre coke bottle fitted with a rhino teat is used.

Hygiene and sanitation

At WAFT, strict hygiene and sanitation are ensured while preparing the milk formula, cleaning and storage of utensils and feeds. Milk formula is prepared fresh and any left over milk is immediately discarded after feeding. The feeding bottles, teats, and other utensils are sterilised before and after preparing the formula and stored in

Age	Formula strength	Formula offered	Greens and roughages
Nursery (new born to 3 weeks)	250 gms in a litre	On demand	Nil
4 weeks - 12 weeks	Add Denkavit (cereal gradually)	3 hours interval including late nights	
12 weeks -6months	Milk formula with Denkavit	4 feedings, 20 liters per day. Night feeding gradually reduced	Expose to indigenous browse at 17 weeks
6 months -17 months	Denkavit	3 feedings, No night feeding	Greens (legumes), hay
18 months and above	Gradually weaned	Nil	Greens (legumes) hay

Table 1. Feeding schedule followed for African Rhinos at WAFT

refrigerators. For grown up calves, four to five months of age, the bottles can be washed in hot water with detergent ensuring all the milk residues in the teats are rinsed well. Bottles and teats of each individual are marked with indelible markers for identification and to prevent use on other orphans.

Cleaning of animal cages and the campus are handled by the animal keepers on a daily basis. The enclosure is cleaned daily and the organic debris is carried away by a trailer to be disposed off. In order to reduce the flies and other insect vector population, a commercially available plastic flytrap is hung over every boma.

Record keeping

Comprehensive records on the diet, weight, growth, illness, behaviour and development are maintained at WAFT. After "rehabilitation" of the animal all the records are kept in separate files for reference in the future.

Translocation to boma

Initially, the keeper never leaves the calf alone until the calf develops a strong bond with him. Once the calf settles well in the nursery and makes a strong bond with the keeper, it is taken out for exercise outside the nursery. The rhino calf is myopic and if the feeding bottle with milk is held in front of the calf, it will follow the bottle. Thus, the calf can be gradually exposed to the new surroundings and then finally moved to a bigger enclosure under chemical immobilisation.

This enclosure is enriched with a wooden night shelter and a bedding of thatch. An UV lamp similar to that of nursery is put on 24 hoursto give the animal the feeling of comfort and security. There is a mud pool to wallow in, which is disinfected periodically with disinfectant.

Weaning

Weaning at the correct stage facilitates the animal to break the bond developed with keepers (imprinting). They are kept in the company of other animals of the same species till they are ready to be released in their natural environment (Karen Trendler, pers. com.). At WAFT, rhino calves are weaned at 18 months of age and are maintained only on greens and hay after that. They are fed twice a day with lucerne and *ad-libidum* clean drinking water is provided in a pail.

Acclimatisation *in-situ* and final release

After the rhinos are weaned and when they are about two to two and half years old, they are ready to be moved for in-situ acclimatisation and final release into the wild. After selection of the suitable site (preferably the same protected area from where the individual animal was rescued) a boma is constructed in the same design as that of the weaning boma. The boma is enriched with a wooden shelter and an UV lamp is placed inside to help the animal to quickly stabilise in the new environment. The same species of lucerne and hay is carried to the site before the animal arrives there and the animal is initially fed for at least seven days with it to avoid any digestive disturbances. Simultaneously the animal is also encouraged to access the natural grass species of the area. As the animal gets completely accustomed to the new surrounding and the fodder species of the area, the animal is released from the boma. The boma is kept for another two months at the same place for the animal to come back to have a sense of security if it feels insecure.

Implications for Indian rhinos

The rhino calves in India can be transported to the centre in Assam in a four-wheel drive vehicle with a fabricated body having minimum internal dimensions of 5x5 feet. The calves can be sedated with "Meditimodine" @ 1µg/kg body weight during transport to minimise stress. A combination of physical and chemical capture for rhino calves below six months of age is ideal. Blindfolding the calf with a dark cloth just after immobilisation would facilitate smooth loading into the vehicle and transportation to the rehabilitation centre.

The nursery protocol should be similar to that followed at WAFT except that the nursery can be constructed inside a large herbivore enclosure (a 750 square meter paddock) so that the process of transfer to the bigger enclosure can be avoided. For animals like the rhinoceros, exposure to newer surroundings every now and then definitely adds to the stress level and may affect proper growth of the animal in subsequent stages. The animal can be put inside the nursery for the first few days until it develops a bond with the keeper and starts taking the milk formula. Then the animal can gradually be taken for a walk inside the enclosure to familiarize itself with the surroundings and feel secure and comfortable. The enclosure must have shade as

well as a wallow and the animal should be encouraged to wallow gradually. Unlike at WAFT, natural grass species available at the proposed release site can be planted inside the enclosure so that the animal has access to it prior to translocation to the release site for final release.

Indian rhino calves were found to tolerate infant milk formula with high fat content like Lactogen 2 (Nestle, India containing 21% fat). A month-old female rhino calf at the Centre for Wildlife Rehabilitation and Conservation (CWRC) has been raised with the Lactogen 2 formula (Table 2) and two other calves are being raised currently (October 2004). For feeding, a one-litre coke bottle or a three litre elephant feeding bottle and a rhino teat can be used (Figure 1).

Age	Formula strength	Quantity offered	Cereals added	Greens and roughages
New born - 4 weeks	40 gms in a litre	On demand/ every two hours	Nil	Nil
4 weeks -3 months	50 gms in a litre	2 litres of formula at 3 hour intervals	Cereals added gradually	Starts nibbling grass blades
3 months - 6 months	50 gms in a litre	3 litres 3 hourly	Cereals (moong crush and brown rice)	4-5 kg. of green succulent fodder
6 months -18 months	75-150 gms in a litre	4-6 litres, 6 hourly.	Moong crush and brown rice	*Ad lib* fodder

Table 2: Feeding schedule followed for Indian Rhino at CWRC

Strict hygiene and sanitation similar to the WAFT should be followed for hand-raising Indian rhino calves. An important factor is the personal hygiene of the animal handlers in the Indian scenario. The animal keepers can be a potential source of infection specially Salmonella and *E. coli* infections. Animal handlers can be screened for the presence of such infections prior to handling animals.

Rhinos are most susceptible to ectoparasitic infestations and other skin problems. Routine veterinary care like periodic faecal screening and de-worming should be done. To avoid skin problems, feed supplements especially fat-soluble vitamins (Vitamins A and E) and minerals rich in Calcium, Phosphorus, Iron, and Selenium should be incorporated in the feeding schedule.

Weaning should be done at 18 months of age. In case of dearth of sufficient succulent green fodder, a maintenance concentrate mixture can be fed until the animal is finally moved to the release site for *in-situ* acclimatisation.

A week before the translocation to the release site, complete blood count (CBC) and packed cell volume (PCV) should be performed. A serum-chemistry profile can be made before release of the animal. Serum samples can be stored (ultra frozen) for future tests. Pre-release immunisation against tetanus, anthrax and rabies with killed vaccine can be considered.

Figure 1: A rhino calf being bottle-fed at CWRC

After weaning, a large power-fenced open paddock (area not less than three acres) can be constructed at the proposed release site for *in-situ* acclimatisation of the animal before final release. The proposed release site should have a genetically viable existing population of greater one-horned rhinos in proximity and the proposed activity should not affect the existing population of the animal. The fenced area should represent a microhabitat for the species having adequate shade and elevated lands to take shelter during floods. A concentrate mixture can be provided to the animal after transportation to the new area for a period of at least a month to help the animal acclimatise quickly to the new surroundings. The same species of green fodder can also be supplemented in the lean season in the fenced paddock. The animal should be closely monitored during the acclimatisation period, which can vary from six months to a year before final release into the habitat.

Imprinting of hand-reared wildlife orphans is a subject that needs serious consideration. Appropriate mothering and weaning at correct age will minimise the chance of imprinting in hand-reared wildlife orphans (Karen Trendler, *pers. com.*). Hand-rearing of social animals like elephant calves or primates in isolation is not possible and hence minimal imprinting is inevitable, but in species like the rhinoceros it is experi-

enced that weaning at 18 months and rearing among individuals of same species or others helps in minimising the problem (Karen Trendler, *pers. com*.).

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Displacement, Survival and Placement of Elephant Calves in India: A Preliminary Analysis

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Introduction

Fragmentation of wildlife habitat is a major cause of conflict between humans and wildlife, which in recent times is one of the most serious threats to India's wildlife (Easa and Sankar, 1999; Gureja *et al.*, unpublished). Habitat destruction caused by human population growth and the expansion of anthropogenic activities is increasingly confining wildlife into smaller and smaller forest pockets (Chaudhuri, 2000). This is resulting in an increased interaction between people and wild animals (Karanth and Madhusudan, 2002). These interactions can take on many forms including cattle lifting and man eating by carnivores (Jhala and Sharma, 1997) and crop raiding (Sukumar, 1989) and trampling of people by mega-herbivores such as the elephant. Such manifestations of conflict are the ones that remain in people's minds and are the more studied as the casualty in all these cases is the human being. Other manifestations of such conflict, like the conflict killings of animals and the displacement of wildlife, is not looked at in great detail, specially because the effects of this is felt by species other than man. Wild species get displaced not only due to conflict but also due to natural calamities such as floods, forest fires and cyclones. (Ashraf *et al.*, in press).

Two wild species suffering the most due to man–wildlife conflict in India are elephants and leopards. Publications on human–leopard and human–elephant conflict

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invariably refer to incidents of cattle lifting or crop raiding, trapping, poisoning, capture and translocation (Sukumar, 1990; Athreya *et al.* 1994; Easa and Sankar, 1999). However, the status of leopard cubs or elephant calves that are displaced as a consequence of this conflict are never given due attention. Some work has been done on the displacement of leopards in western India. This paper attempts to examine the number of elephant calves that are displaced each year in elephant habitats across the country, the causes for displacement of these calves, the percentage survival of these calves and the general trend in the final placement of the calves.

Elephant calves in India get displaced due to various reasons both natural and man-induced. There are times when an elephant calf is too weak or too slow to keep pace with its maternal herd in undulating terrain or is attacked by a predator or gets disoriented and follows a domestic buffalo herd into a village. Elephant calves also get swept away in floods as is the case of the Kaziranga National Park in Assam, which is affected by floods of the Brahmaputra every year. Many elephant calves get trapped in tea garden ditches, quagmires, wells and irrigation canals. There are even cases when entire elephant herds are killed in railway accidents leaving behind a lone elephant calf (Singh *et al.*, 2001).

Methods

Data on displaced elephant calves that required intervention was collected from nine states, i.e. Assam, Arunachal Pradesh, Meghalaya, Uttaranchal, Karnataka, Kerala, Tamil Nadu, Orissa and West Bengal. Each Forest Department, state zoo or a WTI staff was either sent a data sheet, or were contacted over telephone for details of displaced elephant calves from January 2001 to November 2004. Information on reasons for displacement, sex and age class of the displaced calves and their condition upon arrival was collected. The data thus collected, to determine the status of displaced elephant calves and their final placement, was pooled and analysed. It is important to note that this paper is not a complete census of elephant calf rescues. It is an analysis of a representative sample of 81 cases that gives a preliminary idea of displacement, survival and placement .

Results

1. Minimum numbers of displacement

A minimum number of animals displaced in India in a random four-year interval recorded by this survey was 81. This translates into a minimum number of around 20 animals a year that suffer displacement. Another analysis (Choudhury *et al.* in this issue) records 54 elephant calves displaced in Assam alone between 1988 and 2004. This statistic shows that in Assam alone a minimum of three calves annually have been displaced in a 16-year interval. However, since the beginning of CWRC (Centre for Wildlife Rehabilitation and Conservation), a specialised centre set up in Assam by the Assam Forest Department and WTI, 18 calves have been brought in

since 2000 in four years, i.e. an average of over four calves a year. This could be due to displacement of calves not being recorded or paid attention to in earlier years. It can be safely recorded that the minimum numbers being recorded here are absolute minimums and do not represent averages which can only be determined after more study.

2.a. Cause of Displacement

Though elephant calves do get displaced from the herd due to natural causes (38%, n=81), anthropogenic pressure seems to be the major cause for their displacement across elephant habitats in India (51%, n=81). The reason for calves abandoned by the herd is sometimes not known to the rescue team (11%, n=81). In highly fragmented habitats with large-scale anthropogenic activities, elephants often stray into paddy fields, tea gardens and villages. An analysis of data shows that the three major causes that make up two-thirds of all causes of displacement are getting trapped in man-made depressions (trenches, ditches, canals and drains: 25%, n=81), getting left behind when crop-raiding herds are chased by villagers (21%, n=81) and getting displaced in the process of surviving the floods (14.8%, n=81). Injured calves account for 13.5% of the cases (due to predator attacks: 4.9%, or accidents: 8.6%, n=81). Sometimes lactating mothers reject orphaned calves, whereupon the entire herd abandons the calf (9.9%, n=81). A small percentage gets disoriented when caught in the middle of domestic buffalo herds (4%, n=81) and there is even a case when an elephant calf was caught in a snare and was rescued (1%, n=81).

The major reason for displacement from the natal herd differs from state to state (Figure 1). For instance, in Assam, elephants often stray into paddy fields, tea gardens and villages (38%, n=29) and may also get trapped in snares set by local inhabitants to trap deer. In Karnataka, more than half the calves being displaced from the natal herd is caused by the chasing away of crop-raiding herds by villagers, the elephants leaving calves behind in the chaos (61%, n=18). In Uttaranchal, a third of the calves being displaced get stuck in irrigation canals passing through elephant corridors (33%, n=3) or are orphaned due to the mother getting killed in railway accidents. Natural calamities such as floods also play a role in the displacement of elephant calves, especially in north-east India. In Assam 31%, (n=29) and in Arunachal Pradesh 50%, (n=4) of the elephant calves regularly get swept away in the floods each year. In Kerala, nearly two-thirds of the calves get displaced due to accidental injuries (64%, n=11). Predator attacks were reported in Assam (3%, n=29), Arunachal Pradesh (50%, n=4) and Karnataka (6%, n=18). It was interesting to note that of all nine states surveyed for elephant calf displacement only one, i.e. Arunachal Pradesh reported calves being displaced solely due natural causes (predation and floods). All other states had man-made causes predominating. Arunachal Pradesh has the highest and the least disturbed forest cover (81.25%) among all these states (FSI, 2001).This could probably the reason why no calves have been displaced due to man-made causes.

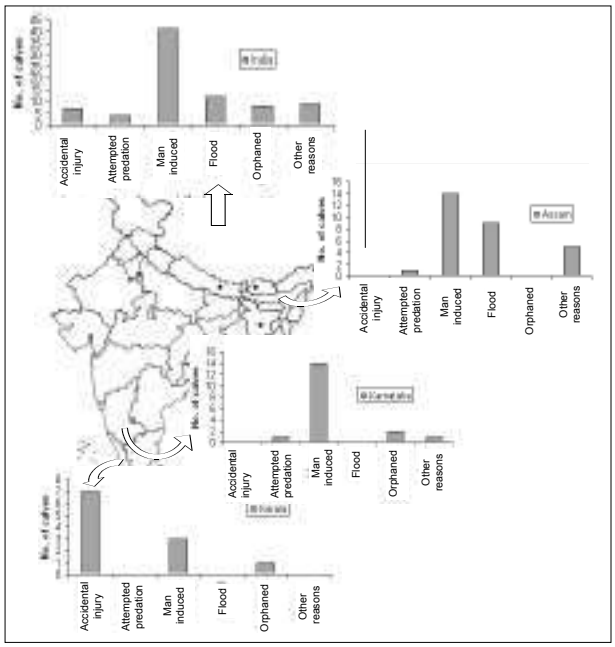

Figure1: Cause of displacement of elephant calves

It is important to state here that this analysis is based only on reported cases and the percentage of unreported displacements especially deep in the forest where

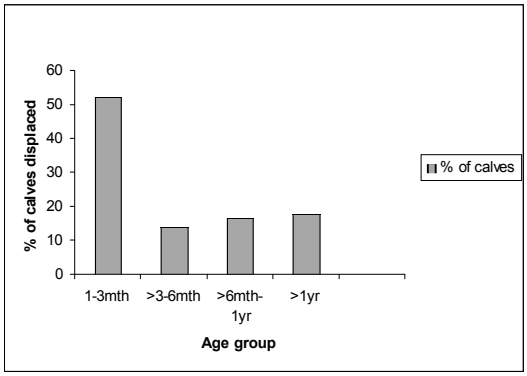

Figure 2: Age group of displaced calves

abandonment or injury would probably result in death, is probably much higher. A classic example of the limitation of this data set is Meghalaya, which did not have any reported cases of displaced elephant calves during the prescribed time frame (2001-2004).

2.b. Age and sex of displaced calves

Majority of the elephant calves that get displaced in India are below three months of age (52%, n=79) (Figure 2). At this age they seem more at threat from unfamiliar terrain, often falling into pits, unable to keep up with the pace of adult elephants and also more susceptible to floods. Significantly 82.2% (n=79) of known ages of displaced calves were under one-year of age.

Of this sample the male:female ratio was nearly the same with 56% (n=79) male and 44% (n=79) female calves being displaced. However, for conservation purposes this is a significant ratio, as the normal female to male ratio in Asian elephant populations is 1:1 to 1:5 and this is skewed in most populations due to poaching leading to 2:1 or even higher ratios (Menon, 2002).

3. Survival

As most of the calves that are displaced are below one year of age and a majority are less than three months old, it is critical that elephant calf husbandry protocols are followed well to decrease the infant mortality rate in captivity. To raise and wean elephant calves is not an easy task and several attempts across the world (see Sheldrick, Jayawardane and Easwaran in this compendium) have all had their share of mortality. In India, where elephant care is supposed to be an age-old tradition and

Sl. No.	State	Dead	Captive	Released	Escaped
1	Karnataka	9	8	1	0
2	Tamil Nadu	1	3	2	0
3	Kerala	4	6	1	0
4	Arunachal Pradesh	3	1	0	0
5	Meghalaya	0	0	0	0
6	Assam	10	15	3	1
7	Uttaranchal	2	1	0	0
8	Orissa	5	1	0	0
9	West Bengal	0	3	1	0
Total		34	38	8	1
%		42	47	10	1

Table 1: Survival status of displaced elephant calves brought to captivity

where elephant care standards are well set, there is still significant mortality. Of the reported cases analysed by this study (Table 1) 42% mortality was observed (n=81) and of these only 24% survived the first month and none of the recorded cases of mortality survived the second month (Figure 3). Once the calf was over two months

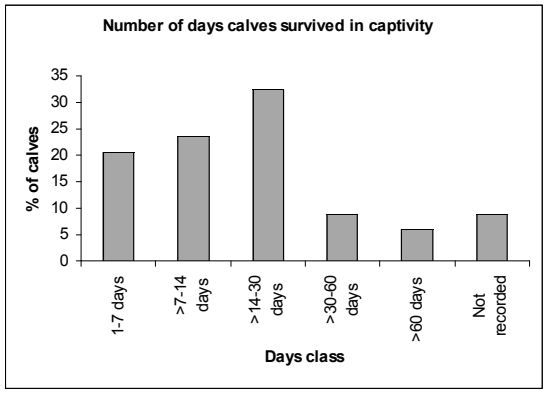

Figure 3: Survival rates in captive calves

old there were no recorded cases of mortality and 58% of displaced calves were surviving at the time of this study (Table 1). Specialised centres recorded less mortality, e.g. CWRC in Assam recorded 66% survivability (see Choudhury *et al.* in this compendium) and Kodanad recorded 63.6% in Kerala (see Easwaran in this compendium).

Displaced elephant calves are often severely traumatised, injured and dehydrated. Once displaced and brought to captivity the calf's survival depends on a combination of factors like appropriate veterinary care, caring rehabilitators or keepers who will replace the calf's elephant family, a suitable milk formula and the individual animal's will and strength to survive. The high mortality of elephant calves in most captive facilities in India is primarily due to lack of infrastructure, resources, information on behaviour and psychology of the species and hand raising skills. The biggest challenge in hand raising elephant calves is settling down to a suitable milk formula. Most facilities or individuals hand-raising elephant calves struggle in this aspect, experimenting with a whole range of formulas ranging from cow and buffalo milk to human milk formulas. Unfortunately, commercially manufactured elephant milk substitutes are not available in India although even this has been reported to cause intolerance in Asian elephant calves (Sara Riger, *pers. com.*). Experiences at WTI's Centre for Wildlife Rehabilitation and Conservation in Assam is that most calves are lost due to formula intolerance and failure to get stabilised during their first one or two months of arrival.

4. Placement

Of the 81 referred cases 47 calves survived, of which 38 are in various lifetime care facilities, eight having been re-united with the natal herds. The percentage of animals that remain captive of the ones that survive is therefore a staggering 81% and only 19% have gone back to the wild. Corrective measure for this has only been taken in Assam, where because of the setting up of the CWRC, the number of ele-

phant calves that have gone to a zoo or the Forest Department camp has gone down in a 16 year analysis to 66% (see Choudhury *et al.* in this compendium). However, the moot point even here is whether the elephants at CWRC will go back to the wild as planned or whether political, natural or scientific problems will render some more of these 'captive'.

5. Discussion and Recommendations

It is clear that the majority of displacement of elephant calves in India is caused by man-induced reasons. It is important to minimise this by pro-active management measures such as securement of elephant corridors and passages and the spreading of awareness of the dangers that open tea garden irrigation ditches, power channels etc can do to an elephant so that developmental activites are made a little more elephant-friendly.

Equally a lot has to be learnt about elephant milk substitutes and initial stabilisations so that the mortality rate is lessened. Most importantly in a conservation era when the fate of the captive elephant is in doubt, there should be a conscious attempt to put back those elephants that are genetically and otherwise able to contribute to a wild population. This is also essential for conservation especially in parts of Asia where male female ratios are skewed due to poaching and the wild population requires males while a significant percentage of calves that are being rendered captive today are males.

WTI believes that there are four options that the Forest Department or wildlife rehabilitators have once an elephant calf is displaced from its natal herd, depending upon the reasons for displacement and the state of the displaced calf. These options are listed below (WTI - ERP, 2003):

1. Re-uniting the displaced calf with its natal herd immediately

2. Re-uniting the calf with its natal herd or any other wild elephant herd, which may accept it after rescue and stabilisation in captivity after a few days.

3. Re-integrating a displaced elephant calf with a wild elephant herd after long-term rehabilitation in captivity.

4. Hand raising in a lifetime care facility such as zoo or a Forest Department elephant camp.

The last option is the most frequently exercised in India. The normal approach of the Forest Department is to take the calf into captivity to a zoo for exhibition or to a Forest Department elephant camp for forest activities such as patrolling or tourism. However, in countries such as Sri Lanka, lifetime care facilities such as the

Pinnawela Elephant Orphanage maintain orphaned, abandoned, injured and displaced elephants in a free-ranging situation where the elephants are not engaged in any work.

"Rescuing" a displaced elephant calf in India has traditionally meant saving it from injury, predation or death due to starvation. Very few attempts have been made to re-unite displaced calves with the natal herd immediately upon displacement. Rehabilitation of elephant calves as a concept did not exist in wildlife management in India. Wherever such an attempt has been made it has been an individualistic attempt on the part of a forest officer and even this is very difficult to measure as there has been no attempt to monitor the release by radio telemetry or any other form of marking.

Before considering rehabilitation of elephant calves two very important aspects need to be considered, the welfare value and the conservation value of the initiative. Once both these values have sufficient weightage, returning these calves back to the wild can be thought of.

Some of the important criteria to be taken into account while planning and execution of a rehabilitation programme are the conservation status, ecology, and behavior of wild elephants; the biological, social, economic and political context of the release site; and the health and genetic status of the candidates for re-integration. Equally important is rigorous post-release monitoring of the behavior and health of the rehabilitated animal to determine whether the animal has been able to adjust and make a switch over to a life in the wild and has the quality of life that free ranging wild animals deserve.

There are cases across the elephant range where people have made an attempt to rehabilitate elephants to the wild with varying degrees of success. A group of six adult females and a two-year old male calf were released into the wild in Thailand's Doi Phameung Wildlife Sanctuary (Sukumar, 2004). Several groups of hand-raised elephant calves have been released in the Udawalave National park in Sri Lanka (Jayawardane *et al.* 2002, and Jayawardane in this compendium). Daphne Sheldrick has successfully hand-raised 62 displaced wild elephant calves of which 16 calves have reintegrated into the wild elephant community at Tsavo National Park (Sheldrick, per. com. and Sheldrick in this compendium).

Such experimental rehabilitations if conducted honestly and diligently may create a programme in Asia, which has the capability to return elephants to the wild, resulting in 'complete rescue' of displaced calves.

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Care and Management of Elephant Calves in Kodanad Elephant Camp, Kerala, India

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Introduction

The elephants in Kerala are a part of the South Indian population distributed over the Western Ghats and parts of Eastern Ghats. The population, with an estimated 5000 elephants, exists in almost six areas, some of which are contiguous with forests of adjoining states. The smallest of these is the Idukki population with about 150 elephants, which are confined to about 300 km^2(Easa, 1989; Easa *et al.*, 2002). Kodanad is a part of a larger conservation unit with an extent of 4500 km^2 comprising a number of Forest Divisions of Kerala and Tamil Nadu (Easa *et al*., 1990). Kodanad is also one of the few places in the state where a traditional elephant camp is still maintained. The other functional elephant camps in Kerala are Konni and Muthanga. In the neighbouring states of Tamil Nadu and Karnataka, calves are reared in the camps in Mudumalai, Top Slip, Bandipur and Nagerhole. Unlike Kodanad or any other elephant camp in Kerala, these camps have the advantage of sending the calves to the forest for grazing along with other elephants. They also have many adult females to take care of the growing calves. The Kerala Forest Department has only three adult female elephants, all stationed in three different locations.

Calves abandoned in the wild are sighted by the patrolling parties of the Forest Department and brought to the camp for treatment and hand-rearing.Traditional problems were non availability of a nursing cow and infections.

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Project area

Kodanad elephant camp is located in Ernakulam district of Kerala on the banks of the River Periyar. Kodanad is a territorial forest division with evergreen and riverine forests, reed beds and teak plantations. The elephant camp is old with the present kraal built in 1964. Before this, there used to be temporary kraals inside the forest. The surrounding area comprises of staff quarters, a range office and lately a deer park and small animal rescue center has been added to the complex. There is at least a hectare of land around the kraal that is being used for grazing the small calves and tying the older elephants. Adults have separate day and night tethering sites. There is a small house for mahouts on night duty to stay. The camp is directly under the control of the Range Officer, whose quarters and office are on either side of the camp, assisted by a Forester and Forest Guard. Each animal has two mahouts, though only one is a permanent employee and the rest work on daily wages. All have prior experience of working as third, second and first mahouts with elephants owned by private individuals and in the camp. The DFO inspects the camp daily. His residence is just opposite to the camp and his office is about 300 m from the camp.

Methods

Elephant calves are normally rescued near streams or when stuck in swampy ditches, often injured and displaced from the natal herd. They are brought to the nearest range office by the patrolling forest department officials and are then taken to Kodanad camp. The age of the calves upon arrival varies from six days to two years. Some of the calves are found in a bad shape and are unable to stand up due to severe pain in the joints resulting from prolonged prostration. Contusion and laceration injuries are commonly found. Animals are dehydrated, debilitated and exhausted at the time of arrival.

Wound management

The wounds are dressed with a mixture of tropical antibiotic and ayurvedic antiseptic liquid (Neosporin powder 10 gm and Himax liquid 100 ml). Aspirin and broad-spectrum antibiotics are used orally for pain relief, wound healing and prevention of enteritis. The body is massaged with an Ayurvedic oil mixture (Dhanwandaram oil and Murivenna oil 1:1–preparations for muscle injury, pain and wounds). The animal is then given a bath with boiled and cooled medicated water (prepared with a number of herbs having antiseptic, fly-repellent and astringent qualities). This treatment has been found to be very useful in stabilising the animal.

Sl No.	Particulars	Dimension
1	Length	1240 cm
2	Width	840 cm
3	Height	460 cm
4	Number of cubicles	6
5	Inner size	390 cm^2
6	Number of pillars in lengthy side	10
7	Number of pillars in shorter side	7
8	Number of crosses in each side	8
9	Distance between two crosses	45 cm
10	Door measurement	175 cm (Only in shorter side)

Table 1: Measurements of kraal in Kodanad elephant camp

Nursing

Two keepers take charge of each animal and nurse the calf day and night. The food is prepared by them and fed to the calf at definite intervals. The *kraal* in which the animals are kept is a large enclosure with wooden pillars and bars with six cubicles for six animals at a time. The cross-bars can be pulled asides to open the cubicles. The structure is well ventilated through the space between the wooden bars which are kept 45 cm apart; as a result the animal can see the surroundings and the keepers can also see the calves from outside. The measurements are given in Table 1. The *kraal* is cleaned every now and then to keep it tidy and clean at all times. Dettol is the only antiseptic used and even so only occasionally since most disinfectants are irritatant to the skin and as the calf may consume food fallen on the floor. Toxic disinfectants are avoided.

One keeper sleeps with the calf at night and it is interesting to note that the calf puts its trunk over the keeper while it sleeps and would get up as soon as the keeper wakes up. The calves would never allow the keepers to leave their site. The keepers basically assume the role of a foster mother within no time. This bonding is important for the survival of the calves. In the wild, the calves get the attention of all the group members and their behaviour is learnt through this relationship. It is noted that hand-raised elephants are more difficult to manage in later life as they do not grow under the hierarchy of the social group and thus do not appreciate dominance, obedience and the mahout.

Sl. No.	Type of animal	DM (gm)	DCP (gm)	TDN (gm)	DE kcl	ME kcl	Calcium
1	Adult	108	6	58	278	237	0.5
2	Young growing Elephants (500 Kg to 3500 Kg.)	142	7	70	335	279	0.6

Table 2: The nutrient requirement per unit of metabolic body weight of elephants (Ananthasubraminiam, 1979)

Item	Below 3 months.	3 to 6 Months	6 months to 12 months	1 year to 2 years	2 years to 4 years	4 years 7 years	7 years to 12 years	12 years to 20 years	ABOVE 20 YEARS			
									During Rest		During Work	
Milk	10 liters				--	--	--	--	Male	Female	Male	Female
Ragi	2 kg. of Ragiton.(a reday made ragi powder)		4 kg	3 kg	3 kg	4 kg	6 kg	6 kg	2 kg	2 Kg	7 kg	6 kg
Horse Gram	---	--	--	1 kg	2 kg	2 kg	3 kg	4 kg	2 kg	1 Kg	5 kg	4 kg
Wheat / Rice	1 kg. High quality wheat.			1 kg	2 kg	2 kg	3 kg	3 kg	2 kg	1 Kg	3 kg	3 kg
Common Salt	10 g.	15 g.	20 g	50 g	50 g	100 g	100 g	100 g	100 g	100 gm	100 g	100 g
Mineral Mixtures	20 g.	25 g.	25 g	50 g	75 g	100 g	100 g	100 g	100 g	100 g	100 g	100 g
Jaggery	500 g.	500 g.	250 g	200 g	100 g	100 g	50 g	50 g	50 g	50 g	50 g	50 g
Green Fodder (Coconut leaves / palm leaves)	--	5 kg. green grass.	10 kg green grass	50 kg	100 kg	150 Kg	200 Kg	250 Kg	250 kg	250 Kg	250 kg	250 kg
Glucose	500 g.	250 g.	--	--	--	--	--	--				
Complan	100 g/day in two doses.											
Coconut milk	Obtained from2 medium sized coconuts		--	---	--	--	--	--				
Ashtachoorna	50 g. 4 days in a week.			--	--	--	--	--				
Potable water	Adlibitum,											

Table 3: Dietary composition and feeding schedule followed at Kodanad elephant centre

Feeding

The calves are fed with a formula based on cow's milk. Cow's milk is used as it is cheap, does not contain chemicals like stabilising, emulsifying and anti-oxidising agents as in the case of milk powder. Initially, the milk is diluted with an equal quantity of water and then turmeric, vitamins, minerals, complan and coconut milk are added. Turmeric is added as a natural antiseptic to the feed. The feed is enriched with vitamins and minerals using mineral mixtures used for milch cattle. Further, Complan, a milk drink formulation for human beings is added for the supplementation of trace minerals (50 gm each morning and evening in 1 litre of milk).

The composition of elephant milk is very different from cow's milk. Not only is the fat content high but the fat composition also differs, with high level of capric and lauric fatty acids (Peters *et al.*, 1972). Fat droplets in elephant milk are smaller than those of cow's milk. An appropriate substitute for elephant milk is very difficult to formulate. The addition of fresh coconut milk helps to supplement the above fatty acids but does not get rid of the fatty acids in cow milk. Coconut fat (oil) is rich in capric acid. Coconut milk is taken from a medium sized coconut and the quantity varies depending on the dryness of the coconut. The feed is normally given every two hours. Small quantities are given initially. Feeding is also done during night when the animal is awake since elephant calves in the wild suckle anytime of the day at will.

Occassionally the calves develop diarrhoea due to infection and are treated with antibiotics. The milk ration is prepared in small quantities and fed lukewarm. Initially the feed is given as a gruel and gradually made into a semi-solid form and later into a solid form by the age of 10 to 12 months. Fresh soft grass is provided from the very beginning. Pieces of sugar cane and fruits are fed from four to five months of age. It is very important that the feed be changed to solid form by 10 to 12 months for facilitating intake of fodder. Otherwise the calves tend to avoid fodder and this will affect the development of digestive tract and gut micro-flora. Water extract of fresh dung of another healthy elephant is fed at the rate of 250 to 500ml, two to three times a month from the fourth month onwards for providing gut micro-flora. By one year of age soft parts of coconut and fish-tail palm (*Caryota urens*) leaves are fed in addition to grass. The nutrient requirement of young and adult elephants is given in Table 2. The schedule followed at Kodanad centre has been shown in Table 3. The quantity of certain items has been marginally increased to compensate for the loss while cleaning, powdering, handling and cooking.

Animal enclosures

The small calves are kept inside the *kraal* without tying for up to six months of age –or at least for the initial two to three months. In the case of grown up calves a chain is put on the hind limb initially for a short time and then for a long duration and eventually within a month they are de-sensitised to the chain. Then the chain is tied to a pillar in the *kraal* and within two to four weeks of time they get used to it. For calves up to one and a half years of age the chain is put when they are taken out for walk, bathing and grazing and the animals are tied for a very short duration inside the *kraal* for keeping them de-sensitised to tying. They are free inside the *kraal* for the rest of the time, when they receive their concentrate and green ration. Calves are kept in adjacent cubicles of the *kraal* so that they can see and feel each other with their trunk.

In the mornings they are taken to the river for a bath and after bathing they are brought to the feeding area along with other animals for feeding concentrates and then let out for grazing. By the time the calves are 5–6 months of age, they are let out for grazing in pasture around the camp, which is about one hectare in size, for about two to three hours in the forenoon. After one and a half years they are tied near other animals during the day time after grazing and are kept inside the *kraal* at night untied. After two years of age, after grazing, they are tied for the rest of the day, in a shady place where they receive their fodder.

Drug	**Dose**	**Route**
Mebendazole	2.3 to 4 mg/Kg Bwt.	Orally
Levamizole	2.5 to 3 mg/kg Bwt.	Orally
Albendazole	2.5 mg/kg Bwt.	Orally
Fenbendazole	2.5 mg/Kg Bwt.	Orally
Oxyclosanide	5-7 mg/Kg Bwt.	Orally
Praziquental	2.5-4 mg/Kg Bwt.	Orally

Table 4: The dose of antihelminthics at Kodanad centre followed (ESC-KAU, 2000)

Hygiene

The success of any hand-aising programme depends to a great extent on the level of hygiene maintained. The feeding and cooking utensils are thoroughly cleaned and disinfected with boiling water. The keepers clean and disinfect their hands every time before and after handling food.

Healthcare

Digestive enzymes (Unizyme 2 tablets) and carminatives (Carmicide adult 20–30 ml) are given occasionally for improving digestion. 'Ashtachoornam' which has anti-helminthic properties, is given three to four times a week at the rate of 25–50 gm. The feed is also supplemented with minerals and vitamins.

Sl. No.	Name	Age at Receipt.	Growth after (cm) (SH-shoulder Ht. CG-chest girth.)							
			At thetime of receipt		1 months		2 months		3 months	
			SH	CG	SH	CG	SH	CG	SH	CG
1	Minna	3 months	97	128	98	129	100	135	103	143
2	Ammu	1.5 years	123	176	125	181	128	187	130	192
3	Mimi	5 months	--	--	92	118	93	122	95	126
4	Eva	2.5 years	134	184	135	185	136	186	138	188

Table 5: Body measurements of some elephant calves at Kodanad

Shoulder height	Permitted load
Below 1.50 m	Not to be used for carrying load
1.50 m to 1.80 m	Not exceeding 150 kg. (To carry only fodder and trainer)
1.80 m to 2.25 m	Not exceeding 200 kg.
2.25 m to 2.55 m	Not exceeding 300 kg
Above 2.55 m	Not exceeding 400 kg.

Source: (KCEMM, 2003)

Table 6: Workload prescribed for different age groups

[1]*Ed note: This rates above the overall rate of 53% survival that has been reported from India -see Menon et al. in this compendium)*

Dung samples are tested every month for parasitic ova and appropriate anti-helminthics are given as and when required (Table 4). Round worms and tapeworms were found occasionally through periodic dung examinations. If the ova is detected treatment is given accordingly. Tapeworms segments, which look like small-undigested pieces of rice, may be observed occasionally. It is very difficult to eliminate tapeworms completely. The chances of re-infection are also very high. One elephant calf died at the age of one and half years due to severe tapeworm infection and another calf died at the age of five years due to impaired calcium metabolism and secondary complications. At present vaccination is not done against any disease. The over all survival rate for the past three years has been 63.63% [1](7 out of 11). Survival rate for calves below 6 months is 50% (4 out of 8).

Vitamins E and C are very essential for calves and this is supplemented through feeding respective capsules or tablets in the feed. Proper assimilation 2:1 ratio of calcium:phosphorous is ensured by adding these minerals also added to the feed. Calves might eat a little soil when they are let out for grazing. Excessive intake, leading to colic and indigestion, is an indication of mineral deficiency. Administration of Iron-Folic acid capsules at the dose of five capsules per day for 5–10 days has been found to considerably reduce this problem.

Calves require regular exercise and body care. Exposure to sunlight during grazing and exercising helps in faster wound healing, early eating of fodder and Vitamin-D synthesis. If tied continuously for long period, the calves may develop behavioural abnormalities such as head-bobbing or abnormal swaying. The keeper should try to keep the animal engaged. Body measurement like shoulder height and chest girth are taken. The average growth rate of elephant calves at Kodanad was found to be satisfactory throughout (Table 5). Healthy calves may gain approximately one kilogram of body weight every day.

Training

Training of the calves starts from the first day itself. Training is required to drink milk from bottle, to open its mouth and take medicines orally, to distinguish its keeper from others, to sleep on the bedding provided, de-sensitisation towards smells, touch and sounds, to respond to call by name etc. Initially training is given to take treats directly into mouth (this is essential for medicine administration and examination of mouth), moving to sides, trunk control, moving along with other animals and keepers/mahout. Training is also given for performing small tricks such as kicking a ball etc. These training activities help to improve the bond between the mahout and elephant. The training for carrying the mahout on the back starts at five years of age. The level of training and workload depends on age and height of the animal. The prescribed levels of workload is given in Table 6. The non-availability of efficient trainers is a serious problem faced in Kodanad these days.

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Hand-raising Displaced Elephant Calves at CWRC for Rehabilitation in Assam, India

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Introduction

Elephant calves that are orphaned or displaced in the wild or rejected by the lactating mother need to be hand-raised in captivity by zoo keepers, rehabilitators or mahouts. Hand-raising elephant calves in captivity is a most challenging task requiring an appropriate substitute for elephant milk, patience and tender love and care (Sheldrick, 2002). How an elephant calf is hand-raised and treated by its keepers during its formative years not only determines its survival but also marks the temperament of the elephant as an adult. Elephant calves have been successfully hand-raised to adulthood in countries such as Kenya, Sri Lanka as well as in India in lifetime care facilities such as zoos and forest department elephant camps (e.g. Mudumalai in Tamil Nadu and Kodanad in Kerala) as well as rehabilitation facilities (Sheldrick, 2002; Jayawardane, *et al.,* 2002; Krishnamurthy, 1989). Different protocols and methodologies are followed in captive and rehabilitation facilities for hand-raising elephant calves.

Objectives

Wild elephant calves that get displaced from their natal herd need to be hand-raised

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on a suitable substitute for mother's milk by a human family of keepers or mahouts. The physical and emotional condition of the displaced elephant calf and the efforts of the rehabilitator to stabilise the calf determine the survival of the calf. The milk formula plays a critical role in this. The immediate purpose of bringing the elephant calf into captivity for hand-raising is to make sure it survives. A decision on its final placement comes later. Elephant calves are one of the key species that is hand raised at the Centre for Wildlife Rehabilitation and Conservation (CWRC), Assam. This paper is an attempt to place on record the methods followed at CWRC to successfully hand- raise elephant calves.

Project Area

CWRC is located near the Kaziranga National Park, in Borjuri village, Golaghat district in Assam. CWRC was established in 2001(although rescue and rehabilitation operations started in 2000) with the Wildlife Trust of India (WTI) signing an MoU with the Assam Government. The Center is therefore a joint initiative of WTI and the Assam Forest Department, supported by the International Fund for Animal Welfare (IFAW). CWRC was set up in order to rescue and rehabilitate wild animals displaced during the annual floods in Assam.

Methods

Re-uniting with wild herd

An elephant calf seen alone in the forest is a temporarily displaced animal. Since the natural mother is always the best option, every effort should be made to re-unite the calf with the natal herd depending on the condition of the calf as well as the conduciveness of the field situation. Displaced elephant calves have been re-united with the natal herd right from the moment of being spotted to after a period of 10 days of bottle-feeding in captivity. In each of these cases, rehabilitators have worked round the clock to facilitate the maternal relationship (Kinzley and Emanuelson, unpublished).

CWRC has re-united four elephant calves with their natal herds soon after displacement. Two of the calves had fallen into tea garden ditches, one had been swept in the flood of 2003 and one was trapped in a snare (See Choudhury, *et al*., in this compendium). All of the calves were under one year of age.

Hand-raising in captivity:

Once all efforts to re-unite a displaced elephant calf with its natal herd fail, there is no other option but to take the calf into captivity for hand-raising. The elephant calf thereafter becomes a permanently displaced animal needing hand-raising and long-term rehabilitation before it can be re-integrated into a wild elephant herd. The following is the step-wise process of rehabilitation of permanently displaced elephant calves at CWRC.

Stabilization

The survival of an elephant calf during the period of stabilization depends on a combination of factors like age of the calf, condition of the calf, the interval between displacement and intervention by rehabilitators, amount of colostrum consumed, extent of injury and the presence or absence of congenital abnormalities and the trauma the calf has undergone (Sheldrick, 1995). A permanently displaced calf is first transported from the site of displacement to CWRC in CWRC's ambulance or a forest department vehicle depending upon the situation. Transporting the animal from location A to location B by vehicle is an extremely stressing experience and depending upon the age and condition of the calf, it is at times mildly sedated. There is always a keeper and a veterinarian accompanying the calf in the vehicle. Enough bedding is provided in the vehicle to cushion the calf in case it falls.

A displaced elephant calf will be severely traumatised, dehydrated and completely disoriented if it has been separated from the mother for a long period (Thakuria, *et al.,* 1996). Upon arrival at CWRC the calf is immediately provided with a secure environment in a small stabilization room, which is dimly lit and warm and with the keeper constantly trying to calm the calf down through re-assurance. Dehydration is corrected with electrolytes and the calf is introduced to a half-strength formula (see section on feeding). It is vital that apart from treatment for wounds and injury and dehydration, the calf feels secure and comfortable it as it will be completely lost without its herd members.

Colostrum

Displaced elephant calves can be divided into two categories (Schmidt, 1986): (1) those that never received colostrum in the wild and (2) those that end up in captivity after receiving colostrum and some natural maternal milk. Elephants consume 2-10 litres of colosrum, with nursing beginning as early as 30 minutes after birth. Thereafter it is recommended to give this amount, assuming that absorption time is from birth to 6–12 hrs of age, possibly up to 24 hours of age. Colostrum can be stored frozen up to a period of one year at 20ºC. In a rehabilitation situation such as at CWRC, serum can be obtained from a captive cow and fed to the calf or administered subcutaneously (Schmidt, 1986).

Elephant milk composition

Elephant milk is low in fat and has a unique fatty acid composition; capric and lauric acids are present in much higher concentrations than in other species (Peters *et al.* 1972). The intolerance of elephant calves to bovine milk that has been amply experienced by various facilities hand raising elephants may well be attributed to this unique fatty acid composition (Bowling, *et al.*, 1965). The concentration of amino acids in elephant milk is generally low and nearer to human milk than bovine milk

(Mainka, *et al.* 1994). Elephant milk is unmatched by any other substitute, being much higher in fat and protein content than human milk. In other words, a human milk formula as a substitute for elephant milk is nutrition deficient to raise elephant calves (Table 1).

Milk Category	Mammalian Families	Dry Matter %	Composition of dry matter		
			Fat %	Protein %	Sugar %
I Equine, Rhinos		Low (8-12)	Very Low (2-15)	Low (15-20)	Very High (60-75)
II Primates (man)		Medium (12-16)	Medium (25-35)	Very Low (7-15)	High (50-60)
III Elephants, Cloven footed (except deer)		Medium (12-23)	Medium (30-45)	Medium (21-27)	Medium (20-37)
IV Rodents, Deer, Carnivores (Fissip)		High (18-31)	Med/High (32-50)	High (28-42)	Low (10-25)
V Hares, Bears, Beaver		Very High (30-40)	High (40-50)	High (25-45)	Very Low (5-10)
VI Seals, Sea lions		Extreme (50-65)	Very High (70-80)	Low (10-20)	Negligible (0-2)

Table 1: Oftedal's classification of mammal milk types (Oftedal, 1980)

The right formula

The choice of a suitable substitute for elephant milk is the most difficult task in hand-raising elephant calves. Commercially manufactured replacers for elephant milk are not available in India, however even these are known to cause intolerance in elephant calves (Sara Rigers, *pers. com.*).

Several milk formulas have been tried and tested with varying degrees of success including cow's milk, goat's milk and even elephant milk replacers. However human milk formulas are found to be the easiest to use and the best tolerated by elephant calves. The advantage of this is that human infant formulas are available in a huge variety, so that one ingredient can be substituted for another if the calf develops intolerance to a particular ingredient (Schmidt, 1986).

At CWRC, Lactogen 2 has proved to cause the least amount of intolerance to elephant calves. The calves are fed on a diet of Lactogen 2, up to the age of six months, after which they are switched over to Nestogen 2. Cereal mixture of Nestum (Rice) is also added to the formula.

Most displaced elephant calves being hand-raised in northeast India fail to survive due to gastrointestinal disorders triggered by formula intolerance and later compounded by bacterial and mixed infection. Recognising formula intolerance and diarrhoea is also another aspect in successful hand-raising orphans elephant calves (Choudhury, unpublished). While using commercially available milk formulas individual variation in formula intolerance is experienced in cases handled for the last five years.

Concentration of formula and feeding frequency

As with any method of hand-raising it is best to begin with a half-strength formula in moderate amounts and to increase the volume and concentration gradually according to the calf's tolerance (Schmidt, 1986). Initially, for the first three months the calf at CWRC is bottle-fed on demand, round the clock. Elephant calves invariably inform you of when they are hungry by either standing with a half-open mouth with their tongues bulging out making suckling noises or by sucking on the keepers' clothing. Like in African elephant calves (Sheldrick, 1995) the calves gradually settle into a three-hourly round-the-clock feeding schedule that applies until the age of one. For the first one week a probiotic (Provilac, Vets Pharma, India) is introduced along with the formula initially for a period of two weeks continuously.

Ripened *Aathia* banana (a local variety of banana with good iron content) is also introduced. Initially half a banana is given and this is later increased to five or six per day, after thorough de-seeding and mashing. Care is taken so that the consistency of the formula is liquid enough to pass through the teat opening. Where the calves are between four and six months of age Nestum cereal and rice are used to fortify the milk and gradually over a period of one year this amount is consistently increased till the milk becomes porridge-like in consistency. From the 8th month onwards the cereal mixture is changed to increase dry matter consumption, protein supplement and to bring down cost. By the 24th month the calves are completely weaned and the concentrate mixture is continued up to three years of age or more depending upon the growth of the animal (Table 2).

Age	Milk formula (Lactogen 2)	Consumption per feed	Cereals (added to milk)	Frequency of feed	Greens
01-03 Month	50 gm in 1 litre	3 litres	Nestum Rice 10 gm in 1 liter	On demand (2 hours)	Coprophagy at 3 month, nibbling
04-07 Month	50 gm in 1 litre	4 litres	Nestum Rice 25gms in 1 litre	3 hours	2/3 kg at night pen/free grazing
08-12 month	80gm to 100 gms	6 litres	50-100 gm boiled brown rice and 50 - 100gm crushed moong, *Aathia* banana	4 hours	2-3 kg at night pen/free grazing
13-24 months	100gm in 1 litre	6 litres	Total 150-500 gm brown rice,150 -500 gm crushed moong daily, *Aathia* banana	6 hours-12 hours. Gradually weaned on 24th month.	10 kg in night pen/free grazing

Table 2: Concentration of the formula and feeding frequency

The right temperature

Elephant calves are extremely fussy about the temperature of the milk and reject it if it is not 'just right'. The temperature of the milk formula must never be extreme, neither too hot nor too cold. The milk must always be at body temperature (Krishnamurthy, 1997). A bucket of warm water can be kept at one's disposal while feeding the calf, to avoid the milk getting cold too quickly.

Feeding posture

In the case of bottle-feeding all mammals, due care has to be taken that the feeding posture is perfect, in order to prevent milk going down the animal's trachea. Also the animal must feel comfortable enough and encouraged to suckle. Elephant calves are difficult feeders and need some effort and persistence before they catch on how to feed from a bottle. An elephant calf in the wild will always be under the mother's huge body and will rest the tip of its trunk against the mother's belly while suckling. Therefore, while bottle feeding, the calf must be made to feel as secure as it does while suckling from its mother. A blanket can be hung and the bottle can be offered to the calf from behind the blanket, while the calf can rest its trunk against the blanket. At times the calf is more comfortable resting its trunk on its keepers shoulder or chest and then suckling. Both these methods are employed at the Sheldrick Trust in Kenya as well as the Wildcare Africa Trust in South Africa. The methods have proved to be very successful at CWRC.

Suckling

Orphaned elephant calves always struggle to suckle from the bottle for obvious reasons. However, the calf settles down quickly if the teat resembles as closely to natural mothers as possible and if the calf feels comfortable in holding on to something while suckling.

Getting the calf used to the strange and alien rubbery teat requires tremendous patience as the calves resist quite a bit. However the keeper has to be persistent in his/her efforts to encourage the calf to suckle. When calves resist suckling, milk must never be poured into the mouth. Elephant calves easily habituate to this and lose the suckling reflex completely. It is advised that suckling may be psychologically important until the calf is five (Sheldrick, 1995).

Coprophagy

Eating droppings of ones own species is termed as coprophagy. Coprophagy is essential for elephant calves to cultivate gut microorganisms for digestion and assimilation of the green fodder (Eltringham, 1991). In elephant camps at Kaziranga National Park elephant calves with natural mothers were observed for coprophagy

and found that they start eating the droppings of their mothers at about two months of age. Given the opportunity, coprophagy was noticed in all the elephant calves that were hand-raised approximately at two to three months of age before they start nibbling the grass blades (Choudhury, unpublished). Elsewhere in India, dung water is given in the feed (see Easwaran in this compendium).

Weaning

Even though elephant calves have developed the motor skills needed for feeding on plants, they continue to derive significant amounts of nutrition from their mothers until three years or older. This maternal contribution beyond two years could be crucial for maintaining growth rates and body condition (Sukumar, 2004). The weaning process at CWRC begins during the second milk-dependant year.

When the elephant calves are about eight to nine months old, they receive the largest amount of formula at about 24–28 litres per day. After this point gradually the amount of formula is decreased. By the time the calves are two years old the mixture of cereals and rice and gram completely replaces the milk-based diet. Elephant calves in the wild invariably begin to pick up of blades of grass alongside the mother by the time they are two months of age. Apart from just in play this grass is also consumed by the calves. Therefore at CWRC the calves are introduced to blades of grass by the time they are three months of age. Four months of age onwards, foliage is provided to the calves in the night stockades as well. This amount is increased each month up to 10 kgs by the time the calves are between one and two years of age.

Husbandry

Elephants are highly social animals and share special bonds with each other in a herd. Therefore when a wild elephant calf is displaced and brought to captivity for hand-raising, the "family" of human keepers or rehabilitators have to replace the calf's elephant family. Elephants imprint almost immediately upon being brought into the care of human beings. Elephant calves cannot be hand-raised in isolation with minimal human contact especially if there is only one to a few in numbers at the rehabilitation facility. There must be two keepers/rehabilitators attending to a calf at any given time. The two can work on rotation to ensure that the elephant does not imprint onto any one individual, which is highly likely with elephants.

The elephant calves are never left alone at any point of time. There is always a keeper present with the elephant calves in the nursery rooms as well as when the elephants are taken to the forest each day. The keepers/rehabilitators caress and communicate with the calves at all times and until the calf is settled and comfortable in its new surroundings. One of the keepers sleeps with the calf at night. The keepers need to make the calf feel comfortable and secure at all times for the calf to combat

the stress of separation from the natal herd. The calf is protected from the sun, rain, and cold. During the rainy seasons, a raincoat is spread over the calf's body while it is in the forest and tied with a soft cotton rope around its belly. During winters, a blanket is put on the back of the calf and similarly tied around the belly. Also room heaters are used in the nursery rooms while the young calves are being stabilized, irrespective of the weather.

Elephants in the wild spend a considerable amount of time in water, bathing and wallowing. Elephant calves especially enjoy wallowing, splashing about and playing in mud wallows. Access to water for the calf for bathing and playing is always provided at CWRC. A small water pool has been created within the elephant stockade itself for the hand raised calves to wallow in. This also helps in removing the dead cells on the skin and getting rid of ecto-parasites. Calves without access to water and soft earth develop rough skin and course body coat. Elephant calves get bored very easily and require constant stimulation. To avoid boredom all elephant calves at CWRC are taken to the nearby protected area, the Panbari Reserve Forest for grazing and exercise. The calves have plenty of unbound space to expel all their energy, to explore the native vegetation, forage and play. Once a displaced calf brought to CWRC stabilizes and is feeding well it is introduced to the resident group and taken with them to the forest each day. This initiative was taken upon the advice of the David Sheldrick Wildlife Trust.

The older calves tend to stray away from the keepers while the younger milk-dependant ones stick around near the keepers. During the day in the reserve forest the keepers leave the calves to their own devices and sit up in a wooden "machan" which has been constructed atop a tree in order to keep an eye on the calves. The calves are brought back in the early evening hours to the stockade. The milk-dependant calves are given their bottles in the forest itself during the day.

The area around the CWRC campus is prime elephant habitat and wild elephants regularly visit the site. Howeve, so far the elephant calves at CWRC have had no head-on interaction with wild elephants. It is imperative however that the hand-raised elephant calves not only acclimatize to the wild environs but also have chance encounter with wild elephants in order to eventually re-integrate into the wild elephant community (Sheldrick, 2003).

Housing

A stabilization room or nursery for intensive care during the first few weeks of the calve's arrival is essential for treatment of injuries and acclimatization to the new environment. Currently due to shortage of space and a huge influx of elephant calves, two small bed-rooms on the campus which have been weather proofed are used as stabilization units for the elephant calves. These have complete provision of blankets, bedding and room heaters. However, the construction of a stabilization

room of 10x11x15 feet dimension per calf is under way.

A thick bedding of straw is provided for the elephants to settle down on. These are turned over and changed daily to avoid development of ammonia smell inside the room. The flooring of the room is concrete. There is a bamboo paddock where the eight elephant calves at CWRC are housed. The paddock has a shaded portion to protect the calves from harsh weather. It is also enriched with a small water pool for bathing the calf and natural toys like dead logs. The paddock furnishings are changed regularly to avoid boredom or monotony.

Keeper considerations and hygiene

A strict hygiene protocol is also vital for the success of any hand-raising exercise. All keepers before being handed over the responsibility of hand raising an elephant calf are screened for infectious diseases, especially tuberculosis and salmonellosis.

All keepers as a habit and routine maintain the strictest level of personal hygiene possible. Hands are washed before and after feeds. Footwear is kept clean at all times. There is separate footwear for the elephant stockade and nursery. All utensils used to prepare elephant food, bottles, teats, spoons and ladles are all sterilized before and after use. The elephant stockade and the nursery are fumigated once a week. They are cleaned with antiseptic solution like potassium permanganate (1 in 10000 solutions) and the floor is then allowed to dry.

The stool and urine inside the stockade and the nursery are removed immediately and the area which is soiled is swept with a disinfectant like chlorohexidine (Savlon). If the hindquarters of the calf are soiled then it is cleaned with warm water and wiped with a disinfectant immediately.

Bedding material such as straw is sun dried prior to use and changed daily as north-east India is extremely hot and humid. If the calves defecate while in the forest the stool is immediately buried in the soil.

Storing milk powder is a huge struggle at CWRC due to the high humidity year round. Great pains are taken to keep the containers and the storage room air-tight.

Diseases and problems of hand-raised elephant calves

Elephant calves when raised on a substitute diet, invariably get digestive disorders like diarrhoea, constipation and flatulence (Mukharjee *et al.,* 1997). The most commonly encountered problem while hand-raising elephant calves is diarrhoea often due to formula intolerance. Loose stool in a variety of colours may be "normal" for formula fed infants. Severely odorous stool may be abnormal. The frequency of stool production that is normal for one particular calf is helpful in determining the extent of

diarrhea when it occurs (Kinzley and Emanuelson, unpublished). The consistency and colour of the stool is monitored closely for any evidence of intolerance.

In the case of mild diarrhoea without any additional clinical signs, the dilution level of the formula is brought down to 25% to 50% for 2-3 days, or the formula is discontinued and substituted with any of the following three:

(i) Electrolyte solution

(ii) Rice water

(iii) A combination of diluted milk and electrolyte solutions in alternate feeds. In case of diarrhoea accompanied by other clinical signs such as lethargy, weakness, reduced appetite, colic or dehydration, diagnostic evaluation and treatment is provided.

Young calves under a month of age are often found with an open umbilicus, which is infected. Betadine solution is applied and the umbilicus is kept clean and dry. For the first month or so after the calves' arrival at the center initial weight loss is considered normal. The calves are obviously stressed and grieving and feeding is invariably low. The first set of molars erupts at three months of age and teething is always accompanied by discomfort and weight loss just like in human babies. Elephant calves often grind their teeth due to pain and tingling in the gums.

Constipation has been reported in mother-reared as well as hand-reared elephant calves. In two cases of elephant calves hand raised by WTI rehabilitators at Pakke Tiger Reserve and Rajaji National Park, elephant calves suffered from constipation following separation from the herd and near drowning in rapid river waters (Dargey Tsering, *pers. com.*) and change of formula.

Signs of constipation include listlessness, anorexia, abdominal contractions with no defecation (straining), absence of defecation and rubbing hindquarters against walls (Kinzley and Emanuelson, unpublished).

In extreme cases enema may be necessary on a daily basis; however intrusive measures should always be the last resort (Daphne Sheldrick, *pers. com.*, Dargey Tsering, *pers. com.*). Oral cathartics such as glycerin can be used. However these have to be used with extreme caution in very young animals as they could cause further abdominal discomfort. Two tablespoons of brown sugar mixed in the dilute formula has also proved to be successful in relieving constipation (Daphne Sheldrick, *pers. com.*).

Skin dryness has often been noted in elephant calves (Kinzley and Emanuelson, unpublished; Daphne Sheldrick, *pers. com.*). The dryness can cause pruritis resulting in the calf rubbing itself raw on doors, walls and tree trunks. This is treated with massaging coconut oil onto the skin. In extremely hot and dry climates rubbing plain earth has proved effective.

Imprinting

Hand-raised elephant calves require 24-hour care and companionship as they would receive in their natal herd. Therefore, it is near impossible not to imprint the calves. In the wild where elephants have a complex social structure, including a long developmental and dependency period not reaching sexual maturity until six to ten years of age (Rapaport *et al*., 1987). Allomothering behaviours, with individuals frequently touching or in close proximity, communication through infra sound as well as visual channels and frequent play are all important components in creating close family bonds (Lee and Moss, 1986; Moss, 1988; Poole, 1988).

Hand-raised elephants do not have this support nor the example of family members to follow and therefore have to learn about their environment through trial and error and whatever little their human family can teach them. However a rehabilitation protocol that emulates the environment of a wild elephant family, the hand-raised calves can learn the skills necessary to become independent of humans at a young age and to avoid conflict with humans (McKnight, 1995). CWRC has always strived to provide the elephant calves under its care an environment that will encourage the elephants to express their natural behaviour in order to return them to the wild as soon as possible. These practices were further re-inforced with training of WTI's rehabilitators at the David Sheldrick Wildlife Trust in Kenya.

Future plans

The ultimate goal of hand raising displaced wild elephant calves at CWRC is their eventual successful re-integration into the wild elephant community in Assam. WTI is currently working on building a facility off the CWRC campus for re-integration. However a suitable release site in prime elephant habitat with no prior history of human–elephant conflict is yet to be identified. WTI's elephant rehabilitation protocol too is still evolving and will be put forward for peer review at the international consultative workshop on Wildlife Rehabilitation that will be conducted by WTI and IFAW in February 2005.

What is in the pipeline is a field re-integration station, where the elephant calves will be moved to once they are weaned at the age of two years. The young elephant calves need to acclimatise to the natural environment, which is to be their future home and also need to be introduced to and socialised with their wild counterparts. The natural instincts of these elephant calves need to be honed. The switch however will be gradual with the keepers slowly withdrawing contact with the elephant calves. The elephant calves will be spending their entire day in the forest hopefully interacting with wild elephants and they will only return to the facility at night for rest. There is no fixed time frame or procedure followed by an elephant for re-integrating with a wild herd. It depends on each individual elephant when they choose to break away from the human family and join the wild elephant (Daphne Sheldrick, *pers. com.*).

Currently there are eight elephant calves being hand-raised at CWRC. Three of the male calves have already been weaned off milk and are effectively ready to be moved for rehabilitation to the field. Throughout the period of hand-raising at CWRC extreme care has been taken not to imprint any of the elephant calves in a detrimental way.

Rehabilitation: Problems and prospect

Rehabilitation and re-introduction programmes are complex and require monitoring and shared results (Box, 1991). When such a programme is to rehabilitate a highly intelligent and social animal such as the elephant there is an amalgam of biological, social, political and legal issues that need to be addressed.

CWRC is hand-raising elephant calves in a region where most of the loss of forest cover is in elephant habitats caused by encroachment and deforestation. Another matter of serious concern is the deliberate killing of elephants by angry farmers by poisoning or electrocution in retaliation against crop raiding by elephants. On an average 25 elephants die annually in the country due to poisoning—most cases being reported from Assam. In 2001, 13 cases of poisoning of elephants were officially reported from Sonitpur District (Bist, 2002). There is tremendous apathy towards elephants among the local people.

The site selected for rehabilitation of the hand-raised elephants will have to be a suitable habitat with adequate natural water source, preferably with no history of human–elephant conflict.

The major cause for concern is the unavoidable imprinting of the elephant calves. There is no guarantee that once rehabilitated the hand-raised elephants will not come into conflict with humans. However the David Sheldrick Wildlife Trust has successfully assimilated 16 hand-raised African elephants back into the wild community (Daphne Sheldrick, *pers. com*.) The elephant Transit Home in Udawalave National Park in Sri Lanka has released 39 Asian elephants in the wild of which 16 have successfully re-integrated into wild elephant herds (See Jayawardane, *et al.* in this issue). Six captive elephants have also been successfully rehabilitated in Doi Phameng Wildlife Sanctuary in Thailand (Sukumar, 2004). Rehabilitation of Asian elephants in Sri Lanka and African elephants in Kenya has succeeded inspite of high degree of human elephant conflict and tremendous threat from poaching.

The displaced elephant calves have no other options other than a lifetime in captivity in elephant camps or a chance for liberty through rehabilitation. Even if all captive elephants under private ownership are provided alternatives in the form of elephant sanctuaries, there will still be an influx of elephant calves brought to captivity for hand-raising. In the last four years itself 81 wild elephant calves have been displaced from their natal herds and brought into captivity for hand-raising (see Menon

et al. in this compendium). Therefore it is vital to explore rehabilitation as a possible option for displaced elephant calves. However, a lot needs to be done in creating awareness amongst the people who will be directly impacted by the rehabilitation exercise. Generating political and public will in favour of elephant rehabilitation will also go a long way in determining the success of CWRC's efforts.

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Reuniting Temporarily Displaced Elephant Calves with Wild Herds in Kaziranga National Park, Assam, India

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Introduction

Both wild and captive-born elephant calves sometimes have to be hand-raised due to various circumstances. Though the incidence of maternal rejection is very rare among captive elephants, the most common cause of elephant calves being marooned in the wild is due to man-made reasons (see Menon *et al.* in this compendium). In Assam, where wild elephants are distributed in a highly fragmented habitat, calves are often found in human habitats or degraded forests. Elephant calves sometimes get trapped either in man-made trenches or canals, tea gardens or are washed away by flood in the foothills. The natal herds leave behind the injured calf. Traditionally calves were taken to human custody for hand-raising and subsequent training for use as a captive elephant. In spite of a long history of captive elephant management in Assam, there is not even a single recorded case of marooned elephant calves being reunited with the natal herd. Few attempts made in the past have all failed to yield the deserved result. Thus, the theory still exists in Assam, that once the calf is handled by human beings, the mother rejects the calf.

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The Centre for Wildlife Rehabilitation and Conservation (CWRC) is a joint venture of the Wildlife Trust of India (WTI) and Department of Environment and Forest, Government of Assam supported by the International Fund for Animal Welfare (IFAW). The centre has successfully re-united four elephant calves with wild herds soon after their displacement. All four elephant calves received veterinary treatment for their minor injuries. These four cases are probably the first such reported incidents in northeast India of reuniting rescued elephant calves with wild elephants (perhaps their natal herd) after they were handled by humans for a certain period of time. CWRC has so far has successfully hand-reared eight elephant calves that could not be reunited (Table 1). In the following paragraphs, CWRC's experiences of reuniting temporarily displaced elephant calves with its natal herd are discussed.

Rescue of displaced elephant calves

Based on the information collected by CWRC, a minimum of 54 elephant calves have been found displaced or abandoned in Assam from 1988 to 2004 (Table 1). This figure is only a conservative estimate, as many cases of displacement would have gone unreported to the Forest Department. Moreover, this information is based on the information that reached CWRC as many cases of "rescue" either fail to get recorded or the data lies scattered in various divisional offices of the State Forest Departments.

Parameters	Assam State Zoo	CWRC	Others	Total
Total Number of Calves handled	32 (1988-2003)	20 (July 2000 – Aug 2004)	4 (July 2004- Aug 2004)	59
No. of calves successfully reunited with natal herd	Nil	4	Nil (attempted 3)	4
No. of calves successfully raised	18	8	Nil	26
No. of calves that died	14	7	4	25

Table 1: Fate of marooned elephant calves in Assam from 1988-2004 (based on information recorded at CWRC)

Re-uniting temporarily displaced elephant calves with wild herds

Any healthy animal, 'rescued' from the wild, is a potential candidate for return to the wild. From the records presented above, it is evident that an alarming number (66%, n= 54) of 'rescued' elephant calves invariably end up in Forest Department camps or in zoos for hand-rearing. The Wildlife Trust Of India and Kaziranga National Park management has been involved in the rescue and rehabilitation of wildlife in Assam since July 2000. The team has succeeded in reuniting four temporarily displaced

Sl.No.	Date of intervention	Place of intervention	Reason of displacement	Distance traveled (in kms) from site of intervention to site of reunion	Interval between intervention and reunion
1	09/09/2000	Baguri, Kaziranga National Park.	Swept in flood and separated from herd.	15	6 hrs
2	26/10/2001	Lakhojan Tea estate, Golaghat.	Trapped in tea garden trench	3	12 hrs
3	30/ 07/2003	Baghjan area, Burapahar, Kaziranga National Park.	Trapped in a snare	1	2 hrs
4	23/11/2004	Lakhojan Tea Estate, Golaghat.	Trapped in tea garden ditch	3	3 hrs

Table 2: Details of reunion of elephant calves with wild herds.

and disoriented elephant calves back with the natal herd within 24 hours of rescue (Table 2).

In all these four cases CWRC's rescue team arrived within a few hours of the separation of the calves from their mothers. Once the calves were spotted, the following protocol was employed. Only when all the efforts to return the calf to the mother failed was it taken to CWRC for hand-rearing.

The protocol

Calves of few weeks to three months old are restless and disoriented and they will have to be secured by human company at the 'rescue' site by holding a blanket or an umbrella in front them. The calf will try to follow the blanket or umbrella later. Calves of four months and above will be aggressive and need to be chemically restrained. The calf should not be touched and pampered too frequently. There should be minimum handling and every time the personnel does so he/she should wear disposable gloves. The calf should be examined for presence of any congenital deformity and injuries and treatment rendered for minor injuries. The reason of displacement should be figured out from circumstantial evidences. In the case of the calf being only temporarily displaced and not bearing any congenital anomalies and serious injuries, as encountered in most of the cases, then the elephant herd should be looked for in the vicinity.

Local people will be able to inform the rescue team of the probable locations of elephant herd and this can also be confirmed by indirect evidences like the presence of elephant dung feeding signs and movement tracks. The signs should be followed to locate the herd. Captive elephants can be engaged for the job, if available.

Once the presence of an elephant herd is confirmed, then the herd should be

checked for lactating females. It is important to verify if this identified group is the natal herd of the calf. If field conditions make this identification difficult, the herd in the nearest proximity of the 'rescue' should be taken as a potential natal herd and rehabilitation tried. The calf can then be walked down to the site with the help of the blankets, umbrella or captive elephants. If the distance is more then the calf should be taken covered with a blanket in a vehicle .

Fresh dung samples of the wild herd should be taken in a polythene bag and mixed with mud and applied over the body of the calf to prevent dehydration. This procedure also helps to get rid of any extraneous odour especially due to medication, or human handling.

Once the calf is near the herd, about 50 meters away, the response of the herd members should be noted from a distance without making any noise. It is to be made sure that there is no trench, pit, or water pool near that area. If any herd member tries to approach, the calf is left alone. The calf will also trumpet loudly in such circumstances and will help in letting the herd know of its whereabouts. People on captive elephants or on treetop will be able to monitor the proceedings.

The herd will encircle the calf and every member will inspect it with their trunks before accepting it. If the calf follows the herd successfully, follow the herd for a distance. The calf will suckle the mother immediately or after a brief period which can be taken as an indication of reunion. The herd should be followed for at least two to three days to confirm the success of reunion.

If all these efforts fail, the calf can be taken to the rescue centre for hand raising.

Discussion

Of the 20 cases of displaced elephant calves handled by CWRC, only on six occasions did the team get an opportunity to look for natal herds. Of these, the herd could be identified on five occasions. CWRC was successful four times out of these five attempts, with one calf being brought to captivity after three days. This calf had lameness and this could have been the reason for separation from the herd. In all cases, the team was not sure whether the herd was the actual herd of the displaced calf. In one case, the calf had struggled the whole night to come out from the tea garden ditch where it was trapped. As a result, the calf was already weak when seen by the tea garden workers in the morning. The local people also applied mustard oil on the body which they thought would help the calf regain its strength. The smell of the mustard oil was still there when the calf was reunited with a wild elephant herd.

After four successful attempts of reuniting calves by the CWRC team in Assam, it is time to get rid of the false notion that elephant calves once touched or handled cannot be reunited because of maternal rejection.

Rescue of Twin Elephant Calves (*Elephas maximus*) at Anaikatty, Coimbatore, India

B. Rathinasabapathy[1] **and R. Manickam**[2]

Introduction

The Coimbatore Zoological Park Society (CZPS) was established in 1986 and is located at Anaikatty (Anai- elephant, Katty- place) 30 km west of Coimbatore, occupying an area of 110 hectares at an altitude of 650 meters (11°6' N, 76°45'E). CZPS is recreating different vegetation types to simulate the forest types found in the Nilgiri Biosphere Reserve (NBR), Western Ghats, India. The zoo will be a replica of this Biosphere Reserve, focusing on the conservation of its flora and fauna, thus functioning as an interpretation centre for the NBR (Walker *et al.*, 1999 and 2004).

The reserve forest, which forms the eastern boundary of the CZPS site, is part of an elephant corridor linking the Mudumalai and Siruvani forests. In fact elephants radio collared in Mudumalai have been tracked and located in the reserve forests adjoining the zoo site. Sightings of wild elephants are more during the summer, particularly between May and August. A water tank (22 feet in length and 11 feet in width and 4 feet in depth) at the CZPS site, which is used for irrigation purposes, also fulfills the needs of wild animals.

The rescue

This note describes the rescue of twin elephant calves at the CZPS site, Anaikatty. A herd of wild elephants comprising 13 adults and twin calves entered the CZPS site on 13 February 2002. The herd comprised of adult and sub-adult males and females with apparently no tusker. It was reported that around 2 AM, the matriarch was heard trumpeting, followed by the other elephants in the herd. The pandemonium continued till morning, when CZPS workers inspected the site around 6 am and found that two calves were trapped inside the water tank. The Forest Department personnel

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were informed of the incident and efforts were taken to rescue the calves.

None of the members of the rescue team could approach the trapped calves as the elephants, especially the mother, refused to leave the place and often charged when approached. Chemical restraint was ruled out as it involved tranquilising more than 10 elephants. The only option was to raise the floor of the tank by dumping boulders in it. When the rescue operation started, the water level was half the level of the tank. The elephant used some water to spray around. During the rescue operation, the water level came down to 1.5 feet. The idea was to raise the water level by dumping stones, which would ultimately help the calves to climb out of the tank.

The adult elephants were driven away from the calves by shouting and bursting crackers to distract the mother's attention from the calves. These disturbances forced the other animals in the herd to move back to about 500-600 mts, but the mother elephant stayed back and made aggressive vocalisation and sprayed water towards the people surrounding the tank. Even when they were driven away, the elephants came back to the water tank at approximately five-minute intervals. Using this interval, the team managed to dump boulders and stones into the water tank without harming the calves. The dumping of stones was repeated for more than two hours to raise the water level of the tank. This helped the calves to climb on to them and assisted by the mother elephant, who used her trunk to lift them out. The calves were finally reunited with the herd.

This is not the first time that temporarily displaced elephant calves have been rehabilitated in Tamil Nadu. In 2000, one elephant calf was successfully returned to a wild herd in Mudumalai WLS (Menon, *pers. com*.).

Acknowledgments

Our thanks to Dr. N.S. Manoharan, Veterinary Officer, Coimbatore Corporation and the staff of the Tamil Nadu Forest Department, Coimbatore Circle for guiding us while rescuing the elephants. Thanks are also due to the Secretary of CZPS for his constant encouragement and support. Last but not the least to all the people who had assisted during the rescue operation.

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Release and Monitoring of Rehabilitated Asian Elephants (*Elephas maximus*) at the Elephant Transit Home, Udawalawe National Park, Sri Lanka

B.A.D.S. Jayawardane[1]

Introduction

The mega-herbivore, *Elephas maximus maximus* (Sri Lankan elephant), exists mainly in the dry zone of Sri Lanka with a population of around 4000 (Santiapillai and Jackson 1990). The very existence of this endemic sub-species of Asian elephant is threatened by degradation, fragmentation and loss of habitat.

The biggest threat to Sri Lanka's elephants is the ever-expanding agricultural and developmental activities and human habitations. There are four major irrigation schemes in Sri Lanka, which are affecting elephant habitats; the largest and the most ambitious is the Mahaweli-Ganga scheme. The recent human–elephant conflict in the north-west and north-east is due to this scheme (de Silva, 1998).

The deaths of adult female elephants, mainly due to human interferences and natural causes, have resulted in orphaned or abandoned elephant calves (Figure 1). Sometimes elephant calves move into habitats outside of the Protected Areas and face disasters like falling into wells dug for cultivation and illegal gem pits, getting trapped in mud holes, noose traps, etc. and eventually get displaced from the herds.

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Figure 1: Death of an adult female–resulting in an orphaned calf

The Department of Wildlife Conservation in Sri Lanka established an elephant orphanage in February, 1976 at Pinnawala in Kegalle district with the objective of caring for the orphaned or abandoned animals, both young and old, from the wild.

With the steady decline in the wild population, the re-integration of orphaned elephants back to their natural habitats became a necessity as a conservation measure to maintain the mega-herbivore populations in the wild.

Study area

In 1995, the Department of Wildlife Conservation (DWC) started a rehabilitation and reintegration program of young elephants, orphaned from the wild, back to the wild. The Elephant Transit Home (ETH) at Udawalawe National Park is the first of such facilities established for Asian elephants. The ETH is located at the south-west corner of the Udawalawe national park. The ground plan of ETH extends approximately over twenty hectares of land when the water retention of the Udawalawe reservoir is at full supply level (FSL).

Methods

Bringing orphaned elephants to ETH

The ETH receives elephant orphans from all over the country, where wild elephant habitats still exist. Approximately 69% of the orphans received at the centre come from the north-central province, where human-elephant conflict is intense. Officers

of the wildlife conservation department and the other government departments and villagers rescue the elephant orphans. The field veterinarians of the department of the wildlife provide the initial veterinary attention and care to the elephant calves before they are brought to ETH from these distant areas. Approximately 85% of the orphans received were in emaciated body condition. Their body condition score was below 5 points according to the body condition scoring system. Some animals were received in a recumbent state. The average annual mortality rate of the orphaned calves at the ETH is 12%.[1]

Feeding

The nutrition, health and rehabilitation program for orphans is managed at the site. The elephant calves are allowed minimum human contact. Only the ETH staff are allowed to handle the calves.

ETH premises

The premises includes a hospital facility/complex, an observation platform, a feeding area, tethering area, a natural grassland, a small shrub jungle patch, a cultivated grassland, inundated land and a created grassland at the north-west boundary of the ETH consisting of fodder grass species; Hamil (*Panicum maximum*) and Napier and fodder tree species like *Erythrena indica* (Figure 2). The natural grassland includes grasses and forages commonly found in Udawalawe NP. The shrub jungle patches are located at the south-east corner and north-east corner of the ETH premises. The tethering area (Figure 3) consists of an elephant shed and individual tethering logs fixed close to the elephant shed.

Figure 2: Shrub jungle patches and inundated area at ETH

[1]*(Ed note: This reported survival rate of 88% is much higher than the best centres in India where it does not surpass 66%)*

Figure 3: The feeding area and part of the tethering area

Results

Release

The elephant calves are weaned when they are over three years of age. Only when a group of socially bonded juveniles become totally dependent on grass and forage, are they released to Udawalawe National Park (Figures 4 and 5).

Figure 4: Release

The selected group of animals are then loaded into lorries after sedation and translocated to the middle of the developed part of the Udawalawe NP and are released. Selected individuals of the groups are radio-collared for post release monitoring. The females with matriarch characteristics, tuskers or dominant males are radio-collared.

Availability of ample green grass, fodder and fresh water in Udawalawe N.P is considered as a favorable environmental conditions for release. In the drought season the water retained in Udawalawe and Mau-ara reservoirs are released to the cultivations beyond the park boundaries. As the water level of these reservoirs decrease, palatable grass and legume species thrive. If the environment conditions are not favorable for elephants the release is postponed.

Year of release	No. of individuals	Male: Female ratio	Release sites at Udawalawe NP
March, 1998	04	3:1	Goonaviddagala
July, 2000	05	1:4	Boraluwala
January,2002	08	3:5	Goonaviddagala
June,2003	11	4:7	Boraluwala, Goonaviddagala, Seenuggala
March, 2004	11	7:4	Boraluwala , Jithwala, Seenuggala

Table 1: Composition of released groups/batches

In the six-year period between March 1998 and March 2004, 39 individuals were released in five batches where the minimum group composition was four individuals and the maximum was 11 (Table 1).

2. Monitoring of the released groups

The first batch

The post-release monitoring of the young elephants, is carried out by radio telemetry (Figure 6) and by direct observations of the individuals who are not collared by individual identification.

Three of the four animals in the first batch were radio-collared. The group had remained together for over five months and then dispersed and integrated into three wild herds. The only female in the group, had joined a wild female herd ranging in the area of Galamunawewa area (present Mau-arawewa area), which is an undeveloped part of Udawalawe NP. This wild herd was shy of vehicles and was very difficult to track even on foot for observation.

One of the radio-collared males was in a wild female herd that ranged mostly in the developed part of the Udawalawe NP and this individual was frequently observed moving by the side of the matriarch while the herd of twelve was on the move. The other male, a tusker and the eldest of the four, remained in a wild herd for ten months and started roaming with mature male groups. In 1999, ETH staff had to drive this male from cultivation areas towards the developed part of the park. In the same year, the elephant got stuck in mud at Thimbirimankada area, near the edge of the Udawalawe reservoir. However, the ETH staff were able to rescue it.

The following year, the animal's radio signals were received near the border of an elephant corridor and thereafter was untraceable. In July, 2003 the animal was re-sighted by the park staff (without the radio-collar) near Mau-ara area of the park and was identified by the body conformation. The first two elephants were de-collared in 2001.

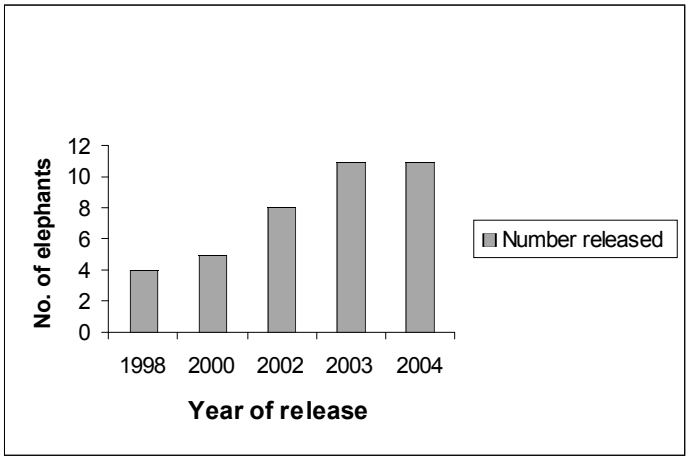

Figure 5: Number of elephant calves released at ETH, Udawalawe NP.

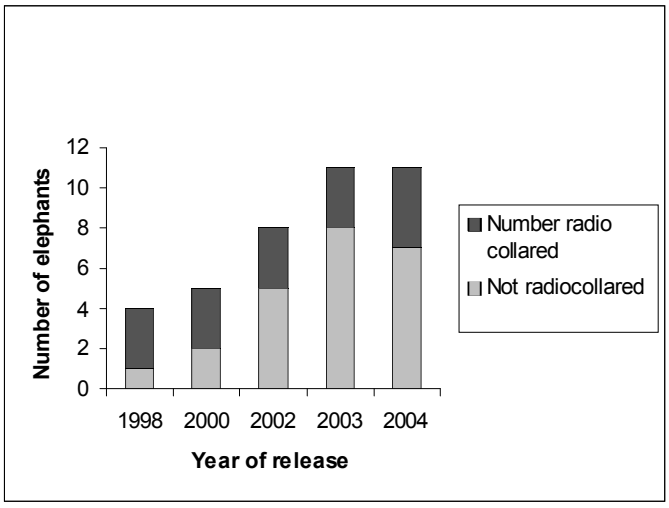

Figure 6: Elephants radio-collared before being released into the wild

Figure 7: Fourth batch–the ten individuals with wild adult males

The second batch

The second batch of five animals remained together for three months and integrated into two wild female herds that had overlapping home ranges. The male was in one herd and the four females were in the other herd. Harassments, like attacking (head pressing/wrestling) and kicking with hind leg were observed in some juveniles and calves of the wild herd during the early stages of reintegration. Counter attacking was also observed. These harassments waned after about one year of reintegration. After two years of reintegration, it was difficult to distinguish the released members from the wild juveniles. Collars were removed off the individuals of this batch in October 2003.

Figure 8: A juvenile on the left–established in a wild herd after three years

The third batch

Three individuals of the third batch of eight elephants were radio-collared with recycled radio-collars of the first batch. This group did not integrate into a wild herd till the time the collars were removed 15 months after the release. This was done as the collars were malfunctioning.

The fourth batch

The fourth batch consisted of eleven individuals who were released at three different sites at least four km from each other. The elephants got together 25 days after the release except one female which joined a wild herd, the day after the release. The other 10 animals roam together in a comparatively smaller home range. They were observed with wild female herds and adult males but such integrations were only for short periods (Figure 7).

The fifth batch

The last batch of eleven was also sub-grouped and released at three sites. Although the intention was to release them at least ten km apart, rainy weather prevented reaching the last site. Four of the elephants were radio collared. Initially five of the individuals reintegrated into wild female herds. In about one month's time two of the

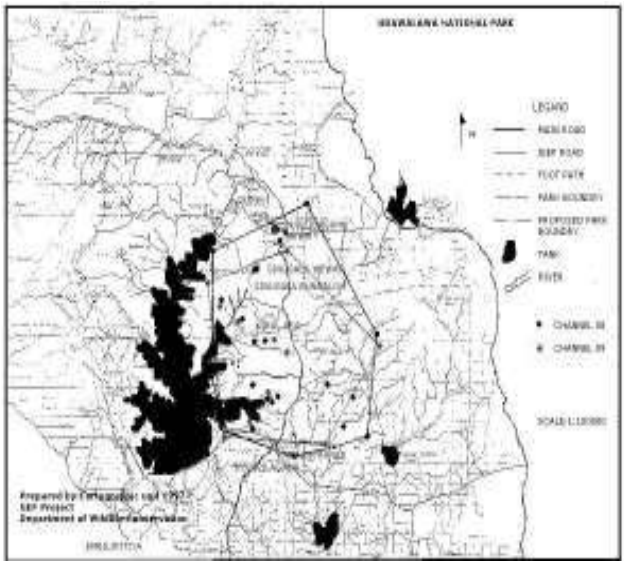

Figure 9: The area utilized/minimum convex polygon by two radio collared individuals of the second released batch

reintegrated individuals of the same batch joined the group of five animals that didn't integrate into wild herds. One month later one female (with a collar) in this group was found with a fracture in the hind leg. It was brought back to ETH for treatment. One of the females (without a radio collar) was observed by villagers five months after the release in the undeveloped part of the Udawalawe NP, adjacent to ETH, with a wild female herd and this female returned to ETH thereafter. One radio-collared male of the batch was in a wild female herd of eleven animals and one female in a wild female herd of two individuals (Figure 8). The remaining radio-collared animal, a tusker, joined several wild female herds for about three months and joined the four individuals of the same batch that remained without integrating to wild herds up to now.

ETH has so far released 39 young elephants to Udawalawe national park in five batches/groups. The post-release monitoring confirms that most of these juveniles have successfully adapted to the wild environment and are surviving well. Radio-collaring has proved to be of immense use in determining the success of the rehabilitation programme. The area utilized/minimum convex polygon by two radio-collared individuals of the second released batch is shown in Figure 9.

Discussion

The release to a habitat similar to the habitat at ETH, during favorable environmental conditions were advantageous for the elephants. Being with individuals that are well known and to whom they are bonded reduced the stress.

The segregation from the bonded elephant group at ETH and from their familiar environment are stresses in the method practiced at ETH to release young elephants. In contrast, the method practiced in Kenya (Sheldrick, 2002), is a gradual method and has less stress to the released individuals where they return back to the rehabilitation facility and continues the bond with humans.

The separation of animals from human contact at a younger age/weaning age helps to get rid of their imprinting on humans which is a prime concern of the method practiced at ETH to release young elephants to wild.

Out of the 39 released individuals, the monitoring records show that 16 individuals (41%) integrated in to wild female herds or groups led by wild matriarch. Except a male juvenile of the first batch that left the matriarch group, most of the released animals that are not integrated into wild herds have survived well as small wild groups.

Post-release monitoring shows that rehabilitation and re-integration of most of the young elephants is a success.

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Rehabilitation of Greater Adjutant Storks *(Leptoptilos dubius)* in Assam

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Introduction

The greater adjutant stork, *Leptoptilos dubius*, is one of two endangered storks found in India (Bird Life International, 2001) (Figure 1). Earlier widely distributed in south-east Asia, this stork is now confined mainly to India and Cambodia (Luthin, 1987, Anon, 1994). The major stronghold of this species is the Brahmaputra Valley of Assam, in India (Saikia and Bhattacharjee, 1989; Rahmani *et al.*, 1990). Approximately 1500 birds are left in India (Saikia and Bhattacharjee, 1989). The species has been categorised as 'Endangered' by IUCN. (CBSG, 1995)

The bird builds its nest on very tall trees that range from 65 to 100 feet in height. Every breeding season, around 15% chicks and juveniles fall from nests due to various reasons (Singha, 1998, 1999). Once they fall, most of them sustain major

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injuries and die. To save these birds from being killed, WTI along with local NGOs as an emergency relief measure tied nets under the nesting trees. Following this attempt the birds falling from the nests remained alive without any major injury. These fallen young storks were rescued and reared in captivity to be released back to the wild. With this idea, an effort was made to rescue the young storks and rehabilitate them in Pabitora Wildlife Sanctuary. This paper deals with the husbandry and management of the birds in captivity, their release and their monitoring after release.

Area of rehabilitation

Pabitora Wildlife sanctuary (N 26°12'–26°15', E 90°2'–90°5') is located 50 km east of Guwahati on the southern bank of the Brahmaputra river in Morigaon district of Assam. It covers an area of approximately 37 km^2. The sanctuary occupies a basin-like structure surrounded by the Mayong, Kamarpur and Manoha hills. The soil is mostly made up of riverine alluvial deposits, with a high percentage of clay in some places. The sanctuary is reported to have 80% grassland, 19% woodland and one percent wetland. The climate of the park is moist and tropical with rainfall distributed almost throughout the year. The site was selected for the project as it was the nearest Protected Area and human disturbances during the rearing process would be minimal.

Results

1. Collection and transport of fallen chicks

As an emergency relief measure, Wildlife Trust of India facilitated the 'Green Guard Nature Organisation' which came up with the idea of tying safety nets below the nesting trees on an experimental basis to prevent the fallen birds from being killed (Figure 2). Volunteers of local NGOs like 'Aaranyak' also helped. Out of the 11 nesting colonies of the greater adjutant storks found in the Brahmaputra valley, the one at Nagaon (26°21'N, 92°45' E) and the other at the district head quarter town of Nagaon district are two traditional nesting colonies (Singha *et al.*, 2002, 2003a). Besides accidental dropping, the young fall out of the nests during storms sweeping across Eastern and North Eastern India particularly during February and April (Singha, 1998).

On 23 February, 2001, three juveniles, nearly a month old, and a chick fell from their nests in Nagaon (see Singha *et al.*, 2003b). They were rescued and transported to Pabitora Wildlife Sanctuary in Morigaon district, 110 km from Nagaon by road. These young storks are referred to as the "first batch" hereafter. Two more juveniles were brought to the sanctuary on 14 March 2001. These will be referred to as the "second batch" hereafter.

The young birds were transported in cardboard boxes provided with small holes for ventilation. Inside the boxes, paddy straw and a folded gunny bag were placed as a

cushion for preventing injury to the keel during transportation. Food and water was not given to the birds during the journey. The vehicle was driven at a speed of 30–40 km/hour. The birds were examined periodically through the ventilation holes during the period of transportation.

After arrival, their weight was taken. The chicks weighed 1.2 kg, and the juveniles weighed 3-4 kgs. The hydration status of all the birds was assessed and rehydration solution (Ringer's lactate) was given orally. Oral Vitamin B-complex drops (commercial poultry formulation) was mixed with the rehydration fluid. The birds were gavage-fed (tube feeding) with the help of an infant feeding tube. They were kept in the same cardboard boxes overnight.

2. Captive management and husbandry

2.1 Housing

A small enclosure (3x3x2.5 m) made of bamboo and covered with a fishing net, was set up in the campus of the Range Office of Pabitora WLS. After their arrival, the birds were initially housed in this to acclimatise them to the new environment. Visual contacts with the keepers were kept to a minimum. The chicks of the first batch was reared in a bamboo basket with thatch and dead logs serving as a platform for the first two weeks. After this period of stabilization and acclimatisation, the bird was shifted to the bamboo and fishing net enclosure. A pre-release conditioning enclosure (4x4x4 m) was constructed near the first enclosure. The enclosure was covered by a fishing net. Some dead logs with branches were erected inside the enclosure for the juveniles to perch on. There was also a small pool inside the enclosure, providing wading facility to the birds.

2.2 Feed

Greater adjutant storks in the wild feed mainly on fish, frogs, snakes, molluscs and partly on carrion. They are reported to gather with others of their species and vultures and kites at carcasses and refuse dumps. They hunt small, live animals in typical stork fashion by stalking slowly through marshes and shallow waters.

The birds rescued were fed early in the morning and afternoon, with live fish and butchery waste. Food was provided in a shallow pit connected through a canal from outside. Initially the chick was fed approximately 20% of its body weight with a long fork made of bamboo. Gradually, as the chick grew in size it was fed approximately 10% of its body weight. As feed supplement, the birds were given "Calcicare syrup" (Calcium + Phosphorus + Vitamin D syrup) once a day. Once a week, "Minerex" powder (commercial mineral mixture for poultry) was given with the feed.

2.3 Clinical examination

The birds were periodically examined for clinical parameters, ecto-parasites and weight gain. The birds were not offered food prior to restraining to prevent the prob-

Figure 1: Greater adjutant stork (*Lepidoptilos dubius*)

ability of regurgitation during handling. They were restrained by throwing a towel over them and simultaneously covering the eyes with black cloth. The routine examination process took 15–20 minutes without any visible adverse effect of restraining. The clinical parameters of the birds were recorded periodically after their arrival in the sanctuary. The rectal temperature in restrained birds ranged from 106–108°F, the respiration rate 25–35 per minute, and the heart rate 140–160 per minute. For endo-parasitic infestation, fresh samples were collected once in a month and examined by both flotation and sedimentation method. Endoparasites, especially *Strongyle* spp. were dominant and treated with drugs of Benzimidazole group (Fenbendazole) orally. The birds had ecto-parasitic infestations, especially due to Menopon gallinae (see Singha *et al.*, 1999). They were dusted with "Notix" powder (Carbaryl dust).

2.4 Treatment of sick birds

One of the juveniles of the second batch had a penetrating wound on the left side of the chest and was bleeding on arrival. This bird was isolated immediately in a wooden box (4x4x6 feet size) for day-to-day handling and treatment. It was treated with topical application of Neosporin powder and oral administration of antibiotic (Amoxicillin and Cloxacillin, @7.5 mg/kg) twice daily for five consecutive days along with the feed. The wound healed completely after seven days.

On 15th May 2001, one of the juvenile storks developed a simple fracture on the left metatarsal bone due to infighting while in captivity. The injured bird was immediately restrained for examination and immobilisation of the fractured bone. Tape-splint was applied on the fractured bone and the bird was confined to a wooden box (3 x 3x6 feet) for restricted movement. The bird was provided a bedding of straw (1.5 inch thick) and newspapers. The droppings were cleaned daily and the bedding was changed twice a week. Food was offered directly to the bird. The bird was given "Renical" injection (calcium + phosphorus + vitamin D) twice a week during the period. After four weeks when the bird could put weight on the fractured limb, the tape splint was removed and the bird was transferred to the pre-release enclosure. Self-mutilation was not seen in the bird during the period of confinement.

2.5 Casualties in captivity

One of the three juveniles of the first batch had multiple compound fractures of both the hip-joint and humerus. The bird refused to feed. It died of hypovolaemic shock and starvation the next day (25 February, 2001). The chick of the first batch died on 27 March, 2001 after suffering for a month of acute diarrhoea, which was diagnosed as a case of salmonella later at the College of Veterinary Sciences, Guwahati.

2.6 Health screening before release

All the birds were screened for routine hematology, parasitic infestations and faecal cultures for Salmonella before the final release.

Blood smear for haemoprotozoon was found to be negative (N=4).

Hb (gm %)	: 12.6- 14.4
E.S.R.	: 11-18
P.C.V.	: 39.7-41.2

The birds that tested negative for the ectoparasite test were prepared to be released. Faecal cultures for salmonella done at the College of Veterinary Science, Guwahati had negative results.

3. Release and post-release monitoring

Once the juvenile birds of the first batch were seen flying within the enclosure and perching on the branches of the dead logs, they appeared to be ready for release. A colour band was put on the tarsus of two individual of the first batch and they were released at Jugdol *beel*, a marshy wetland, of Pabitora WLS on 18 March 2001. There were no wild adjutant storks in Pabitora at that time. After release, both the birds were monitored an hour each in the morning and afternoon from 18 March to 22 March 2001. On 22 March 2001, both the birds flew north and were never spotted in the sanctuary thereafter. The sanctuary staff were also engaged to report the sighting of the birds from different parts of the sanctuary but there were no further sightings.

Figure 2: Volunteers laying nets below the tall nesting trees

On 29 May 2001, two juveniles of the second batch were released at Haduk *beel*, a wetland inside the sanctuary. On 1 June 2001, the detection of the skeleton of one of the birds near the *beel*, suggested possible predation. The second bird was spotted outside the sanctuary, 150 m. away from the Range Office. The bird was captured with bait and nets and was put back in the enclosure. The bird was reared for two more weeks, and higher perching sites were made to encourage it roosting at a higher place. The bird was again released at the same site and was monitored as earlier. After two days, the bird was again spotted in the same place from where it had been recaptured. The bird being close to paddy fields, villagers were involved in giving information on the movement of the bird. The bird could be spotted for three weeks thereafter in and around the sanctuary and in the paddy fields. Subsequently, the bird was not spotted again.

4. Discussion

One of the biggest problems with hand-rearing birds is imprinting especially during feeding. The visual contact with keepers had to be as minimal as possible.

Experience showed that the enclosures were small for the bird. The height of the enclosures could have been increased from the present 4 to 10–15 m. Platforms for perching and wing-flapping activity could have been provided at a greater height. If the birds are not habituated to perching on higher levels, they are susceptible to pre-

dation at night. Probably, the juvenile that was predated upon during the project had either been resting on the ground or roosting at lower levels at night.

Infighting among the reared birds was noticed on a few occasions during feeding which could be attributed to natural intra-specific competition. These birds forage in flocks in the wild and it is always better to release them in pairs or groups. However, the releasing site also should be such that they can be monitored regularly.

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THE GUIDELINES AND STANDARDS

IUCN Position Statement on Translocation of Living Organisms

INTRODUCTIONS, REINTRODUCTIONS AND RESTOCKING

Prepared by the Species Survival Commission in collaboration with the Commission on Ecology, and the Commission on Environmental Policy, Law and Administration

Approved by the 22nd Meeting of the IUCN Council, Gland, Switzerland, 4 September 1987

Foreword

This statement sets out IUCN's position on translocation of living organisms, covering introductions, re-introductions and re-stocking. The implications of these three sorts of translocation are very different so the paper is divided into four parts dealing with Introductions, Re-introductions, Re-stocking and Administrative Implications, respectively.

Definitions

Translocation is the movement of living organisms from one area with free release in another. The three main classes of translocation distinguished in this document are defined as follows:

- Introduction of an organism is the intentional or accidental dispersal

by human agency of a living organism outside its historically known native range.

- Re-introduction of an organism is the intentional movement of an organism into a part of its native range from which it has disappeared or become extirpated in historic times as a result of human activities or natural catastrophe.
- Re-stocking is the movement of numbers of plants or animals of a species with the intention of building up the number of individuals of that species in an original habitat.

Translocations are powerful tools for the management of the natural and man made environment which, properly used, can bring great benefits to natural biological systems and to man, but like other powerful tools they have the potential to cause enormous damage if misused. This IUCN statement describes the advantageous uses of translocations and the work and precautions needed to avoid the disastrous consequences of poorly planned translocations.

Part I

Introductions

Background

Non-native (exotic) species have been introduced into areas where they did not formerly exist for a variety of reasons, such as economic development, improvement of hunting and fishing, ornamentation, or maintenance of the cultures of migrated human communities. The damage done by harmful introductions to natural systems far outweighs the benefit derived from them. The introduction and establishment of alien species in areas where they did not formerly occur, as an accidental or intended result of human activities, has often been directly harmful to the native plants and animals of many parts of the world and to the welfare of mankind.

The establishment of introduced alien species has broken down the genetic isolation of communities of co-evolving species of plants and animals. Such isolation has been essential for the evolution and maintenance of the diversity of plants and animals composing the biological wealth of our planet. Disturbance of this isolation by alien species has interfered with the dynamics of natural systems causing the premature extinction of species. Especially successful and aggressive invasive species of plants and animals increasingly dominate large areas having replaced diverse autochthonous communities. Islands, in the broad sense, including isolated biological systems such as lakes or isolated mountains, are especially vulnerable to introductions because their often simple ecosystems offer refuge for species that are not aggressive competitors. As a result of their isolation they are of special value because of high endemism (relatively large numbers of unique local forms) evolved

under the particular conditions of these islands over a long period of time. These endemic species are often rare and highly specialised in their ecological requirements and may be remnants of extensive communities from bygone ages, as exemplified by the *Pleistocene refugia* of Africa and Amazonia.
The diversity of plants and animals in the natural world is becoming increasingly important to man as their demands on the natural world increase in both quantity and variety, notwithstanding their dependence on crops and domestic animals nurtured within an increasingly uniform artificial and consequently vulnerable agricultural environment.

Introductions, can be beneficial to man. Nevertheless the following sections define areas in which the introduction of alien organisms is not conducive to good management, and describe the sorts of decisions that should be made before introduction of an alien species is made.

To reduce the damaging impact of introductions on the balance of natural systems, governments should provide the legal authority and administrative support that will promote implementation of the following approach.

Intentional Introduction

General

1. Introduction of an alien species should only be considered if clear and well defined benefits to man or natural communities can be foreseen.
2. Introduction of an alien species should only be considered if no native species is considered suitable for the purpose for which the introduction is being made.

Introductions to natural habitats

3. No alien species should be deliberately introduced into any natural habitat, island, lake, sea, ocean or centre of endemism, whether within or beyond the limits of national jurisdiction. A natural habitat is defined as a habitat not perceptibly altered by man. Where it would be effective, such areas should be surrounded by a buffer zone sufficiently large to prevent unaided spread of alien species from nearby areas. No alien introduction should be made within the buffer zone if it is likely to spread into neighbouring natural areas.

Introduction into semi-natural habitat

4. No alien species should be introduced into a semi-natural habitat unless there are exceptional reasons for doing so , and only when the operation has been comprehensively investigated and carefully planned in advance. A semi-natural habitat is one which has been detectably changed by man's actions or one which is managed by man, but still resembles a natural habitat in the diversity of its species and the complexity of their interrelationships. This excludes

arable farm land, planted ley pasture and timber plantations.

Introductions into man-made habitat

5. An assessment should be made of the effects on surrounding natural and semi-natural habitats of the introduction of any species, sub-species, or variety of plant to artificial, arable, ley pasture or other predominantly monocultural forest systems. Appropriate action should be taken to minimise negative effects.

Planning a beneficial introduction

6. Essential features of investigation and planning consist of:
   - an assessment phase culminating in a decision on the desirability of the introduction;
   - an experimental, controlled trial;
   - the extensive introduction phase with monitoring and follow-up.

The assessment phase

Investigation and planning should take the following factors into account:

a) No species should be considered for introduction to a new habitat until the factors which limit its distribution and abundance in its native range have been thoroughly studied and understood by competent ecologists and its probable dispersal pattern appraised.

Special attention should be paid to the following questions:

- What is the probability of the exotic species increasing in numbers so that it causes damage to the environment, especially to the biotic community into which it will be introduced?
- What is the probability that the exotic species will spread and invade habitats besides those into which the introduction is planned? Special attention should be paid to the exotic species' mode of dispersal.
- How will the introduction of the exotic proceed during all phases of the biological and climatic cycles of the area where the introduction is planned? It has been found that fire, drought and flood can greatly alter the rate of propagation and spread of plants.
- What is the capacity of the species to eradicate or reduce native species by interbreeding with them?
- Will an exotic plant interbreed with a native species to produce new species of aggressive polyploid invader? Polyploid plants often have the capacity to produce varied offspring some of which quickly adapt to and dominate, native floras and cultivars alike.
- Is the alien species the host to diseases or parasites communicable to other flora and fauna, man, their crops or domestic animals, in the area of introduction?

- What is the probability that the species to be introduced will threaten the continued existence or stability of populations of native species, whether as a predator, competitor for food, cover, breeding sites or in any other way? If the introduced species is a carnivore, parasite or specialised herbivore, it should not be introduced if its food includes rare native species that could be adversely affected.

b) There are special problems to be considered associated with the introduction of aquatic species. These species have a special potential for invasive spread.

- Many fish change trophic level or diet preference following introduction, making prediction of the results of the re-introduction difficult. Introduction of a fish or other species at one point on a river system or into the sea may lead to the spread of the species throughout the system or area with unpredictable consequences for native animals and plants. Flooding may transport introduced species from one river system to another.
- Introduced fish and large aquatic invertebrates have shown a great capacity to disrupt natural systems as their larval, sub-adult and adult forms often use different parts of the same natural system.

c) No introduction should be made for which a control does not exist or is not possible. A risk-and-threat analysis should be undertaken including investigation of the availability of methods for the control of the introduction should it expand in a way not predicted or have unpredicted undesirable effects, and the methods of control should be socially acceptable, efficient, should not damage vegetation and fauna, man, his domestic animals or cultivars.

d) When the questions above have been answered and the problems carefully considered, it should be decided if the species can reasonably be expected to survive in its new habitat, and if so, if it can reasonably be expected to enhance the flora and fauna of the area, or the economic or aesthetic value of the area, and whether these benefits outweigh the possible disadvantages revealed by the investigations.

The experimental controlled trial

Following a decision to introduce a species, a controlled experimental introduction should be made observing the following advice:

- Test plants and animals should be from the same stock as those intended to be extensively introduced.
- They should be free of diseases and parasites communicable to native species, man, his crops and domestic livestock.
- The introduced species' performance on parameters in 'the Assessment Phase' above should be compared with the pre-trial assessment, and the suitability of the species for introduction should be reviewed in light of the comparison.

The extensive introduction

If the introduced species behaves as predicted under the experimental conditions, then extensive introductions may commence but should be closely monitored. Arrangements should be made to apply counter measures to restrict, control, or eradicate the species if necessary.

The results of all phases of the introduction operation should be made public and available to scientists and others interested in the problems of introductions.
The persons or organisation introducing the species, not the public, should bear the cost of control of introduced organisms and appropriate legislation should reflect this.

Accidental introductions

1. Accidental introductions of species are difficult to predict and monitor, nevertheless they "should be discouraged where possible. The following actions are particularly important:

    - On island reserves, including isolated habitats such as lakes, mountain tops and isolated forests, and in wilderness areas, special care should be taken to avoid accidental introductions of seeds of alien plants on shoes and clothing and the introduction of animals especially associated with man, such as cats, dogs, rats and mice.
    - Measures, including legal measures, should be taken to discourage the escape of farmed, including captive-bred, alien wild animals and newly-domesticated species which could breed with their wild ancestors if they escaped.
    - In the interest of both agriculture and wildlife, measures should be taken to control contamination of imported agricultural seed with seeds of weeds and invasive plants.
    - Where large civil engineering projects are envisaged, such as canals, which would link different biogeographical zones, the implications of the linkage for mixing the fauna and flora of the two regions should be carefully considered. An example of this is the mixing of species from the Pacific and Caribbean via the Panama Canal, and the mixing of Red Sea and Mediterranean aquatic organisms via the Suez Canal. Work needs to be done to consider what measures can be taken to restrict mixing of species from different zones through such large developments.

2. Where an accidentally introduced alien successfully and conspicuously propagates itself, the balance of its positive and negative economic and ecological effects should be investigated. If the overall effect is negative, measures should be taken to restrict its spread.

Where alien species are already present

1. In general, introductions of no apparent benefit to man, but which are having a negative effect on the native flora and fauna into which they have been introduced, should be removed or eradicated. The present ubiquity of introduced species will put effective action against the majority of invasives beyond the means of many States but special efforts should be made to eradicate introductions on:

   - islands with a high percentage of endemics in the flora and fauna;
   - areas which are centres of endemism;
   - areas with a high degree of species diversity;
   - areas with a high degree of other ecological diversity;
   - areas in which a threatened endemic is jeopardised by the presence of the alien.

2. Special attention should be paid to feral animals. These can be some of the most aggressive and damaging alien species to the natural environment, but may have value as an economic or genetic resource in their own right, or be of scientific interest. Where a feral population is believed to have a value in its own right, but is associated with changes in the balance of native vegetation and fauna, the conservation of the native flora and fauna should always take precedence. Removal to captivity or domestication is a valid alternative for the conservation of valuable feral animals consistent with the phase of their evolution as domestic animals.

   Special attention should be paid to the eradication of mammalian feral predators from areas where there are populations of breeding birds or other important populations of wild fauna. Predatory mammals are especially difficult, and sometimes impossible to eradicate, for example, feral cats, dogs, mink, and ferrets.

3. In general, because of the complexity and size of the problem, but especially where feral mammals or several plant invaders are involved, expert advice should be sought on eradication.

Biological control

1. Biological control of introductions has shown itself to be an effective way of controlling and eradicating introduced species of plants and more rarely, of animals. As biological control involves introduction of alien species, the same care and procedures should be used as with other intentional introductions.

Micro-organisms

1. There has recently been an increase of interest in the use of micro-organ-

isms for a wide variety of purposes including those genetically altered by man. Where such uses involve the movement of micro-organisms to areas where they did not formerly exist, the same care and procedures should be used as set out above for other species.

Part II

The re-introduction of species*

- Re-introduction is the release of a species of animal or plant into an area in which it was indigenous before extermination by human activities or natural catastrophe. Re-introduction is a particularly useful tool for restoring a species to an original habitat where it has become extinct due to human persecution, over-collecting, over-harvesting or habitat deterioration, but where these factors can now be controlled.
- Re-introductions should only take place where the original causes of extinction have been removed.
- Re-introductions should only take place where the habitat requirements of the species are satisfied. There should be no re-introduction if a species became extinct because of habitat change which remains unremedied, or where significant habitat deterioration has occurred since the extinction.

The species should only be re-introduced if measures have been taken to reconstitute the habitat to a state suitable for the species.

- The basic programme for re-introduction should consist of:
  - a feasibility study;
  - a preparation phase;
  - release or introduction phase; and a
  - follow-up phase.

The feasibility study

An ecological study should assess the previous relationship of the species to the habitat into which the re-introduction is to take place, and the extent that the habitat has changed since the local extinction of the species. If individuals to be re-introduced have been captive-bred or cultivated, changes in the species should also be taken into account and allowances made for new features liable to affect the ability of the animal or plant to re-adapt to its traditional habitat.

The attitudes of local people must be taken into account especially if the reintroduction of a species that was persecuted, over-hunted or over collected , is proposed. If the attitude of local people is unfavorable an education and interpretive programme emphasizing the benefits to them of the re-introduction, or other inducement, should be used to improve their attitude before re-introduction takes place.

The animals or plants involved in the re-introduction must be of the closest available

race or type to the original stock and preferably be the same race as that previously occurring in the area.

Before commencing a re-introduction project, sufficient funds must be available to ensure that the project can be completed, including the follow-up phase.

The preparation and release or introductory phases

The successful re-introduction of an animal or plant requires that the biological needs of the species be fulfilled in the area where the release is planned. This requires a detailed knowledge of both the needs of the animal or plant and the ecological dynamics of the area of re-introduction. For this reason the best available scientific advice should be taken at all stages of a species re-introduction.

This need for clear analysis of a number of factors can be clearly seen with reference to introductions of ungulates such as ibex, antelope and deer where re-introduction involves understanding and applying the significance of factors such as the ideal age for re-introducing individuals, ideal sex ratio, season, specifying capture techniques and mode of transport to re-introduction site, freedom of both the species and the area of introduction from disease and parasites, acclimatisation, helping animals to learn to forage in the wild, adjustment of the gut flora to deal with new forage, 'imprinting' on the home range, prevention of wandering of individuals from the site of re-introduction, and on-site breeding in enclosures before release to expand the released population and acclimatise the animals to the site. The re-introduction of other taxa of plants and animals can be expected to be similarly complex.

Follow-up phase

Monitoring of released animals must be an integral part of any re-introduction programme. Where possible there should be long-term research to determine the rate of adaptation and dispersal, the need for further releases and identification of the reasons for success or failure of the programme.

The species impact on the habitat should be monitored and any action needed to improve conditions identified and taken.

Efforts should be made to make available information on both successful and unsuccessful re-introduction programmed through publications, seminars and other communications.

Part III

Restocking

1. Restocking is the release of a plant or animal species into an area in which it is already present. Restocking may be a useful tool where:

    - it is feared that a small reduced population is becoming dangerously

inbred; or

- where a population has dropped below critical levels and recovery by natural growth will be dangerously slow; or
- where artificial exchange and artificially-high rates of immigration are required to maintain outbreeding between small isolated populations on biogeographical islands.

2. In such cases care should be taken to ensure that the apparent nonviability of the population, results from the genetic institution of the population and not from poor species management which has allowed deterioration in the habitat or over-utilisation of the population. With good management of a population the need for re-stocking should be avoidable but where re-stocking is contemplated the following points should be observed:

   a) Restocking with the aim of conserving a dangerously reduced population should only be attempted when the causes of the reduction have been largely removed and natural increase can be excluded.

   b) Before deciding if restocking is necessary, the capacity of the area it is proposed to restock should be investigated to assess if the level of the population desired is sustainable. If it is, then further work should be undertaken to discover the reasons for the existing low population levels. Action should then be taken to help the resident population expand to the desired level. Only if this fails should restocking be used.

3. Where there are compelling reasons for restocking the following points should be observed.

   a) Attention should be paid to the genetic constitution of stocks used for restocking.
      - In general, genetic manipulation of wild stocks should be kept to a minimum as it may adversely affect the ability of a species or population to survive. Such manipulations modify the effects of natural selection and ultimately the nature of the species and its ability to survive.
      - Genetically impoverished or cloned stocks should not be used to restock populations as their ability to survive would be limited by their genetic homogeneity.

   b) The animals or plants being used for re-stocking must be of the same race as those in the population into which they are released.

   c) Where a species has an extensive natural range and restocking has

the aim of conserving a dangerously reduced population at the climatic or ecological edge of its range, care should be taken that only individuals from a similar climatic or ecological zone are used since interbreeding with individuals from an area with a milder climate may interfere with resistant and hardy genotypes on the population's edge.

d) Introduction of stock from zoos may be appropriate, but the breeding history and origin of the animals should be known and follow as closely as possible Assessment Phase guidelines a, b, c and d (see pages 5-7). In addition the dangers of introducing new diseases into wild populations must be avoided: this is particularly important with primates that may carry human zoonoses.

e) Restocking as part of a sustainable use of a resource (e.g. release of a proportion of crocodiles hatched from eggs taken from farms) should follow guidelines a and b (above).

f) Where restocking is contemplated as a humanitarian effort to release or rehabilitate captive animals it is safer to make such releases as re-introductions where there is no danger of infecting wild populations of the same species with new diseases and where there are no problems of animals having to be socially accepted by wild individuals of the species.

Part IV

National, international and scientific implications of translocations

National administration

1. Pre-existing governmental administrative structures and frameworks already in use to protect agriculture, primary industries, wilderness and national parks should be used by governments to control both intentional and unintentional importation of organisms, especially through use of plant and animal quarantine regulations.

2. Governments should set up or utilise pre-existing scientific management authorities or experts in the fields of biology, ecology and natural resource management to advise them on policy matters concerning translocations and on individual cases where an introduction, re-introduction or restocking or farming of wild species is proposed.

3. Governments should formulate national policies on:

- translocation of wild species;
- capture and transport of wild animals;
- artificial propagation of threatened species;
- selection and propagation of wild species for domestication; and
- prevention and control of invasive alien species.

4. At the national level legislation is required to curtail introductions:

Deliberate introductions should be subject to a permit system. The system should apply not only to species introduced from abroad but also to native species introduced to a new area in the same country. It should also apply to restocking.

Accidental introductions

- for all potentially harmful organisms there should be a prohibition to import them and to trade in them except under a permit and under very stringent conditions. This should apply in particular to the pet trade;
- where a potentially harmful organism is captive bred for commercial purposes (e.g. mink) there should be established by legislation strict standards for the design and operation of the captive breeding facilities. In particular, procedures should be established for the disposal of the stock of animals in the event of a discontinuation of the captive breeding operation;
- there should be strict controls on the use of live fish bait to avoid inadvertent introductions of species into water where they do not naturally occur.

Penalties

5. Deliberate introductions without a permit as well as negligence resulting in the escape or introduction of species harmful to the environment should be considered criminal offences and punished accordingly. The author of a deliberate introduction without a permit or the person responsible for an introduction by negligence should be legally liable for the damage incurred and should in particular bear the costs of eradication measures and of habitat restoration where required.

International administration

Movement of Introduced Species Across International Boundaries

1. Special care should be taken to prevent introduced species from crossing the borders of a neighboring state. When such an occurrence is probable, the neighboring state should be promptly warned and consultations should be held in order to take adequate measures.

The Stockholm Declaration

2. According to Principle 21 of the Stockholm Declaration on the Human

Environment, states have the responsibility 'to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states'.

International Codes of Practice, Treaties and Agreements

3. States should be aware of the following international agreements and documents relevant to translocation of species:

   - ICES, Revised Code of Practice to Reduce the Risks from introduction of Marine Species, 1982.
   - FAO, Report of the Expert Consultation on the Genetic Resources of Fish, Recommendations to Governments No L 1980.
   - EIFAC (European Inland Fisheries Advisory Commission), Report of the Working Party on Stock Enhancement, Hamburg, FRG 1983.
   - The Bonn Convention MSC: Guidelines for Agreements under the Convention.
   - The Berne Convention: the Convention on the Conservation of European wildlife and Natural Habitats.
   - The ASEAN Agreement on the Conservation of Nature and Natural Resources.
   - Law of the Sea Convention, article 196.
   - Protocol on Protected Areas and Wild Fauna and Flora in Eastern African Region.

   In addition to the international agreements and documents cited, States also should be aware of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). International shipments of endangered or threatened species listed in the Appendices to the Convention are subject to CITES regulation and permit requirements. Enquiries should be addressed to: CITES Secretariat**, Case Postale 456, CH-1219 Chatelaine, Genève, Switzerland; telephone: 41/22/979 9149, fax: 41/22/797 3417.

Regional development plans

4. International, regional or country development and conservation organisations, when considering international, regional or country conservation strategies or plans, should include in-depth studies of the impact and influence of introduced alien species and recommend appropriate action to ameliorate or bring to an end their negative effects.

Scientific work needed

5. A synthesis of current knowledge on introductions, re-introductions and re-stocking is needed.

6. Research is needed on effective, target specific, humane and socially acceptable methods of eradication and control of invasive alien species.
7. The implementation of effective action on introductions, re-introductions and re-stocking frequently requires judgements on the genetic similarity of different stocks of a species of plant or animal. More research is needed on ways of defining and classifying genetic types.

8. Research is needed on the way in which plants and animals are dispersed through the agency of man (dispersal vector analysis).

A review is needed of the scope, content and effectiveness of existing legislation relating to introductions.

IUCN responsibilities

International organisations, such as UNEP, UNESCO and FAO, as well as states planning to introduce, re-introduce or restock taxa in their territories, should provide sufficient funds, so that IUCN as an international independent body, can do the work set out below and accept the accompanying responsibilities.

9. IUCN will encourage collection of information on all aspects of introductions, re-introductions and restocking, but especially on the case histories of re-introductions; on habitats especially vulnerable to invasion; and notable aggressive invasive species of plants and animals.

Such information would include information in the following categories:

- a bibliography of the invasive species;
- the taxonomy of the species;
- the synecology of the species; and
- methods of control of the species.

10. The work of the Threatened Plants Unit of IUCN defining areas of high plant endemism, diversity and ecological diversity should be encouraged so that guidance on implementing recommendations in this document may be available.

11. A list of expert advisors on control and eradication of alien species should be available through IUCN.

IUCN/SSC Guidelines for Re-Introductions

*Prepared by the SSC Re-introduction Specialist Group**

Approved by the 41st Meeting of the IUCN Council,
Gland Switzerland, May 1995

Introduction

These policy guidelines have been drafted by the Re-introduction Specialist Group of the IUCN's Species Survival Commission (1), in response to the increasing occurrence of re-introduction projects worldwide, and consequently, to the growing need for specific policy guidelines to help ensure that the re-introductions achieve their intended conservation benefit, and do not cause adverse side-effects of greater impact. Although IUCN developed a Position Statement on the translocation of living organisms in 1987, more detailed guidelines were felt to be essential in providing more comprehensive coverage of the various factors involved in re-introduction exercises.

These guidelines are intended to act as a guide for procedures useful to re-introduction programmes and do not represent an inflexible code of conduct. Many of the points are more relevant to re-introductions using captive-bred individuals than to translocations of wild species. Others are especially relevant to globally endangered species with limited numbers of founders. Each re-introduction proposal should be rigorously reviewed on its individual merits. It should be noted that re-introduction is always a very lengthy, complex and expensive process.

Re-introductions or translocations of species for short-term, sporting or commercial

purposes - where there is no intention to establish a viable population - are a different issue and beyond the scope of these guidelines. These include fishing and hunting activities.
This document has been written to encompass the full range of plant and animal taxa and is therefore general. It will be regularly revised. Handbooks for re-introducing individual groups of animals and plants will be developed in future.

Context

The increasing number of re-introductions and translocations led to the establishment of the IUCN/SSC Species Survival Commission's Re-introduction Specialist Group. A priority of the Group has been to update IUCN's 1987 Position Statement on the Translocation of Living Organisms, in consultation with IUCN's other commissions.

It is important that the Guidelines are implemented in the context of IUCN's broader policies pertaining to biodiversity conservation and sustainable management of natural resources. The philosophy for environmental conservation and management of IUCN and other conservation bodies is stated in key documents such as "Caring for the Earth" and "Global Biodiversity Strategy" which cover the broad themes of the need for approaches with community involvement and participation in sustainable natural resource conservation, an overall enhanced quality of human life and the need to conserve and, where necessary, restore ecosystems. With regards to the latter, the re-introduction of a species is one specific instance of restoration where, in general, only this species is missing. Full restoration of an array of plant and animal species has rarely been tried to date.

Restoration of single species of plants and animals is becoming more frequent around the world. Some succeed, many fail. As this form of ecological management is increasingly common, it is a priority for the Species Survival Commission's Re-introduction Specialist Group to develop guidelines so that re-introductions are both justifiable and likely to succeed, and that the conservation world can learn from each initiative, whether successful or not. It is hoped that these Guidelines, based on extensive review of case - histories and wide consultation across a range of disciplines will introduce more rigour into the concepts, design, feasibility and implementation of re-introductions despite the wide diversity of species and conditions involved.

Thus the priority has been to develop guidelines that are of direct, practical assistance to those planning, approving or carrying out re-introductions. The primary audience of these guidelines is, therefore, the practitioners (usually managers or scientists), rather than decision makers in governments. Guidelines directed towards the latter group would inevitably have to go into greater depth on legal and policy issues.

1. Definition of terms

"Re-introduction": an attempt to establish a species (2) in an area which was once part of its historical range, but from which it has been extirpated or become extinct (3) ("Re-establishment" is a synonym, but implies that the re-introduction has been successful).

"Translocation": deliberate and mediated movement of wild individuals or populations from one part of their range to another.

"Re-inforcement/supplementation": addition of individuals to an existing population of conspecifics.

"Conservation/benign introductions": an attempt to establish a species, for the purpose of conservation, outside its recorded distribution but within an appropriate habitat and eco-geographical area. This is a feasible conservation tool only when there is no remaining area left within a species' historic range.

2. Aims and objectives of re-introduction

a. Aims:
The principle aim of any re-introduction should be to establish a viable, free-ranging population in the wild, of a species, subspecies or race, which has become globally or locally extinct, or extirpated, in the wild. It should be re-introduced within the species' former natural habitat and range and should require minimal long-term management.

b. Objectives:
The objectives of a re-introduction may include: to enhance the long-term survival of a species; to re-establish a keystone species (in the ecological or cultural sense) in an ecosystem; to maintain and/or restore natural biodiversity; to provide long-term economic benefits to the local and/or nataional economy; to promote conservation awareness; or a combination of these.

3. Multidisciplinary approach

A re-introduction requires a multidisciplinary approach involving a team of persons drawn from a variety of backgrounds. As well as government personnel, they may include persons from governmental natural resource management agencies; non-governmental organisations; funding bodies; universities; veterinary institutions; zoos (and private animal breeders) and/or botanic gardens, with a full range of suitable expertise. Team leaders should be responsible for coordination between the various bodies and provision should be made for publicity and public education about the project.

4. Pre-project activities

4a. Biological

(i) Feasibility study and background research

- An assessment should be made of the taxonomic status of individuals to be re-introduced. They should preferably be of the same subspecies or race as those which were extirpated, unless adequate numbers are not available. An investigation of historical information about the loss and fate of individuals from the re-introduction area, as well as molecular genetic studies, should be undertaken in case of doubt as to individuals' taxonomic status. A study of genetic variation within and between populations of this and related taxa can also be helpful. Special care is needed when the population has long been extinct.
- Detailed studies should be made of the status and biology of wild populations (if they exist) to determine the species' critical needs. For animals, this would include descriptions of habitat preferences, intra-specific variation and adaptations to local ecological conditions, social behaviour, group composition, home range size, shelter and food requirements, foraging and feeding behaviour, predators and diseases. For migratory species, studies should include the potential migratory areas. For plants, it would include biotic and abiotic habitat requirements, dispersal mechanisms, reproductive biology, symbiotic relationships (e.g. with mycorrhizae, pollinators), insect pests and diseases. Overall, a firm knowledge of the natural history of the species in question is crucial to the entire re-introduction scheme.
- The species, if any, that has filled the void created by the loss of the species concerned, should be determined; an understanding of the effect the re-introduced species will have on the ecosystem is important for ascertaining the success of the re-introduced population.
- The build-up of the released population should be modelled under various sets of conditions, in order to specify the optimal number and composition of individuals to be released per year and the numbers of years necessary to promote establishment of a viable population.
- A Population and Habitat Viability Analysis will aid in identifying significant environmental and population variables and assessing their potential interactions, which would guide long-term population management.

(ii) Previous re-introductions

- Thorough research into previous re-introductions of the same or similar species and wide-ranging contacts with persons having relevant expertise should be conducted prior to and while developing re-introduction protocol.

(iii) Choice of release site and type

- Site should be within the historic range of the species. For an initial re-inforcement there should be few remnant wild individuals. For a re-introduction, there should be no remnant population to prevent disease spread, social disruption and

introduction of alien genes. In some circumstances, a re-introduction or re-inforcement may have to be made into an area which is fenced or otherwise delimited, but it should be within the species' former natural habitat and range.

- A conservation/ benign introduction should be undertaken only as a last resort when no opportunities for re-introduction into the original site or range exist and only when a significant contribution to the conservation of the species will result.
- The re-introduction area should have assured, long-term protection (whether formal or otherwise).

(iv) Evaluation of re-introduction site

- Availability of suitable habitat: re-introductions should only take place where the habitat and landscape requirements of the species are satisfied, and likely to be sustained for the for-seeable future. The possibility of natural habitat change since extirpation must be considered. Likewise, a change in the legal/ political or cultural environment since species extirpation needs to be ascertained and evaluated as a possible constraint. The area should have sufficient carrying capacity to sustain growth of the re-introduced population and support a viable (self-sustaining) population in the long run.
- Identification and elimination, or reduction to a sufficient level, of previous causes of decline: could include disease; over-hunting; over-collection; pollution; poisoning; competition with or predation by introduced species; habitat loss; adverse effects of earlier research or management programmes; competition with domestic livestock, which may be seasonal. Where the release site has undergone substantial degradation caused by human activity, a habitat restoration programme should be initiated before the re-introduction is carried out.

(v) Availability of suitable release stock

- It is desirable that source animals come from wild populations. If there is a choice of wild populations to supply founder stock for translocation, the source population should ideally be closely related genetically to the original native stock and show similar ecological characteristics (morphology, physiology, behaviour, habitat preference) to the original sub-population.
- Removal of individuals for re-introduction must not endanger the captive stock population or the wild source population. Stock must be guaranteed available on a regular and predictable basis, meeting specifications of the project protocol.
- Individuals should only be removed from a wild population after the effects of translocation on the donor population have been assessed, and after it is guaranteed that these effects will not be negative.
- If captive or artificially propagated stock is to be used, it must be from a population which has been soundly managed both demographically and genetically, according to the principles of contemporary conservation biology.
- Re-introductions should not be carried out merely because captive stocks exist, nor solely as a means of disposing of surplus stock.
- Prospective release stock, including stock that is a gift between governments,

must be subjected to a thorough veterinary screening process before shipment from original source. Any animals found to be infected or which test positive for non-endemic or contagious pathogens with a potential impact on population levels, must be removed from the consignment, and the uninfected, negative remainder must be placed in strict quarantine for a suitable period before retest. If clear after retesting, the animals may be placed for shipment.

- Since infection with serious disease can be acquired during shipment, especially if this is intercontinental, great care must be taken to minimize this risk.
- Stock must meet all health regulations prescribed by the veterinary authorities of the recipient country and adequate provisions must be made for quarantine if necessary.

(vi) Release of captive stock

- Most species of mammal and birds rely heavily on individual experience and learning as juveniles for their survival; they should be given the opportunity to acquire the necessary information to enable survival in the wild, through training in their captive environment; a captive bred individual's probability of survival should approximate that of a wild counterpart.
- Care should be taken to ensure that potentially dangerous captive bred animals (such as large carnivores or primates) are not so confident in the presence of humans that they might be a danger to local inhabitants and/or their livestock.

4b. Socio-economic and legal requirements

- Re-introductions are generally long-term projects that require the commitment of long-term financial and political support.
- Socio-economic studies should be made to assess impacts, costs and benefits of the re-introduction programme to local human populations.
- A thorough assessment of attitudes of local people to the proposed project is necessary to ensure long term protection of the re-introduced population, especially if the cause of species' decline was due to human factors (e.g. over-hunting, over-collection, loss or alteration of habitat). The programme should be fully understood, accepted and supported by local communities.
- Where the security of the re-introduced population is at risk from human activities, measures should be taken to minimise these in the re-introduction area. If these measures are inadequate, the re-introduction should be abandoned or alternative release areas sought.
- The policy of the country to re-introductions and to the species concerned should be assessed. This might include checking existing provincial, national and international legislation and regulations, and provision of new measures and required permits as necessary.
- Re-introduction must take place with the full permission and involvement of all relevant government agencies of the recipient or host country. This is particularly important in re-introductions in border areas, or involving more than one state or when a re-introduced population can expand into other states, provinces or ter-

ritories.

- If the species poses potential risk to life or property, these risks should be minimised and adequate provision made for compensation where necessary; where all other solutions fail, removal or destruction of the released individual should be considered. In the case of migratory/mobile species, provisions should be made for crossing of international/state boundaries.

5. Planning, preparation and release stages

- Approval of relevant government agencies and land owners, and coordination with national and international conservation organizations.
- Construction of a multidisciplinary team with access to expert technical advice for all phases of the programme.
- Identification of short- and long-term success indicators and prediction of programme duration, in context of agreed aims and objectives.
- Securing adequate funding for all programme phases.
- Design of pre- and post- release monitoring programme so that each re-introduction is a carefully designed experiment, with the capability to test methodology with scientifically collected data. Monitoring the health of individuals, as well as the survival, is important; intervention may be necessary if the situation proves unforseeably favourable.
- Appropriate health and genetic screening of release stock, including stock that is a gift between governments. Health screening of closely related species in the re-introduction area.
- If release stock is wild-caught, care must be taken to ensure that: a) the stock is free from infectious or contagious pathogens and parasites before shipment and b) the stock will not be exposed to vectors of disease agents which may be present at the release site (and absent at the source site) and to which it may have no acquired immunity.
- If vaccination prior to release, against local endemic or epidemic diseases of wild stock or domestic livestock at the release site, is deemed appropriate, this must be carried out during the "Preparation Stage" so as to allow sufficient time for the development of the required immunity.
- Appropriate veterinary or horticultural measures as required to ensure health of released stock throughout the programme. This is to include adequate quarantine arrangements, especially where founder stock travels far or crosses international boundaries to the release site.
- Development of transport plans for delivery of stock to the country and site of re-introduction, with special emphasis on ways to minimize stress on the individuals during transport.
- Determination of release strategy (acclimatization of release stock to release area; behavioural training - including hunting and feeding; group composition, number, release patterns and techniques; timing).
- Establishment of policies on interventions (see below).

- Development of conservation education for long-term support; professional training of individuals involved in the long-term programme; public relations through the mass media and in local community; involvement where possible of local people in the programme.
- The welfare of animals for release is of paramount concern through all these stages.

6. Post-release activities

- Post release monitoring is required of all (or sample of) individuals. This most vital aspect may be by direct (e.g. tagging, telemetry) or indirect (e.g. spoor, informants) methods as suitable.
- Demographic, ecological and behavioural studies of released stock must be undertaken.
- Study of processes of long-term adaptation by individuals and the population.
- Collection and investigation of mortalities.
- Interventions (e.g. supplemental feeding; veterinary aid; horticultural aid) when necessary.
- Decisions for revision, rescheduling, or discontinuation of programme where necessary.
- Habitat protection or restoration to continue where necessary.
- Continuing public relations activities, including education and mass media coverage.
- Evaluation of cost-effectiveness and success of re- introduction techniques.
- Regular publications in scientific and popular literature.

Footnotes:

1 Guidelines for determining procedures for disposal of species confiscated in trade are being developed separately by IUCN.

2 The taxonomic unit referred to throughout the document is species; it may be a lower taxonomic unit (e.g. subspecies or race) as long as it can be unambiguously defined.

3 A taxon is extinct when there is no reasonable doubt that the last individual has died

** The IUCN/SSC Re-introduction Specialist Group (RSG) is a disciplinary group (as opposed to most SSC Specialist Groups which deal with single taxonomic groups), covering a wide range of plant and animal species. The RSG has an extensive international network, a re-introduction projects database and re-introduction library. The RSG publishes a bi-annual newsletter RE-INTRODUCTION NEWS.*

Guidelines for Nonhuman Primate Re-introductions

Prepared by the Re-introduction Specialist Group of The World Conservation Union (IUCN) Species Survival Commission (Edited by Lynne R. Baker)

DRAFT DOCUMENT

I. Context of Guidelines

The IUCN/Species Survival Commission's (SSC's) Re-introduction Specialist Group was established in 1988 in response to an increasing number of plant and animal re-introductions worldwide.

The IUCN/SSC Re-introduction Specialist Group: Guidelines for Nonhuman Primate Re-introductions (2001) has been prepared for the Re-introduction Specialist Group by Lynne R. Baker. The document is based on the IUCN Guidelines for Re-introductions (1998), IUCN Guidelines for the Placement of Confiscated Animals (2000), a review of case histories, and consultation across a range of disciplines. To involve experts and interested parties, comments were solicited from a large group of reviewers.

It is important that these guidelines are implemented in the context of IUCN's broader policies pertaining to biodiversity conservation and sustainable management of natural resources. The philosophy for environmental conservation and management of IUCN and other conservation bodies is stated in key documents such as Caring for the Earth and Global Biodiversity Strategy. Primate re-introduction projects should be conducted in accordance with the following IUCN policy guidelines: IUCN/SSC Re-introduction Specialist Group: Guidelines for Nonhuman Primate Re-introductions (2001), IUCN Guidelines for Re-introductions (1998), IUCN Guidelines for the Placement of Confiscated Animals (2000), IUCN Guidelines for the Prevention of

Biodiversity Loss due to Biological Invasion (2000), Translocation of Living Organisms (IUCN Position Statement, 1987), as well as the CITES Guidelines for the Disposal of Confiscated Live Species (1997).

II. Executive Summary

The Guidelines for Nonhuman Primate Re-introductions is intended as a guide for procedures useful to re-introduction programmes and does not represent an inflexible code of conduct. The priority has been to develop guidelines that are of direct, practical assistance to those planning, approving, or implementing re-introductions. The primary audience of these guidelines is, therefore, the practitioners (usually managers or scientists), rather than decision-makers in governments.

Re-introduction practitioners are strongly encouraged to contact the IUCN/SSC Re-introduction Specialist Group (RSG) and present and discuss their re-introduction proposals (see ANNEX III*). As a result, a network of contacts can be developed and information from various projects more easily shared.

Before initiating any re-introduction project, managers must clearly define why that project is needed. The main goal of any re-introduction effort should be to establish viable, self-sustaining populations of primates in the wild. These guidelines do not apply to one-off releases for welfare or other purposes. They are instead written for managers working toward the overall conservation of the species and its habitat.

This document is relevant to re-introductions of primates from both ex-situ zoological and habitat-country facilities. Details regarding the care of animals in captivity prior to release, such as enclosure enrichment, captive-breeding methods, and similar topics, are beyond the scope of these guidelines. However, where appropriate, important points regarding these topics will be noted. (See Annex II,* a listing of husbandry guidelines for certain primate species and genera)

Because the recommendations contained in this document are intended as guidelines, each re-introduction project should develop a written set of instructions and protocol that apply specifically to its species, region, legal structure, etc. Managers should seriously consider all aspects of a re-introduction project before initiation, and they should clearly establish objectives and define both short- and long-term goals. Strategies to achieve these goals should be developed and understood by all relevant parties, and a projected time frame should be established.

Adherence to these guidelines will reduce problems and errors that may hin-

der project success. It is recognised, however, that ultimate "project success" is not yet easy to determine. There are currently no clear and easy rules for determining the success of a re-introduction project. However, with a strong monitoring programme, interim project success can be measured in such terms as survival rate and population growth. And as more re-introduction efforts are conducted and documented, tools for measuring success will be forthcoming.

Although managers may be unable to easily define project success, they are accountable for the project's outcomes. Thus, a re-introduction project team should be identified, and each member should clearly understand the goals and objectives of the project. It is also recommended that managers develop intervention policies and mechanisms to correct or reverse situations that don't conform to the desired objectives.

These guidelines cover the main steps of a re-introduction effort. The steps are listed in a suggested order of progression, although some steps overlap with one another. It is realised that many release projects have been operating for some time, and so managers of these projects should attempt to integrate these guidelines as soon as possible into their current operating procedures and protocol.

III. Introduction

In 1996 the IUCN Red List of Threatened Animals noted that the major mammal order most threatened by extinction was primates, and this remains true today. The latest release of the IUCN Red List of Threatened Species (2000) reveals that the greatest change among mammals is the number of threatened primates, which has increased by 20 species - from 96 to 116 species. Since 1996 the number of endangered primates has increased from 29 to 46, and critically endangered primates are up from 13 to 19 species. Some primate species are particularly at risk, such as the Sclater's guenon *Cercopithecus sclateri*, found in Nigeria; the Cat Ba langur *Trachypithecus poliocephalus*, found in Vietnam; and the Golden and Black lion tamarins *Leontopithecus rosalia* and *Leontopithecus chrysopygus*, found in Brazil.

With such a global situation, conservation measures beyond or in conjunction with habitat protection, community-based development, and other approaches are underway. The practice of restoring primates to their natural habitats has gradually become a more accepted and widespread method of primate conservation. Some conservation managers and primatologists are also considering or planning the capture of wild primate species that are critically endangered for captive breeding to ensure the species' immediate survival and genetic vicissitude. The intent is often to maintain stable, breeding

populations that will eventually be released into a protected habitat.

Worldwide, there are numerous sanctuaries and primate-care facilities with aims to release rehabilitated primates. Certain zoological institutions are also releasing or considering the release of some of their primate populations. Primate release projects can and do come under scrutiny for not adhering to strict guidelines, such as proper veterinary clearance, tourism management, prevention of ecological risks to wild fauna and conspecifics from release groups, and so forth. Although the issues involved with re-introduction can vary greatly depending on the species and region, general rules do apply.

Developed in response to the increasing occurrence of primate re-introduction projects and consequently, to the growing need for specific policy guidelines, these guidelines will help ensure that such re-introduction efforts achieve their intended conservation benefit without causing adverse side effects of greater impact.

(NOTE: In the context of these guidelines, references to "primates" refer to nonhuman primates.)

IV. Definition of Terms

Conservation approaches

a. Re-introduction: an attempt to establish a species in an area that was once part of its historical range, but from which it has been extirpated or become extinct ("re-establishment" is a synonym, but it implies that the re-introduction has been successful). In this document, re-introduction refers to species, not individual animals. Re-introductions can be of captive-born animals, wild-born captive animals, or wild animals (via direct translocation).

b. Reinforcement/Supplementation: addition of individuals to an existing population of conspecifics.

c. Conservation/Benign Introduction: an attempt to establish a species, for the purpose of conservation, outside its recorded distribution, but within an appropriate habitat and eco-geographical area. This is a feasible conservation tool only when there is no remaining area left within a species' historic range.

d. Substitution: introduction of a species that is closely related to, or is a subspecies of, a primate species or subspecies that has become extinct in the wild and in captivity. The introduction occurs in suitable habitat within the extinct species' former range.

NOTE: For the purpose of this document, unless stated otherwise, "re-introduction" is used as a general term to refer to the various types of conservation approaches stated here.

Project types

a. *Ex-situ*: projects not based in a country within the species' natural range. This would include North American and European zoological facilities that keep and attempt to breed primates and then transport to the habitat country for final release.

b. *In-situ*: projects based in a country within the species' natural range.

Release strategies

a. Soft: animals held in captivity for a period of time prior to release to allow them to adjust to their new environment. Post-release support, such as supplemental feeding and protection from predators, is often provided.

b. Hard: animals not held in captivity prior to release. Animals are immediately released at the re-introduction site, and there is no post-release support.

Release stock types

a. Captive born: animals born to captive-held animals in in-situ or ex-situ facilities.

b. Wild born: animals born to wild animals in their natural habitat.

c. Confiscated: animals seized by legal authorities. Can be seized inside or outside countries in which the species' natural range occurs. Can be captive- or wild-born animals.

d. Acquired: animals obtained by donation and/or obtained with the permission of the current caretaker, but without direct involvement of the legal authorities. Animals rescued from poor conditions or former pets fall into this category. Can be acquired inside or outside countries in which the species' natural range occurs. Can be captive- or wild-born animals.

Aims, Objectives and Precautionary Principle

Aims

The principle aim of any primate re-introduction should be to establish a viable, self-sustaining population in the wild - of a species, subspecies, or race that has become globally or locally extinct or extirpated in the wild. The population should be re-introduced within the species' former natural range and should require minimal long-term management.

Objectives

The objectives of a re-introduction may include enhancing the long-term survival of a species; re-establishing a keystone species (in the ecological or

cultural sense) in an ecosystem; maintaining and/or restoring natural biodiversity; providing long-term economic benefits to the local and/or national economy; promoting conservation awareness; or a combination of these.

Precautionary principle

With any re-introduction of primates, there is always a level of risk to the released individuals, as well as to indigenous, wild populations, if they exist. Consequently, this "precautionary principle" should guide all re-introduction efforts: If there is no conservation value1 in releasing primates to the wild, or no management programme exists in which such a release can be undertaken according to conservation guidelines, the possibility - however unlikely - of inadvertently introducing a disease or behavioural or genetic aberration not already present in the environment should rule out returning primates to the wild.

V. Planning for Re-introduction

Identify the need for re-introduction; define project aims, objectives, and time frame; and establish a multidisciplinary team.

When done correctly, primate re-introduction projects are always very complex and expensive. They can also be very lengthy, although some, such as direct translocations of wild animals, do not necessarily require a long-term time commitment.

Each re-introduction proposal should be rigorously reviewed on its individual merits. Thus, in the planning stages, it should be strongly considered whether funds available for re-introduction efforts might be better used to finance conservation and protection efforts of current wild populations. The benefits of a primate re-introduction project should outweigh the benefits of new or additional conservation and protection measures for current wild populations, as well as any risks involved.

The potential benefits of returning primates to the wild include the following:

1. When the existing wild population is severely threatened, re-introduction might improve the long-term conservation potential of the species as a whole, or of a local population of the species.
2. Re-introduction can also make a strong political and educational statement concerning the fate of animals and may serve to promote local conservation values. However, as part of any education or public-awareness programme, the costs and difficulties associated with the re-introduction must be emphasised.
3. Species returned to the wild have the opportunity to continue to fulfil their biological and ecological roles as nature intended.

Nonetheless, the risks of reintroducing primates to the wild can be high, and such action should be undertaken only if it does not threaten existing populations of conspecifics or populations of other interacting species, or the ecological integrity of the area in which they live. The conservation of the species as a whole, and of other animals already living free, must take precedent over the welfare of individual animals already in captivity.

In considering the welfare of potential release animals, it should be noted that previous re-introductions of animals released from captivity have shown that mortality is often high. Thus, poorly planned or executed release programmes may equate to simply dumping animals in the wild and should be strongly opposed on both conservation and humane grounds.

Re-introductions should never be carried out merely because captive stocks exist, nor solely as a means of disposing of surplus stock.

A re-introduction effort requires a multidisciplinary approach involving a team of persons drawn from various backgrounds. As well as government personnel, the team may include representatives from governmental natural-resource management agencies, non-governmental organisations, funding bodies, universities, veterinary institutions, and/or zoos (and private animal breeders), with a full range of suitable expertise. Project leaders should be responsible for co-ordinating among the various bodies.

Previous re-introductions of the same or similar species should be thoroughly researched, and contact should be made with persons and organisations having relevant expertise, particularly the IUCN/SSC Re-introduction Specialist Group, prior to and while developing re-introduction protocol. Short- and long-term success indicators and predictions of programme duration should be identified, in the context of the agreed upon aims and objectives.

The following covers a suggested pattern of evolution and decision-making for a re-introduction project. It is acknowledged that some projects have been operating for a considerable length of time, so managers of these projects are encouraged to integrate these guidelines where appropriate and rectify any activities that do not adhere to the steps listed below.

A. Socio-economic, financial and legal requirements

Assess whether the re-introduction project can sufficiently meet the socioeconomic, financial, and legal requirements.

1. Primate re-introductions are always long-term efforts that require the com-

mitment of long-term financial and political support. Consultation with other release project managers is advised so that the actual costs, time commitment involved, and similar requirements are fully understood before a re-introduction effort is initiated.

2. An assessment of cost-per-surviving-animal is important to fully understand the expenses involved in the project and to help measure success.

3. Re-introduction must take place with the full permission and involvement of all relevant government agencies of the recipient or host country. This is particularly important for re-introductions in border areas; for those involving more than one state or province; or when a re-introduced population can expand into neighbouring states, provinces, or territories. (Consider consulting the Convention on Migratory Species (CMS): UNEP/CMS Secretariat, Martin-Luther King St. 8, D-53175 Bonn, Germany. E-mail: cms@unep.de. Web site: www.unep-wcmc.org/cms.)

4. The policy of the country toward re-introductions and the species concerned should be assessed. This might include checking existing provincial, national, and international legislation and regulations and working toward the provision of new measures and acquisition of required permits.

5. Socioeconomic studies should be made to assess the impacts, costs, and benefits of the re-introduction programme to local human populations.

6. A thorough assessment of attitudes of local communities to the proposed project is necessary to ensure long-term protection of the re-introduced population, especially if the cause of species' decline was due to human factors, such as over-hunting or loss or alteration of habitat.

7. The programme should be understood, accepted, and supported by local communities.

8. Where the security of the re-introduced population is at risk from human activities, measures should be taken to minimise these activities in the re-introduction area. If such measures cannot be adequately implemented, the re-introduction should be abandoned or alternative release areas sought.

9. If there is a risk of human-wildlife conflict or interaction post-release, an action plan for managing and solving such situations should be agreed upon and fully understood by all project staff and relevant authorities.

10. Re-introduction projects should maintain management and medical records and maintain backup copies in a secure location.

B. Habitat and release site

If the re-introduction project can sufficiently meet the socioeconomic, financial, and legal requirements, next assess whether there is a suitable habitat in which to release primates.

1. The release site should be within the historic range of the species. Because reinforcement projects present a risk of disease transmission, social disruption, and introduction of alien genes to wild populations, there should be no or only a few remnant wild individuals in the release site. In some circumstances, a re-introduction or reinforcement may have to be made into an area that is fenced or otherwise delimited, but it should be within the species' former natural range.

2. A conservation/benign introduction (see "Definition of Terms") should be undertaken only as a last resort when no opportunities for re-introduction into the original range exist and only when a significant contribution to the conservation of the species will result. The re-introduction area should have assured, long-term protection (whether formal or otherwise). Before a conservation/benign re-introduction is considered, it is recommended that the IUCN Guidelines for the Prevention of Biodiversity Loss due to Biological Invasion (2000) be reviewed.

3. The possibility of a change in the natural habitat since extirpation must be considered. The introduction of exotic, non-native species that may have altered the release habitat to such a degree as to affect released animals must be taken into account. Likewise, a change in the legal/political or cultural environment since extirpation needs to be ascertained and evaluated as a possible constraint.

4. Where a release site has undergone substantial degradation caused by human activity, a habitat restoration programme should be initiated before any re-introduction is carried out. If such a restoration effort is not forthcoming, then a new release site should be selected. However, although many primate species are known to fare poorly in secondary or logged forest, a few species survive well. Re-introduction managers should carefully consider such ecological data on the species of interest when evaluating potential release sites.

5. Previous causes of a species' decline must be identified and eliminated, or reduced to a safe level. Such causes can include disease, over-hunting, over-collection, pollution, poisoning, competition with or predation by exotic species, habitat loss, adverse effects of earlier research or management programmes, competition with domestic livestock, or any combination of these.

6. If any species has filled the void created by the loss of the primate species concerned, the effect that the re-introduced species will have on the ecosystem must be understood to better determine the success of the re-introduced population. It is important that the re-introduction does not further disrupt established species.
7. If the re-introduction effort is a reinforcement, then a thorough study of the density and habitat use of the resident population of the species, as well as the potential impact - negative or positive - to this population, must be ascertained. Sufficient time for such investigation must be allowed.

8. The release area should have sufficient carrying capacity to sustain growth of the re-introduced population and support a viable, self-sustaining population in the long run, particularly if there could be a major population expansion. Also important is the presence of corridors that connect the release site with other habitat areas.

9. The build-up of the released primate population should be modelled under various sets of conditions to specify the optimal number and composition of individuals to be released, such as per year, and the numbers of years necessary to promote establishment of a viable population.

10. A Population and Habitat Viability Analysis (PHVA) may aid in identifying significant environmental and population variables and assessing their potential interactions, which would guide long-term population management. (For more information on PHVA, contact the IUCN Conservation Breeding Specialist Group. See Annex III*)

The following points are interrelated with the following section: "Species' Socioecology & Behaviour." Once the habitat itself has been evaluated, it must also be evaluated in context of the socioecological needs of the species of concern.

11. Re-introductions should only take place where the habitat and landscape requirements of the species are satisfied and likely to be sustained for the foreseeable future. Primates released in inappropriate habitat are often doomed to starvation or death due to causes that the animals are not equipped to handle, or against which they are not adapted. If the habitat and ecological requirements of the species are unknown, it is not recommended that animals be released. (However, it is important to note that some primate species are highly adaptable and flexible, and that groups of the same species often utilise the same habitat in different ways. Such information must be considered when assessing habitat requirements of a species.)

12. The release site should be selected with consideration for a species' pre-

ferred microhabitat, such as along water bodies or at particular altitudes. So as not to limit release animals to one specific area, however, managers should consider a release area that incorporates more than one microhabitat.

13. An analysis of available food resources in the proposed release site should be made to confirm the presence and continued availability of foods consumed by wild populations of the species of interest. Certain primate species are more adaptable than others to changes in diet, so each species' dietary requirements must be considered when selecting a release site. If possible, re-introduction managers should provide captive animals foods similar to those they will encounter in the release site.

14. Phenology studies of the proposed release site are advisable and will assist managers in determining the ideal time of year for release.

C. Species' socioecology and behaviour

In conjunction with habitat assessment, review the socioecological and behavioural data available on the species of concern. The proposed habitat and the species' socioecological needs go hand-in-hand and should be evaluated simultaneously.

1. Detailed data on the status, ecology, and behaviour of wild populations (if they exist) to determine the species' critical needs must be considered. If such data are not available, studies to obtain this information should be carried out prior to re-introduction. For primates, such data would include descriptions of habitat preferences, intraspecific variation and adaptations to local ecological conditions, social behaviour, group composition, density, home range size, shelter and food requirements, foraging and feeding behaviour, predators, and diseases. Also, population studies that reveal rate of increase, sex ratio, and ratio of young in a population provide baseline data to help measure project success. Overall, a firm knowledge of the natural history of the species is crucial to the entire re-introduction scheme.

2. If no detailed data exist and current wild populations are extinct, too few, or too shy to be sufficiently studied, then information on the natural history of closely related wild species or subspecies can be used. Information on captive animals of the species concerned may be applied as supplementary data. However, such data alone cannot provide a clear picture of the habitat and social requirements of wild populations.

3. Re-introduction projects must take into account the humane treatment of animals, and there should be a reasonable assessment of the survival

prospects of the animals to justify the risks involved. Specifically, survival prospects for released primates should at least approximate those of wild animals of the same sex and age. When rate of survivability is a major concern, a soft release is often considered more appropriate.

4. Pre- and post-release monitoring programmes focusing on socioecological and behavioural data on the species of interest and other fauna in the release site are critical to measuring the success of the project.

5. It is recommended that re-introduction managers consult with the appropriate IUCN/SSC Primate Specialist Groups and SSC Action Plans to help with data collection and build a solid knowledge of the species' natural history.

D. Release stock

If suitable habitat exists, and it has been determined the species' socioecological and behavioural needs can be met, then assess the suitability of the release stock. First, establish the suitability of animals that have been confiscated or acquired.

1. If the stock animals have been confiscated or acquired, the IUCN Guidelines for the Placement of Confiscated Animals (2000) should initially be consulted. These guidelines offer three options for disposition of confiscated or acquired animals: maintain in captivity for the remainder of the animals' lives, return to the wild, or euthanasia. The decision as to which option to employ depends on various factors. The guidelines' "Decision Tree" is intended to facilitate evaluation of these options. The tree has been designed so that it may be used for both threatened and common species. However, it recognises that the conservation value of the species should be the primary consideration affecting the options available for placement. International networks of experts, such as the IUCN/SSC Specialist Groups (see Annex III*), should be able to assist.

If the IUCN Guidelines for the Placement of Confiscated Animals (2000) has been reviewed, and release to the wild remains an option after following the Decision Tree, then continue assessment of release-stock suitability.

2. If captive or artificially propagated stock is to be used, it must be from a population that has been soundly managed both demographically and genetically according to the principles of contemporary conservation biology.

3. In some instances, such as animals in the international trade or from North American or European zoological institutions or other holding facilities, the

exact origin of a species (including country of origin) may be difficult to determine, even with genetic testing. Primates whose geographic origin cannot be precisely determined should not be considered for re-introduction.

4. Possible behavioural aberrations due to time in captivity must be considered. Primates held in captivity, particularly immature animals, can acquire an inappropriate behavioural repertoire from individuals of other species, possibly lose certain behaviours, and/or not develop the full behavioural repertoire necessary for survival in the wild. Certain species may be particularly weakened or otherwise affected by their time in captivity and thus less able to survive. It is also possible that release of primates could result in interspecific hybridisation (producing offspring of different species or races) in the wild that would not have occurred naturally; such situations must be avoided.

5. Prior to release, captive animals should be given the opportunity to acquire the necessary skills to enable survival in the wild. Re-introduction managers should consider "training" environments, such as semi-wild enclosures, to test species' adaptation skills from holding cages to more natural environments. Managers should consult with others involved in the management, captive breeding, and release of similar species to share information.

6. Captive animals held and released in groups with a composition similar to their species' family groupings in the wild are likely to be more successful after release than those released in unnatural family groupings.

7. Consideration should be given to species of primates that are especially prone to becoming human-oriented and, in turn, less able to survive after re-introduction. Care should be taken to ensure that potentially dangerous captive-bred animals (for example, large primates such as the great apes) are not so confident in the presence of humans that they might be a danger to local inhabitants and/or their livestock.

8. Removal of individuals for re-introduction must not endanger the captive stock population or the wild source population. Stock must be guaranteed available on a regular and predictable basis to meet the specifications of the project protocol.

E. Genetic status

If stock is deemed suitable for release, assess the genetic status of the species.

1. An assessment must be made of the taxonomic status of individuals to be re-introduced. Primates released into existing populations, or in areas near

existing populations, that are not of the same race or subspecies as those in the wild population can result in the mixing of distinct genetic lineages or introduced behavioural or other abnormalities. Release stock animals should be of the same subspecies or race as those currently residing in the release area or of those that were extirpated, unless adequate numbers are not available.

2. Caution should be taken to ensure that no hybrids (offspring of different species or races) are present in the release stock. Hybrids are often not easily determined by physical appearance, and genetic testing can also be misleading.
3. In case of doubt as to taxonomic status, an investigation of historical information about the loss and fate of individuals from the re-introduction area, as well as molecular genetic studies, should be undertaken. A study of genetic variation within and among populations of this and related taxa can also be helpful. Special care is needed when the population has long been extinct.

4. If the precise provenance of the release stock is not known (meaning, animals could have originated from several different sites), or if there is any question of the source of animals, a reinforcement/supplementation project should be abandoned. Such a project may inadvertently lead to pollution of distinct genetic races or subspecies.

5. Taxonomy of certain species and subspecies can and do change. Re-introduction managers should continually work closely with other professionals to ascertain the taxonomic status of the proposed release stock and monitor and account for any possible changes in that status.

VII. Disease transmission and veterinary requirements

While preparing for a re-introduction project, a strict quarantine and veterinary programme must be developed and implemented. Qualified veterinarians should be part of the re-introduction management team and included in planning, implementation, and follow-up activities.

The issue of potential disease transmission - anthropozoonotic and zoonotic - is one of ever-increasing concern and importance. When it comes to re-introduction efforts, this issue is particularly critical: Humans and primates come in contact. Transmission of disease-causing agents is more likely when primates have been in captivity for prolonged periods.

Animals held in captivity and/or transported, even for a short period of time, may be exposed to a variety of pathogens and are potential vectors for the introduction of disease or infectious organisms into wild populations. Release

of these animals to the wild may result in the introduction of disease to conspecifics or unrelated species with potentially severe effects. Even if there is a very small risk that release stock has been infected by exotic pathogens, the impact that such introduced diseases could have on wild populations is often unknown. This should preclude returning the animals to the wild. Priority of concern must be given to wild fauna populations that may come into contact with released primates.

Because of the risks to wild populations, as well as the costs of disease screening and post-release monitoring, reinforcement/supplementation efforts should only be employed when there is a direct and measurable conservation benefit - demographically and/or genetically, and/or to enhance conservation in the public's eye - or at least where the presumed benefits clearly outweigh these risks.

Financial and practical considerations may limit the degree to which disease-screening tests can be applied. Thus, the protocol described below represents an ideal situation toward which re-introduction projects should aim.

This section discusses the veterinary aspects of re-introduction, with a focus on veterinary management and disease screening of captive primates prior to release.

A. Management and general considerations

1. For any type of re-introduction approach, the potential for disease transmission must be eliminated or minimised as much as possible. A clearly defined and strictly followed veterinary protocol, including details on testing procedures, should be established for any such effort.

2. Proper veterinary equipment must be available and maintained.

3. Protective clothing, such as disposable gloves, facemasks, etc., should be worn whenever handling primates - wild or captive.

4. Re-introduction managers and veterinarians should have a solid understanding of anthropozoonotic and zoonotic diseases and their symptoms and treatments. (Anthropozoonotic exchange is disease transmission from humans to animals, and zoonotic exchange is from animals to humans.)

5. Primates that are in good general health are far less likely to carry or suffer from infectious diseases than those living on inadequate diets or in sub-optimal physical or social conditions. Constant attention should be paid to good husbandry practices (see Annex II*).

6. Managers of re-introduction projects should ensure that all primates are readily and reliably identifiable by the use of transponders, tattoos, or similar means.

7. Medical records should always be kept up-to-date and backup copies made and safely stored.

8. Prospective release stock that is being translocated must be subjected to a thorough veterinary screening process before shipment from original source. Any animals found to be infected with, or that test positive for, nonendemic or contagious pathogens with a potential impact on other captive or wild primates must be removed from the consignment, and the uninfected, negative remainder must be placed in strict quarantine for a suitable period before retest. If clear after retesting, the animals may be placed for shipment.

B. Quarantine and veterinary testing

Quarantine

Quarantine is the separation of newly received animals from those already in the facility until the health of the new animals can be reviewed. Newly received animals include both animals destined to be only breeding stock or those intended for release. The purpose of such isolation is to prevent the introduction of infectious disease to any resident captive population. In addition, during this period new animals can be become accustomed to their new diets and housing, and baseline veterinary data can be gathered.

During the quarantine period, a variety of screening tests should be performed to establish health status, vaccination status reviewed, and a serum bank established for each individual. Disease screening should test new animals for infectious agents that are not normally found in wild populations of the species of interest, such as pathogens acquired from people or other animals, and that may cause the introduction or spread of potentially dangerous diseases. To be aware of the infectious agents (bacteria, viruses, parasites, etc.) that are normal or abnormal for a certain species, re-introduction programmes would benefit from the screening of wild conspecifics, particularly in the region of the re-introduction site. For example, some viruses, such as Hepatitis B and Foamy viruses, are part of the normal viral flora of many African primate species. So the presence of such viruses in certain animals would not necessarily preclude the release of these animals. Similarly, the release of parasite-free animals is not necessarily recommended, though re-introduction managers need to establish the types of parasites that are acceptable and in what numbers for a particular species.

1. A minimum quarantine period of 90 days is recommended. An initial sta-

bilisation period of at least one week to allow an animal to adjust to its new environment, food, etc., is advisable, except in the cases where emergency medical treatment is necessary. In certain circumstances, it may be wise to increase the quarantine period to 6 months (for example, for an animal that is known to have been in contact with tuberculosis).

2. Quarantine facilities should be as physically isolated from other animals, particularly breeding groups or animals intended for release, as is possible. Ideally, at least 20 metres should separate newly arrived animals from resident animals and a physical barrier placed between them. Quarantine facilities should also be sited downwind of other animals where wind is predictable.

3. Personnel working with quarantined primates must observe established procedures to prevent cross-contamination to resident animals, such as strict personal hygiene, use of separate equipment (such as cleaning materials), use of separate footwear and clothing for quarantined animals, and thorough disinfection of all such items after use. Particular attention should be paid to avoiding the mechanical transmission of infective material via clothing and equipment.

4. Ideally, a separate staff would care only for quarantined animals. If this is not possible, then contact with quarantined animals should always follow contact with resident animals and never vice versa. Such isolation procedures should also be applied to any animal in resident groups that becomes ill and requires treatment.

5. Direct handling of conscious animals in quarantine should be avoided.

Disease screening & sample collection
During the quarantine period, the following procedures should be carried out:

1. Full clinical examination under a general anaesthetic, including a careful assessment of the dental health, eyes, weight, reproductive organs, external parasite burden, previous injuries, etc., should be conducted.

2. A means of permanently identifying the primate should also be employed at this stage (such as tattoo or subcutaneous microchip transponder).

3. Blood and serum samples for routine haematology (such as screening for anaemia and blood parasites, such as malaria) and serum biochemistry (such as hepatitis [serum] and serological testing for Simian Immunodeficiency Virus [SIV] and Human Immunodeficiency Virus [HIV] infections) should be collected. It is recommended that serum be tested for a

range of human and primate viruses, including some or all of the following: Alpha-herpes viruses, Arenaviruses, Cytomegalovirus (CMV), Enteroviruses, Filoviruses, Flaviviruses, Foamy viruses, Hepatitis A, Hepatitis B, Hepatitis C, Hepatitis E, HTLV/STLV, HIV/SIV, Measles, Monkeypox, and Toxoplasmosis. What is ultimately tested for depends on the geographical region, species, and other such factors. There are many types of viruses for which release animals should be screened. Re-introduction managers should allot enough funding to be able to screen for the key ones and any recommended by a qualified veterinary team.

4. It is recommended to take additional serum and store it at -20°C or below for future reference (to establish a serum bank). Further serum samples should be taken and banked opportunistically, both within the quarantine period and subsequently. A serum sample from each animal should be taken and banked immediately prior to transfer to a final release site.

5. To test for tuberculosis (TB), three Tuberculin skin tests, using the eyelid or abdominal wall area, should be administered during the quarantine period at no less than one-month intervals. TB is thought to be particularly rare in wild primate populations, but can readily establish itself in newly caught animals that come into close contact with humans, particularly in habitat countries where TB is high among the human population. Incoming animals with three negative test readings are considered free of tuberculosis and can be introduced into a resident group after all other quarantine procedures have been carried out.

Note on TB: Intradermal and intrapalpebral skin tests are not highly reliable, so results should be interpreted with caution. Because false-positive results can occur under certain circumstances, qualified veterinary personnel should be consulted regarding these circumstances and to assist with the reading of TB tests. For example, animals suffering from advanced tuberculosis may have a negative reaction to a skin test due to anergy, a state of immunological depression or exhaustion. Such a result is more likely in emaciated or otherwise weak animals or those suffering from chronic respiratory stress. Thus, these animals should be treated with great care and suspicion. It is also recommended that whenever possible, other types of TB tests, such as thoracic radiography, comparative skin testing using different tuberculin types, lung washing and mycobacterial culture, LTT tests, and the mycobacterial culture of faeces, are utilised.

6. Assessment of internal and external parasites should be conducted at least three times during quarantine. Faecal tests will be necessary to determine whether internal gut parasites are present. Samples should be tested for the presence of pathogenic bacteria, such as Campylobacter, Shigella,

Klebsiella, and Salmonella species. Some of these organisms are shed only intermittently, necessitating the examination of several samples. Samples should be examined by direct microscopy and by a floatation technique. Where pathogenic parasites or bacteria are detected as abnormal for the species, appropriate treatment should be given and its effectiveness confirmed by further tests during the quarantine period.

7. Tissue samples should be taken during the quarantine period for genetic analysis.

8. In the case of animals testing positive for any particular infection, advice should immediately be sought from the project's qualified veterinary team.

9. All animals that die during the quarantine period must be necropsied and samples collected for further analysis. The necropsy should be performed as soon after death as possible to minimise the adverse effects of tissue degeneration (autolysis) and bacterial decomposition. Post-mortem guidelines are detailed in the following booklet: Woodford, M.H., Keet, D.F. and Bengis, R.G. (2000). Port-mortem procedures for wildlife veterinarians and field biologists (M.H. Woodford, ed.). Published by the Office International des Epizooties, Care for the Wild International, and the IUCN/SSC Veterinary Specialist Group. Copies can be obtained from Care for the Wild Defence Fund, 1 Ashfolds, Rusper, West Sussex RH12 4QX, United Kingdom. E-mail: info@careforthewild.org.uk; fax: (01293) 871022. Cost is UK £5.00, U.S. $7.50. Postage: £1.50 (Europe), £4.50 (outside Europe). Copies can also be purchased online at www.careforthewild.org/shop/books.asp.

Species-specific considerations

1. Re-introduction project managers should seek expert veterinary advice regarding the types of diseases and infectious agents that are relevant for the species of interest. Such agents are often determined by taxonomy, geographic region, and similar factors.

2. Macaque species should always be tested for Herpesvirus simiae (Herpes B) and related viruses and Simian Retroviruses (SRVs). It is wise to retest macaques for Herpes B virus before release. (Note that Herpes B is a normal pathogen present in Rhesus macaques *Macaca mulatta*, but its definition in other macaque species is not clear.)

3. Clinical tetanus has been reported in wild and captive macaques, squirrel monkeys, guenons, and other species, and it is generally fatal.

4. Many primate species are susceptible to measles, particularly

Callitrichidae and Colobidae species.
5. Clinical poliomyelitis has been reported in chimpanzees, gorillas, and orangutans. Other species are known to be susceptible experimentally.

Animals born in captivity
1. Infants born in captivity to post-quarantine animals are normally exempt from disease screening. Infants born to females in quarantine should be treated as any other animal in quarantine and thus are subject to disease screening.

Vaccination
1. Vaccination should be given as appropriate during the quarantine period. While vaccination is generally very appropriate for breeding-only stock, it is not always the best option for release stock, as the latter may have an unnatural advantage in the wild in some circumstances or be unable to boost the immunisation in the future.

2. Consideration should be given to vaccinating monkeys against tetanus, measles, and poliomyelitis, although the case for polio is not as strong. Great apes should be vaccinated against all three diseases. When vaccines are used, the type, batch number, and source of vaccine should be recorded in the animal's medical records, as well as the site of vaccination in the case of injectable products.

3. If there is a high risk of rabies, it may be necessary to vaccinate against this - using killed vaccines only. There is some evidence, at least in Rhesus macaques Macaca mulatta, that such vaccines produce high antibody titres and protection against death from "street virus."

4. It is not recommended to vaccinate against tuberculosis (TB) as it interferes with the tuberculin skin test for TB and probably induces only a limited period of immunity.

5. It is not recommended to use the triple vaccine known as DPT or DTP (diphtheria, tetanus, and pertussis). A large number of adverse reactions have been recorded in primates, and they are not particularly susceptible to diphtheria or pertussis.

6. As and when the opportunity arises, serum samples from vaccinated primates should be tested to establish the effectiveness of the vaccine schedules.

Prior to release
1. An ongoing preventive medicine programme should be in place for all cap-

tive primates after they have cleared quarantine and before final release.

C. Staff screening and health

1. To reduce the dangers of disease transmission to primates in captivity before they are released, prospective new members of animal-care staff should undergo certain health checks, similar to the health checks carried out during quarantine for animals. This pre-employment medical check has clear advantages for staff and employer and should be developed in co-operation with a health advisor. Such measures are suggested on medical and veterinary grounds.

2. New members of staff should not have any contact with primates for the first two weeks of employment. This should allow sufficient time for the development of most infectious diseases that a new employee may be incubating when hired, and for the completion of specific tests, such as faecal bacteriology and parasitology, TB, Hepatitis B and C, and HIV tests. Also, a nasopharyngeal swab should be cultured to detect carriers of pathogenic bacteria, such as Streptococcus pneumonia and Haemophilus influenzae, which can cause serious and often fatal disease in some species of primates.
3. The vaccine status of the new employee should be reviewed. If possible, it is important that vaccinations against Hepatitis A and B (especially if working with apes), measles, mumps, polio, rabies, rubella, tetanus, tuberculosis, and typhoid are current.

4. It is essential that all members of staff be in good general health. Staff members who are ill should not work with animals or prepare food. People who are weak in any way are far more likely to contract infectious diseases than healthy individuals. Also, colds, influenza, measles, viral hepatitis, salmonellosis, and many other infections can be passed to primates and may cause serious disease.

5. High standards of personal hygiene and facility cleanliness are required of primate care staff if the transmission of infectious zoonoses is to be avoided. It is recommended that animal-care staff wear a range of protective clothing when working in primate facilities.

6. Staff members who are pregnant should be extremely careful when working with primates and should seek a specialist's advice.

7. Staff should be made aware if primates in their care are known or suspected to be suffering from potentially zoonotic infections. Additional measures (if any) to prevent transmission of infection should be explained.

8. Staff should undergo regular, ongoing health checks while working with pri-

mates. These checks should include faecal tests for pathogenic faecal bacteria and parasites; regular assessment of vaccine status; and in certain circumstances, an annual skin test for tuberculosis.

Other considerations

1. Other people who have access to captive release stock may pose a threat to the animals and may themselves be at risk of infection. Thus, the role and management of volunteers, students, temporary staff, visiting zoo personnel, contractors working in animal areas, and even visitors needs careful consideration.

VIII. Release Implementation and Transport

Following completion of the planning stage and clearance of animals for release by a qualified veterinary team, plan and implement final release and transport.

1. A thorough release strategy (hard or soft release) should be developed and understood by all parties involved. The strategy should include such details as acclimatisation of release stock to the re-introduction area; behavioural training, including foraging; group composition; number of animals released; release patterns and techniques; and timing.

2. Stock not permanently identified (tattoo, subcutaneous microchip transponder, radio collar, etc.) during the quarantine period should be marked prior to release. All tracking equipment, such as radiotelemetry equipment, should also be checked to ensure good working condition.

3. The release site should be mapped and possibly demarcated. Trails should be cut and trees or other key points marked to facilitate post-release monitoring exercises, such as recording distance of dispersal after release.

4. If a soft release is used, enclosures or other temporary holding facilities must be constructed at the actual release location.

5. The exact release site should not be close to human dwellings, roadways, or similar locales to minimise the chance of animals' dispersing to areas where humans are present.

6. Upon arrival at final release site, stock should be closely observed. Individuals that have developed serious physical ailments or behavioural abnormalities during transport should not be released. Observation should continue and any appropriate treatment administered.

7. If the re-introduction is a reinforcement/supplementation, stock should be

released at least one kilometre from wild populations to allow the released animals time to settle in and minimise the threat of an immediate attack by resident groups. The release distance should not be so wide that newly introduced individuals have a small chance of contact with resident groups, particularly if the supplementation project aims to increase the genetic viability of the species in an area. Interaction with resident individuals may also assist once-captive individuals in learning survival methods in their new wild environment.

8. Final release should occur in optimal weather conditions and during the peak fruiting season (especially for frugivorous species).

9. Thorough documentation of the release implementation, including behaviour of the animals before, during, and after release, is vital for future planning and to share with other re-introduction managers.

10. Development of transport plans for delivery of stock to the country or site of re-introduction should place special emphasis on ways to minimise stress and avoid injury or illness. Primates should always be transported in secure containment. (Consider consulting the International Air Transport Association: Secretary, Live Animals & Perishables Board, IATA, 800 Place Victoria, P.O. Box 113, Montreal, Quebec, Canada H4Z 1M1. Phone: (514) 390-6770; E-mail: larper@iata.org; Web site: www.iata.org/cargo/live.htm). Reference is: International Air Transport Association, 2000. Live Animals Regulations, Montreal.)

11. Re-introduction managers should consider transporting release stock in the morning or evening to avoid the warmer daytime temperatures.

12. Qualified personnel, such as veterinarians, should accompany the release stock during transport and be prepared to deal with veterinary emergencies.

Considerations for translocating wild animals

The translocation of wild animals involves capturing and moving animals from one area to another in their historic natural range. Many translocations to date have been done for welfare purposes (to rescue animals from natural disasters, for example). However, with the increasing incidence of habitat degradation and fragmentation, more primates are faced with isolated, shrinking, and unsuitable habitats. Conservation-based translocation projects move affected groups or individuals to more secure habitats.

The following are issues that apply to the capture and movement of wild pri-

mates:

1. A thorough capture strategy, including detailed capture techniques, must be developed and fully understood by all involved parties. It is recommended that translocation managers consult with experts. The capture of wild primates is very difficult. Injury or loss of animals must be avoided as much as possible. Trial captures should be considered.

2. Translocation projects should relocate animals quickly to minimise any alteration in the animals' skills, behaviours, and knowledge that might be caused by an extended period in captivity. Hard releases may be better for translocations as holding cages can interfere with the social structure of wild groups.

3. Smaller groups with complete social structures should be targeted for translocation. Large groups are usually more difficult to capture, and translocation plans should account for any animals of a group that are not captured in the projected time frame.

4. Groups with recently weaned juveniles or individuals that are too small to be safely darted, particularly with arboreal species, should not be targeted for translocation.

5. In some cases, translocating mothers with nursing infants is acceptable. This would depend on several factors, including the species of concern. Such decisions should be made with the help of experts.

6. Groups to be translocated should be studied in advance of the move to assist in analysis of their behaviour and adaptability in the new environment.

7. Protective clothing, such as disposable gloves, facemasks, etc., should always be worn when handling wild primates during capture and transport.

8. During the capture procedure, blood and hair samples should be taken for subsequent analysis, and a permanent identifier, such as a radio collar or microchip, should be applied. Serum samples should be collected to assess which infectious agents are present in the population.

9. If more than one group is translocated at the same time, each group's release cage should be widely separated (at least a few kilometres apart) to minimise the chance groups will encounter one another soon after release.

10. The new habitat area should contain at least 50% of the food resources used by the translocated group in its former habitat. A higher percentage would apply to species with more specialised diets and those that do not

adapt well to new food sources. A study of the feeding ecology of the group prior to translocation is thus necessary.

IX. Post-Release and Field Monitoring

After stock has been cleared for release, develop a post-release monitoring programme in conjunction with development of a release strategy. A monitoring programme should be executed during and after final release.

1. Post-release monitoring is one of the most important stages of a re-introduction project, so all (or sample of) released individuals should be monitored after release. This ensures that each re-introduction effort is conducted as a carefully designed experiment, with the capability to test methodology with scientifically collected data. Such monitoring should include behavioural, demographic, and ecological studies, taking into account social changes and interactions, health, reproductive behaviour and success, mortality, and so forth. A study of the processes of long-term adaptation by individuals and the released population is also important.

2. Re-introduction project managers should consult with veterinary and medical experts to develop strict human health and sanitation standards, such as proper burial of faecal material and disposal of trash, for any field research site that is established as a base from which to study released populations.
3. It is recommended field research staff be subject to medical testing, as required in "Staff Screening & Health" in Part C, Section VII. Field staff should not work if they are ill.

4. Released primates, particularly those previously held in captivity, may have lost some fear of humans and be more apt to approach field researchers. Researchers and all others should always maintain a distance of 10 metres from released and wild fauna, and they should not smoke, drink, or eat within 200 metres. The benefit of disease screening can easily be negated in a moment by contact between humans and released animals in the wild.

5. For a primate that requires medical or other attention after release, capture and any subsequent treatments done under anaesthesia require that all participating staff wear protective clothing, and that care is taken to minimise any stress to the animal. Because many primates are arboreal, safety of the animal during capture must be a priority, and experts consulted when necessary.

6. Intervention (such as supplemental feeding, veterinary aid, and/or horticultural aid) may be necessary if a post-release situation proves

unfavourable. A documented plan to handle "problem" released individuals, such as those not assuming natural behaviour or otherwise not adapting to the new environment, should be developed prior to release and should reflect a wide of variety of possible circumstances in which re-capture may be necessary.

7. All mortalities should be collected and investigated whenever possible.

8. When necessary, decisions should be made for revision, rescheduling, or discontinuation of the programme.

9. Habitat protection and/or restoration should continue where necessary.

10. Public relations activities, including education and media coverage, should continue and their impact assessed.

11. An evaluation of the cost-effectiveness and overall success of the re-introduction project should be done regularly and distributed to the re-introduction and scientific community (in scientific and popular literature), so that other re-introduction projects may learn from the results of other endeavours.

** Ed. note: Annexes I, II and III have not been included here. Readers may refer to the entire document available at the following website:*
http://www.iucn.org/themes/ssc/sgs/rsg/rsgcdrom/PDFs/RSG_Guide.pdf

IUCN Guidelines for the Placement of Confiscated Animals

Prepared by IUCN Species Survival Commission

Approved by the 51st Meeting of the IUCN Council, Gland, Switzerland, February 2000

Live wild animals are confiscated by local, regional, and national authorities for a variety of reasons. Once they have taken possession of these animals, these authorities must dispose of them responsibly, timely and efficiently. Prevailing legislation, cultural practices, and economic conditions will influence decisions on the appropriate placement of confiscated animals. Within a conservation context, there are several possible options from which to choose:

1) Maintain the animals in captivity for the remainder of their natural lives.
2) Return the animals to the wild;
3) Euthanise the animals, i.e., humanely destroy them

The IUCN Guidelines for the Placement of Confiscated Animals discuss the benefits and risks involved in each of these options. These Guidelines should be read in conjunction with the IUCN guidelines for re-introductions (IUCN 1998). They should also be read with reference to the CITES Guidelines for the Disposal of Confiscated Live Species of Species Included in the Appendices (Resolution Conf. 10.7) and the IUCN guidelines for the prevention of biodiversity loss due to biological invasion.

Returning confiscated animals to the wild is often considered the most popular option for a confiscating agency and can garner strong public support. However, such action poses real risks and problems and generally confers few benefits. These risks and problems include, but are not limited to, the following.

1. The mortality of animals released from captivity is usually high. Confiscated mammals and birds captured as juveniles have not learned the skills they need to

survive in the wild. Other animals may be weakened or otherwise affected by their time in captivity and, thus, less able to survive. Finally, there is little chance of survival if the animals are released at a site that is not appropriate for the ecology or behavior of the species.

2. Animals released into the wild outside of their natural range - if they survive at all - have the potential to become pests or invasive. The effects of invasive alien species are a major cause of biodiversity loss, as such species compete with native species and in other ways compromise the ecological integrity of the habitats in which they have become established.

3. Having been in trade or a holding facility often in association with other wild animals and, in some instances, domesticated ones, confiscated wild animals are likely to have been exposed to diseases and parasites. If returned to the wild, these animals may infect other wild animals, thus causing serious, and potentially irreversible, problems.

4. In many instances, confiscated wild animals have been moved great distances from the site of capture and changed hands several times, such that their actual provenance is unknown. It may, therefore, be impossible or very difficult to establish an appropriate site for return to the wild that takes into account the ecological needs of the species, the animals' genetic make-up, and other attributes that are important to minimize risks (e.g., competition, hybridization) to wild populations at a release site.

5. In cases where the provenance is known, the ecological niche vacated by that animal may already be filled by other individuals and replacing the animal could result in further undesired disturbance of the ecosystem.

6. Responsible programs to return animals to the wild (c.f. IUCN 1998) are long-term endeavors that require substantial human and financial resources; hence, they can divert scarce resources away from other more effective conservation activities.

If returning confiscated animals to the wild is to be consistent with conservation principles and practice, it should a) only be into a site outside of the species' natural range if such an action is in accordance with the IUCN Guidelines for Reintroductions for a conservation introduction; and b) only be practiced in cases where the animals are of high conservation value and/or the release is part of a management programme. Any release to the wild must include the necessary screening and monitoring to address potential negative impacts, as set forth in the IUCN Guidelines for Re-introductions (IUCN 1998).

Retaining confiscated wild animals in captivity is a clear - and, in most cases, preferable - alternative to returning them to the wild. Clearly, returning animals to their

owners will be required in cases of theft. There are a number of options for keeping animals in captivity; however, each of these also has costs and risks.

- As confiscated animals are likely to have been exposed to diseases and parasites, if held in captivity, they may infect other captive animals, causing serious, and potentially irreversible, problems.
- Finding an appropriate home for confiscated animals can be time-consuming, and caring for the animals during that time can be expensive.
- Wild animals have specific nutritional requirements and require specific care. Short term and long-term humane care of confiscated wild animals requires space, finances and expertise not readily available in many countries.
- Transfer of ownership from a confiscating government authority to a private entity - individual or non-commercial or commercial care facility - can raise complicated legal and ethical issues, which are difficult - and time-consuming - to address. Sale or transfer of ownership may - or may be seen to - stimulate demand for these animals and exacerbate any threat that trade may pose to the species. It may also give the appearance that the government condones illegal or irregular trade or, in the case of actual sale, is benefiting from such trade.

In addition to avoiding risks to wild populations engendered by return to the wild, keeping confiscated animals in captivity provides other benefits, for example:

- Confiscated animals can be used to educate people about wildlife and conservation, as well as the consequences of trade in live wildlife.
- Confiscated animals placed in captivity can provide breeding stock for zoos, aquariums, and other facilities, thus potentially reducing the demand for wild-caught animals although the opposite effect may also occur.
- In specific instances where the provenance of the confiscated specimens is known, these animals can provide the nucleus, and breeding stock, for possible reintroduction programs.
- Confiscated animals can be the subject of a range of non-invasive research, training and teaching programs with important potential benefits for conservation.

Euthanasia must be considered a valid alternative to placing animals in captivity or returning them to the wild. Although it may appear counter-intuitive to employ euthanasia, it is by definition a humane act and can be wholly consistent with both conservation and animal welfare considerations. Further, although many confiscating authorities may be wary of criticism elicited by a decision to euthanise confiscated animals, there are a number of reasons to justify its use, including the following:

- In many, if not most, circumstances, euthanasia offers the most humane alternative for dealing with confiscated wild animals.
- Euthanasia eliminates the genetic, ecological, and other risks that release to the wild may pose to wild populations and ecosystems.

- Euthanasia eliminates the serious risk of spreading disease to wild or captive populations of animals.
- Euthanasia will often be the least costly option.

Establishment of an overall policy framework, with specific procedures for confiscating authorities, will facilitate consideration of the above three options for disposition, including the logistical, legal, and ethical questions that these authorities must address.

IUCN Guidelines for the Placement of Confiscated Animals

Statement of Principle
When live wild animals[1] are confiscated by government authorities, these authorities have a responsibility to dispose of them appropriately. Within a conservation context, and the confines of national and international law, the ultimate decision on placement of confiscated animals must achieve three goals:

1) to maximise the conservation value of the animals without in any way endangering the health, behavioural repertoire, genetic characteristics, or conservation status of wild or captive populations of the species[2] or any other wild living organism;
2) to discourage further illegal or irregular[3] trade in the species; and
3) to provide a humane solution, whether this involves maintaining the animals in captivity, returning them to the wild, or employing euthanasia to destroy them.

Statement of Need
Increased regulation of trade in wildlife and enforcement of these laws and regulations have resulted in an increase in the number of live wild animals that are confiscated by government agencies as a result of non-compliance with these regulations. In some instances, the confiscation is a result of patently illegal trade; in others, it is in response to other irregularities. While in some cases the number of confiscated animals is small, in many others the number is in the hundreds or greater. The large numbers involved, and the need to care for and dispose of them responsibly, have placed serious pressures on confiscating authorities, many of whom lack the technical, financial or human resources or the necessary frameworks to address these situations adequately.

In many countries, the practice has generally been to donate confiscated[4] animals to zoos or aquaria. However, this option is proving less viable. Zoos and aquaria generally cannot accommodate large numbers of animals that become available through confiscations. In addition to the resources required to house them and administer veterinary and other care, these institutions are usually less interested in the common species that comprise the vast proportion of wildlife confiscations. The international zoo community has recognized that placing animals of low conservation priority in limited cage space may benefit those individuals but may also detract

from conservation efforts as a whole. Therefore, they are setting priorities for cage space (IUDZG/CBSG 1993), thus reducing their availability to receive confiscated animals.

There has been an increasing tendency to address the problem of disposition of confiscated animals by releasing them back into the wild. In some cases, release of confiscated animals into existing wild populations has been made after careful evaluation and with due regard for existing general guidelines (IUCN 1987, IUCN 1998). In other cases, such releases have not been well planned and have been inconsistent with general conservation objectives and humane considerations. Animals released in inappropriate habitat are usually doomed to starvation or death from other causes that the animals are not equipped or adapted against. In addition to humane concerns, release into wild populations may also have strong negative conservation value by threatening existing wild populations for the following reasons:

1) Animals released into the wild outside their natural range can become pests or invasive, thus threatening agriculture and other sectors, native species, and the ecological integrity of the area in which they become established. The effects of invasive alien species are a major cause of global biodiversity loss.

2) The former home range of a confiscated animal may be quickly occupied by other individuals and releasing the confiscated animal could lead to further disruption of the animal's social ecology.

3) Diseases and parasites acquired by confiscated animals while held in captivity can easily spread into existing wild populations if these animals are released.

4) Individuals released into existing populations, or in areas near to existing populations, that are not of the same race or sub-species as those in the wild population, results in mixing of distinct genetic lineages.

5) Animals held in captivity, particularly immature animals, can acquire an inappropriate behavioural repertoire from individuals of other species, and/or lose certain behaviours or not develop the full behavioural repertoire necessary for survival in the wild. It is also possible that release of animals could result in inter-specific hybridisation, a problem also to be avoided.

In light of these trends, there is an increasing demand -- and urgent need -- for information and advice on considerations relating to responsible placement of confiscated animals. There is also a pressing need for technical expertise and assistance in assessing the veterinary, husbandry and other questions that must be addressed in

this process. Recognizing this problem, the Parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) have adopted guidelines for Disposal of Confiscated Live Specimens of Species Included in the Appendices (Resolution Conf. 10.7), applicable to both plants and animals. These IUCN guidelines build on and supplement those drawn up by CITES to apply more broadly to confiscated animals and confiscation situations.

Disposition of confiscated animals is not a simple or straightforward process. Only on rare occasions will the optimum course be obvious or result in an action of conservation value. Options for disposition of confiscated animals have thus far been influenced by the public's perception that returning animals to the wild is the optimal solution in terms of both animal welfare and conservation. However, a growing body of scientific study of re-introduction of captive animals, the nature and dynamics of wildlife diseases, and the nature and extent of the problems associated with invasive species suggests that such actions may be among the least appropriate options for many reasons, including those enumerated above. This recognition requires that the options available to confiscating authorities for disposition be carefully reviewed.

1. In these Guidelines, unless stated otherwise, confiscated animals should be understood to refer to live wild animals, not those that have been captive-bred.
2. Although this document refers to species, in the case of species with well-defined subspecies, the issues addressed will apply to lower taxonomic units.
3. Irregular trade in a species refers to, for example, insufficient or incomplete paperwork from the exporting country or poor packing that has comprised the welfare of the live animals in the shipment.
4. Although not discussed here, it should be understood that, depending on the statutory authority of the agencies involved, animals may first be seized and then confiscated only on completion of legal proceedings resulting in forfeiture by the individual having previously claimed ownership of the animals.

Management options

In deciding on the disposition of confiscated animals, there is a need to ensure both the humane treatment of the animals and the conservation and welfare of existing wild populations. Options for disposition fall into three principal categories:

1) maintenance of the individual(s) in captivity;
2) returning the individual(s) in question to the wild; and
3) euthanasia.

Within a conservation perspective, by far the most important consideration in reviewing the options for disposition of confiscated animals is the conservation status of the species concerned. Where the animals represent an endangered or threatened species or are otherwise of high conservation value[5], particular effort should be directed towards evaluating whether and how these animals might contribute to a conservation programme for the species. The expense and difficulty of returning ani-

mals to the wild as part of a conservation (c.f. IUCN 1998) or management programme or pursuing certain captive options will generally only be justified for species of high conservation value. How to allocate resources to the large numbers of confiscated animals representing common species is one of the fundamental policy questions that confiscating authorities must address.

The decision as to which option to employ in the disposition of confiscated animals will depend on various legal, social, economic and biological factors. The "Decision Tree" provided in the present guidelines is intended to facilitate consideration of these options. The tree has been designed so that it may be used for both threatened and common species. However, it recognizes that that conservation value of the species will be the primary consideration affecting the options available for placement. International networks of experts, such as the IUCN Species Survival Commission Specialist Groups (see Annex 3 for contact details), should be able to assist confiscating authorities in their deliberations as to the appropriate disposition of confiscated animals.

In some instances, in the case of international trade, there may be a demand for confiscated animals to be returned to their country of origin, and the government authorities of that country may request their return. CITES has established guidelines on this question through Resolution Conf. 10.7. It should be noted that it is often difficult to establish the true origin (including country of origin) of many animals in trade. Moreover, final disposition of confiscated animals upon their return to the country of origin will require consideration of the same options presented here. There is a need for cooperative efforts to review these options in order to ensure that repatriation is not undertaken simply to shift the burden of addressing the problem to the country of origin.

Option 1 - Captivity

Confiscated animals are already in captivity; there are numerous options for maintaining them there. Depending on the circumstances and the prevailing legal or policy prescriptions, animals can be donated, loaned, or sold, to public or private facilities, commercial or noncommercial, and to private individuals. Placement can be in the country of origin (or export), country of confiscation, or a country with adequate and/or specialized facilities for the species or animals in question. If animals are maintained in captivity, in preference to being returned to the wild or euthanized, they must be afforded humane conditions and ensured proper care for their natural lives.

Zoos and aquaria are the captive facilities most commonly considered for placement of animals, but these institutions are generally less willing and available to receive such animals than is assumed. As most confiscated animals are common species, the full range of captive options should be considered. These include zoos and aquaria as well as the following:

- Rescue centers, established specifically to treat injured or confiscated animals;
- Life-time care facilities devoted to the care of confiscated animals;
- Specialist societies or clubs devoted to the study and care of single species or species groups (e.g., reptiles, amphibians, birds) have provided an avenue for the disposition of confiscated animals through placement with these societies or individual members.
- Humane societies established to care and seek owners for abandoned animals may be in a position to assist with placement of confiscated animals with private individuals who can provide life-time care.
- Commercial captive breeders may be willing to receive and care for animals as well as to incorporate them into captive breeding activities. Such facilities, although commercial in nature, are likely to have the technical expertise and other resources to care for the animals. In addition, production of animals from captive breeding operations may reduce the demand for wild-caught animals.
- Research institutions maintain collections of exotic animals for many kinds of research (e.g. behavioural, ecological, physiological, psychological, medical and veterinary). Some research programmes have direct relevance to conservation. Attitudes towards vivisection or, in some instances, the non-invasive use of animals in research programmes as captive study populations vary widely from country to country and even within countries. These attitudes are likely to affect consideration of such programmes as an option for confiscated animals. However, it should be noted that transfer to facilities involved in research conducted under humane conditions may offer an alternative - and one that may eventually contribute information relevant to the species' conservation.

Choosing amongst these options will depend on the conservation value of the animals involved, the condition of the animals, the circumstances of trade in the species, and other factors. As a general rule, where confiscated animals are of high conservation value, an effort should be made to place them in a captive facility that ensures their availability for conservation efforts over the long term, such as with a zoo, ex-situ research programme, or an established captive breeding program or facility.

Captivity - Sale, loan or donation

Animals can be placed with an institution or individual in a number of ways. It is critical to consider two issues: the ownership of the animals and/or their progeny, and the payment of any fees as part of transfer of ownership. Confiscating authorities and individuals or organizations involved in the placement of confiscated specimens must clarify ownership, both of the specimens being transferred and any progeny.

They must also consider the possible implications of payment of fees in terms of public perception and for achieving the purpose of confiscation, which is to penalize and, in so doing, deter illegal and irregular trade. The following points should considered.

Transfer of ownership/custody. Unless specific legal provisions apply, the confiscating authority should consider including in an agreement to transfer ownership or custody the conditions under which the transfer is made, such as any restrictions on use (e.g., exhibition, education, captive breeding, commercial or non-commercial) or obligations concerning use (breeding efforts), that the animals may be put to. Such an agreement may set forth conditions relating to:

- subsequent transfer of ownership or custody;
- changes in the use of the animals by the new owner or custodian; and
- consequences of violation of the terms of transfer by the new owner or custodian.

Payment of fees. There may be cases where captive facilities are willing to receive and commit to care for confiscated animals providing payment is made by the confiscating authority against those costs. More frequently, the confiscating authority may seek to recoup the costs of caring for the animals prior to placement by levying a fee as part of transfer of ownership. Such payment of fees is problematic for many reasons, including the following:

- it may weaken the impact of the confiscation as a deterrent;
- it may risk creating a public perception that the confiscating authority is perpetuating or benefiting from illegal or irregular trade; or
- depending on the level of the fees proposed, it may work against fining a suitable option for maintaining the animals in captivity.

It is important that confiscating authorities be prepared to make public the conditions under which ownership of confiscated animals has been transferred and, where applicable, the basis for any payments involved.

Captivity - Benefits

In addition to avoiding the risks associated with attempting to return them to the wild, there are numerous benefits of placing confiscated animals in a facility that will provide life-time care under humane conditions. These include:

a) educational value in terms of possible exhibition or other use;
b) the satisfaction to be derived from the increased chances for survival of the animals;
c) the potential for the animals to be used in a captive breeding programme to replace wild-caught animals as a source for trade;

d) the potential for captive breeding for possible re-introduction or other conservation programmes; and
e) the potential for use in conservation and other valuable research programs.

Captivity - Concerns

The concerns raised by placing animals in captivity include:

a) Disease: Confiscated animals may serve as vectors for disease, which can affect conspecifics and other species held in captivity. As many diseases cannot be screened for, even the strictest quarantine and most extensive screening for disease cannot ensure that an animal is disease-free. Where quarantine cannot adequately ensure that an individual is disease-free, isolation for an indefinite period, or euthanasia, must be carried out.

b) Captive animals maintained outside their range can escape from captivity and become pests or invasive. Unintentionally introduced exotic species have become invasive in many countries, causing tremendous damage to agriculture, fisheries, and transport, but also to native animal populations. The decline of the European mink (*Mustela lutreola*), listed as Endangered by IUCN, is in part a result of competition from American mink (*Mustela vison*) escaped from fur farms, while the negative effects of competition from introduced North American red-eared slider turtles (*Trachemys scripta elegans*), originally imported as pets, have been raised in relation to European and Asian freshwater turtles.

c) Cost of placement: Providing housing and veterinary and other care to confiscated animals can be expensive; as a result, it may be difficult to identify institutions or individuals willing to assume these costs.

d) Potentail to encourage undesired trade: As is discussed above, transfer of ownership of confiscated animals to individuals or institutions, whether it involves loan, donation, or sale, is problematic. Some have argued that any transfer of ownership - whether commercial or non-commercial - of confiscated animals risks promoting a market for these species and creating a perception of the confiscating authority's being involved in illegal or irregular trade. These risks must be weighed in relation to the benefits, in particular that maintenance in captivity offers over return to the wild or euthanasia. Some factors that might be considered in assessing the degree to which transfer of ownership - and sale - might promoted undesired trade are:

1) Whether the animals in question are already available for sale legally in the confiscating country in commercial quantities; and
2) Whether wildlife traders under indictment for, or convicted of, crimes related to illegal or irregular trade in wildlife can be prevented from purchasing the animals in question.
3) The monetary/ commercial value of the animals in question.

As regards the latter question, it should be noted that experience in selling confiscated animals suggests that it is virtually impossible to ensure that commercial dealers suspected or implicated in illegal or irregular trade are excluded, directly or indirectly, in purchasing confiscated animals.

In certain circumstances, transfer to commercial captive breeders may have a clearer potential for the conservation of the species, or welfare of the individuals, than non-commercial disposition or euthanasia. In the case of common species, commercial breeders may be a particularly attractive option; in the case of species of high conservation value, this option should be carefully assessed. There may be a risk of stimulating demand from wild populations through increased availability of the species, and it may be difficult to secure access to these animals for future conservation activities.

Option 2 - Return to the wild

Because of the serious risks posed to wild animal populations from released confiscated animals, return to the wild is considered here to be a desirable option in only a very small number of instances and under very specific circumstances. The IUCN Guidelines for Reintroductions (IUCN 1998) make a clear distinction between the different options for returning animals to the wild to meet conservation objectives and discuss the purposes, rationale and procedures relating to these options.

The present Guidelines do not consider a viable option the return of animals to the wild except in accordance with the IUCN Guidelines for Re-introductions. Poorly planned or executed release or (re-)introduction programmes are no better than dumping animals in the wild and should be vigorously opposed on both conservation and humane grounds.

a) Re-introduction: an attempt to establish a population in an area that was once part of the range of the species but from which it has become extirpated.Some of the best known re-introductions have been of species that had become extinct in the wild. Examples include: Père David's deer (*Elaphurus davidanus*) and the Arabian oryx (*Oryx leucoryx*). Other re-introduction programmes have involved species that persist in some parts of their historical range but have been eliminated from others; the aim of these programmes is to re-establish a population in an area, or region, from which the species has disappeared. An example of this type of re-introduction is the recent re-introduction of the swift fox (*Vulpes velox*) in Canada.

b) Reinforcement of an existing population (also referred to as Supplementation): the addition of individuals to an existing population of the same species.

Reinforcement can be a powerful conservation tool when natural populations are diminished by a process which, at least in theory, can be reversed. One of the few examples of a successful reinforcement project involves the golden lion tamarin

(*Leontopithecus rosalia*) in Brazil. Habitat loss, coupled with capture of live animals for pets, resulted in a rapid decline of the golden lion tamarin. When reserves were expanded, and capture for trade curbed, captive-bred golden lion tamarins were then used to supplement depleted wild populations.

Reinforcement has been most widely pursued in the context of rehabilitation programmes, i.e., when individual injured animals have been provided with veterinary care and released. Such activities are common in many countries, and specific programmes exist for species as diverse as hedgehogs and birds of prey. However common an activity, reinforcement carries with it the very grave risk that individuals held in captivity, even temporarily, are potential vectors for the introduction of disease or infectious organisms into wild populations.

Because of disease and other risks to wild populations, as well as the costs of screening and post-release monitoring, reinforcement should only be employed in instances where there is a direct and measurable conservation benefit (demographically and/or genetically, and/or to enhance conservation in the public's eye), or, at least, where the presumed benefits clearly outweigh these risks.

c) Conservation introductions (also referred to as Beneficial or Benign Introductions): an attempt to establish a species, for the purpose of conservation, outside its recorded distribution but within an appropriate habitat and eco-geographical area. This is a feasible conservation tool only when there is no remaining area left within a species' historic range.

Extensive use of conservation introductions has been made in New Zealand, where endangered birds have been transferred to off-shore islands that were adjacent to, but not part of, the animals' original range. Conservation introductions can also be a component of a larger programme of re-introduction, an example being the breeding of red wolves (*Canis rufus*) on islands outside their natural range and subsequent transfer to mainland range areas.

Return to the wild - benefits

There are benefits of returning confiscated animals to the wild, providing the prerequisite veterinary, genetic, and other screening is undertaken and post-release monitoring programmes are established (as per IUCN 1998).

a) In situations where the existing population is severely threatened, re-introduction might improve the long-term conservation potential of the species as a whole, or of a local population of the species (e.g., golden lion tamarins).
b) Return to the wild makes a strong political/educational statement concerning the fate of animals and may serve to promote local conservation values. However, as part of any education or public awareness programmes, the costs and difficulties associated with the return to the wild must be emphasised.

c) Species returned to the wild have the possibility of continuing to fulfill their biological and ecological roles.

Return to the wild - concerns

As indicated above, because of the risk of biological invasion, these guidelines do not consider it a viable option to return animals to the wild outside of their natural range in any but the most exceptional circumstances. Before return to the wild (as per IUCN 1998) of confiscated animals is considered, several issues of concern must be considered in general terms:welfare, conservation value, cost, and disease.

a) Welfare: While some consider return to the wild to be humane, ill-conceived projects may return animals to the wild which then die from starvation or do not adapt to an unfamiliar or inappropriate environment. Humane considerations require that each effort to return confiscated animals to the wild be thoroughly researched and carefully planned. Reintroduction projects also require long-term commitment in terms of monitoring the fate of released individuals.

In order for return to the wild to be seriously considered on welfare grounds, some have advocated that the survival prospects for released animals must at least approximate those of wild animals of the same sex and age. While such demographic data on wild populations are rarely available, the spirit of this suggestion should be respected -- there must be humane treatment of confiscated animals when attempting to return them to the wild, and there should be a reasonable assessment of the survival prospects of the animals to justify the risks involved.

b) Conservation value and cost: In cases where returning confiscated animals to the wild appears to be the most humane option, such action can only be undertaken if it does not threaten existing populations of con-specifics or populations of other interacting species, or the ecological integrity of the area in which they live. The conservation of the species as a whole, and of other animals already living free, must take precedent over the welfare of individual animals that are already in captivity.

Before animals are used in programmes in which existing populations are reinforced, or new populations are established, it must be determined that returning these individuals to the wild will make a significant contribution to the conservation of the species, or populations of other interacting species, or it must serve a purpose directly related to the conservation and management of the species or ecosystem involved. Based solely on demographic considerations, large populations are less likely to go extinct, and, therefore, reinforcing existing very small wild populations may reduce the probability of extinction. In very small populations, a lack of males or females may result in reduced population growth or population decline and, therefore, reinforcing a very small population lacking animals of a particular sex may also improve prospects for survival of that population. However, genetic and behavioural considerations, as well as the possibility of disease introduction, also play a funda-

mental role in determining the long-term survival of a population. The potential conservation benefit of the re-introduction should clearly outweigh the risks.

The cost of returning animals to the wild in a responsible manner can be prohibitive, suggesting that this option should only be pursued when species are of high conservation value. Exceptions to this rule may be instances where the confiscated animals are not of high conservation value, but the circumstances and technical and other resources are available to ensure re-introduction is undertaken in accordance with conservation guidelines (e.g., IUCN 1998).

c) Disease: Animals held in captivity and/or transported, even for a very short time, may be exposed to a variety of pathogens. Release of these animals to the wild may result in introduction of disease to con-specifics or unrelated species with potentially catastrophic effects. Even if there is a very small risk that confiscated animals have been infected by exotic pathogens, the potential effects of introduced diseases on wild populations are often so great that this should preclude returning confiscated animals to the wild.

Release into the wild of any animal that has been held in captivity is risky. Animals held in captivity are more likely to acquire diseases and parasites. While some of these diseases can be tested for, tests do not exist for many animal diseases. Furthermore, animals held in captivity are frequently exposed to diseases not usually encountered in their natural habitat. Veterinarians and quarantine officers, thinking that the species in question is only susceptible to certain diseases, might not test for the diseases picked up in captivity. It should be assumed that all diseases are potentially contagious.

In assessing the possibilities for disease, it may be particularly helpful to consider the known or presumed circumstances of trade, including:

> a) the time and distance from point of capture; the number of stages of trade and types of transport;
> b) whether the animals have been held or transported in proximity to wild or domesticated animals of the same or other species and what specific diseases have been known to be carried by such animals.

d) Source of individuals: If the precise provenance of the confiscated animals is not known (they may be from several different sites of origin), or if there is any question of the source of animals, supplementation may lead to inadvertent pollution of distinct genetic races or subspecies. If particular local races or sub-species show specific adaptation to their local environments, mixing in individuals from other races or sub-species may be damaging to the local population. Where the origin and habitat and ecological requirements of the species are unknown, introducing an individual or individuals into the wrong habitat type may also doom them to death.

Given that any release incurs some risk, the following "precautionary principle" should be adopted: if there is no conservation value in releasing confiscated animals to the wild or no management programme exists within which such release can be undertaken according to conservation guidelines, the possibility of accidentally introducing a disease, or behavioural and genetic aberrations that are not already present into the environment, however unlikely, should rule out returning confiscated specimens to the wild as a placement option.

Option 3 - Euthanasia

Euthanasia -- the killing of animals carried out according to humane guidelines -- is a valid alternative to maintaining animals in captivity or returning them to the wild. Although it may appear counter-intuitive to employ euthanasia, it is, by definition, humane, and, thus can be wholly consistent with conservation and animal considerations. In many cases, it may be the most feasible option for conservation and humane, as well as economic, reasons. It is recognized that euthanasia is unlikely to be a popular option amongst confiscating authorities for disposition of confiscated animals. However, it cannot be overstressed that it may be the most responsible option. In many cases, authorities confiscating live animals will encounter the following situations:

a) In the course of trade or while held in captivity, the animals have contracted a chronic disease that is incurable and poses a risk to other animals, whether held in captivity or in the wild.

b) The actual provenance of the animals is unknown, and there is evidence to suggest that there may be genetic or other differences between them and presumed conspecifics in the wild, which could compromise the integrity of wild and captive populations, including those involved in breeding or conservation research activities.

c) There are insufficient resources to return the animals to the wild in accordance with biological (e.g., IUCN 1998) and animal welfare (e.g., International Academy of Animal Welfare Sciences 1992) guidelines.

d) There are no feasible options for maintaining the animals in captivity. In these instances, euthanasia may be the only responsible option and, thus, should be employed.

Euthanasia-- Benefits

a) With respect to the conservation of the species in question and of captive and wild populations of animals, euthanasia carries far fewer risks (e.g. disease, genetic pollution, biological invasion) than maintenance in captivity or return to the wild.

b) Euthanasia may be the best (and only) possible solution to an acute problem with

confiscated animals. Many possibilities for maintenance in captivity may not guarantee the animals' welfare over the long term, and the survival prospects of animals returned to the wild are generally not high, as, depending on the circumstances, such animals often die of starvation, disease or predation.

c) Euthanasia acts to discourage the activities that gave rise to confiscation, as the animals in question are completely lost to the trade, with no chance of recovery by the traders involved. This removes any potential monetary gain from illegal trade. In addition, euthanasia may serve as a broader deterrent, in educating the public and other sectors about the serious and complex problems that can arise from trade in live wild animals.

d) The choice of euthanasia over maintenance in captivity or return to the wild offers an opportunity for confiscating authorities and other agencies to educate the public about more esoteric conservation problems, including those relating to invasive species and the potential negative consequences of releasing animals to the wild without adequate safeguards. Increased public awareness may generate additional ideas on placement of confiscated animals.
e) Euthanasia can be inexpensive as compared to other options. As such, it does not divert human and financial resources that could be allocated to other conservation or related activities, uch as re-introduction or lifetime care of other animals, or the conservation of threatened species in the wild. When animals are euthanized, or die in captivity, an effort should be made to make the best use of the dead specimens for scientific purposes, such as placing them in a reference collection in a university or research institute, which are very important for the study of biodiversity, or making them available for pathology or other research.

Euthansia- Risks
a) Just as there is potential positive educational value in employing euthanasia, there is a problem that it may give rise to negative perceptions of the confiscating authority for having taken that decision over other options. In such instances, there is a need to foresee such criticism and offer the rationale for the decision to euthanize.

b) There is a risk of losing unique behavioural, genetic and ecological material within an individual or group of individuals that represents variation within a species and may be of value for the conservation of the species.

Establishing the necessary frameworks
In order for prospective confiscating agencies to address the logistical, legal and other difficulties resulting from the seizure of wild animals, their eventual confiscation, and responsible disposition based on the above three options, there should be established an overall policy framework and specific procedures that inter alia:

- Identify the authority or authorities with responsibility for confiscation and place-

ment of wild animals;

- Identify or provide the basis for establishing the facilities that will receive and, quarantine, seized animals and hold them until final disposition is decided;
- Identify government or non-government agencies and experts that can assist in the identification, care, and screening of the seized or confiscated animals and assist in the process of deciding on appropriate disposition;
- Identify institutions, agencies, and private individuals and societies who can provide assistance to confiscating authorities in disposing of confiscated animals (including humane euthanasia) or can receive such animals;
- Elaborate on and provide for the implementation of the above guidelines in terms of specific legal and regulatory provisions and administrative procedures concerning transfer of ownership (including sale) of confiscated animals, short-term (e.g., upon seizure) and long-term (e.g., post-confiscation) care, levying of fees and other payments for care of confiscated animals, and other considerations that may be required to ensure that confiscated wild animals are disposed of responsibly in terms of both their welfare and the conservation.
- Produce and implement written policies on disposal of confiscated wildlife, taking steps to ensure that all enforcement personnel are provided the necessary resources to implement the policy.

prior to translocation is thus necessary.

IX. Post-Release and Field Monitoring

After stock has been cleared for release, develop a post-release monitoring programme in conjunction with development of a release strategy. A monitoring programme should be executed during and after final release.

1. Post-release monitoring is one of the most important stages of a re-introduction project, so all (or sample of) released individuals should be monitored after release. This ensures that each re-introduction effort is conducted as a carefully designed experiment, with the capability to test methodology with scientifically collected data. Such monitoring should include behavioural, demographic, and ecological studies, taking into account social changes and interactions, health, reproductive behaviour and success, mortality, and so forth. A study of the processes of long-term adaptation by individuals and the released population is also important.

2. Re-introduction project managers should consult with veterinary and medical experts to develop strict human health and sanitation standards, such as proper burial of faecal material and disposal of trash, for any field research site that is established as a base from which to study released populations.
3. It is recommended field research staff be subject to medical testing, as required in "Staff Screening & Health" in Part C, Section VII. Field staff should

not work if they are ill.

4. Released primates, particularly those previously held in captivity, may have lost some fear of humans and be more apt to approach field researchers. Researchers and all others should always maintain a distance of 10 metres from released and wild fauna, and they should not smoke, drink, or eat within 200 metres. The benefit of disease screening can easily be negated in a moment by contact between humans and released animals in the wild.

5. For a primate that requires medical or other attention after release, capture and any subsequent treatments done under anaesthesia require that all participating staff wear protective clothing, and that care is taken to minimise any stress to the animal. Because many primates are arboreal, safety of the animal during capture must be a priority, and experts consulted when necessary.

6. Intervention (such as supplemental feeding, veterinary aid, and/or horticultural aid) may be necessary if a post-release situation proves unfavourable. A documented plan to handle "problem" released individuals, such as those not assuming natural behaviour or otherwise not adapting to the new environment, should be developed prior to release and should reflect a wide of variety of possible circumstances in which re-capture may be necessary.

7. All mortalities should be collected and investigated whenever possible.

8. When necessary, decisions should be made for revision, rescheduling, or discontinuation of the programme.

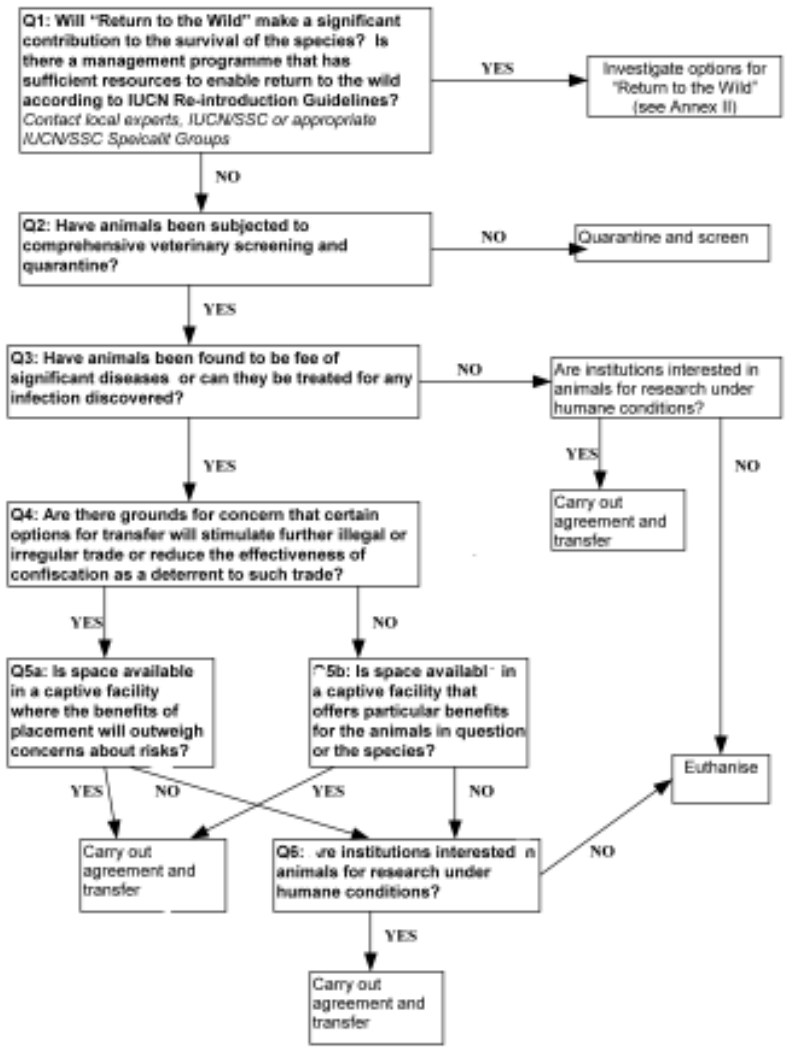
9. Habitat protection and/or restoration should continue where necessary.

10. Public relations activities, including education and media coverage, should continue and their impact assessed.

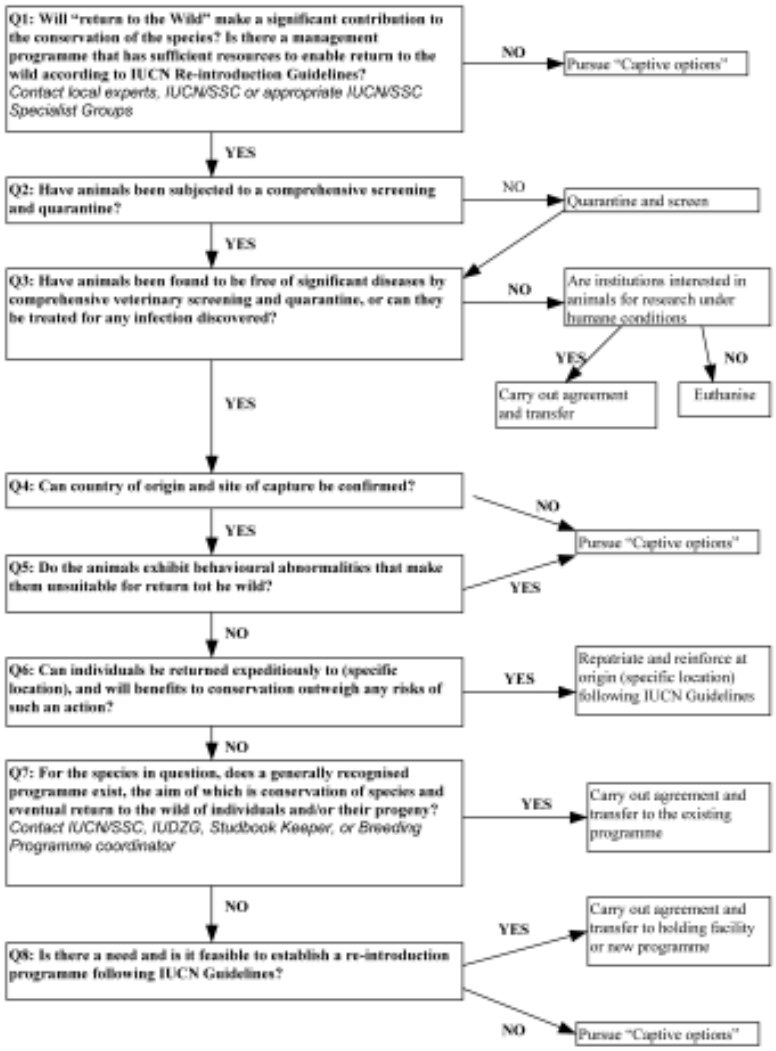
11. An evaluation of the cost-effectiveness and overall success of the re-introduction project should be done regularly and distributed to the re-introduction and scientific community (in scientific and popular literature), so that other re-introduction projects may learn from the results of other endeavours.

Annexes

Annex 1- Decision Tree for Captive Options



Annex 2 - Decision Tree for Return to the Wild



CZA Standards for the Establishment and Running of Rescue Centres in India

Prepared by the Central Zoo Authority (CZA), Ministry of Environment and Forests, Government of India

Notified amendments to the recognition of zoo rules wide GSR 106 (E, dated 6th February 2004).

Definition
'Rescue Centre' means an establishment for the care of animals specified in the Schedules to the Act and not open for exhibition to the public.

Recognition
1. For recognition of a rescue centre, an application under section 38H of the Act for recognition of a Rescue Centre shall be made to the Central Zoo Authority in Form A.

2. Every application shall be accompanied by the prescribed fee of Rs. 500/- and shall contain clear particulars as to the matters specified in Form A.

3. Before granting recognition to a rescue centre under section 38H of the act, the Central Zoo Authority may make such inquiries and require such further information to be furnished, as it deems necessary, relating to the information furnished by the zoo in its application in Form A

4. The recognition granted to a rescue centre shall be subject to the following conditions, namely:

4a) That the recognition unless granted on a permanent basis, shall be for such period not less than one year as may be specified in the recognition.

4b) That the rescue centre shall comply with such standards and norms as are or may be prescribed or imposed under the provisions of the Act and these rules from time to time.

5. For Renewal of recognition, three months before the expiry of the period of recog-

nition, a recognised rescue centre desirous of renewal of such recognition may make an application to the Central Zoo Authority in Form A.

6. The Central Zoo Authority shall grant recognition with due regard to the interests of protection and conservation of wildlife, and such standards, norms and other matters as are specified in Recognition of Zoo Rules.

Standards:

1. The primary objective to operate the rescue centre shall be conservation of wildlife and no rescue centre shall allow any activity that is not consistent with the well being of the wild animals.

2. No rescue centre shall allow any animal to be subjected to the cruelties prohibited under the "Prevention of Cruelty to Animals Act, 1960 (59 of 1960)."

3. Animals pertaining to species whose performance has been banned under the Prevention of Cruelty to Animals Act, 1960 (59 of ++1960), shall not be transported from place to place.

4. Rescue centres may accept wild animals brought to them under intimation to the Chief Wild Life Warden.

5.Every rescue centres shall have one full-time officer in-charge of the zoo. The said officer shall be delegated adequate administrative and financial powers to purchase feed and medicine and carry out emergency repair of animal enclosures, as may be necessary for proper upkeep and care of zoo animals.

6. Every rescue centre shall have at least one full-time veterinarian to look after the animals. The Veterinarian should have minimum educational qualification of B.V.Sc and AH with diploma in zoo and wildlife animal healthcare management or masters degree in Wildlife Disease and management from a recognized University, and should be duly registered with the State Veterinary Council or Veterinary Council of India.

7. All animal enclosures in a rescue centre shall be so designed as to fully ensure the safety of animals, caretakers.

8. All animal enclosures in a rescue centre shall be so designed as to meet the biological requirements of the animals housed therein. The enclosures shall be of such size as to ensure that the animals get space for their free movement and exercise and the animals within herds and groups are not unduly dominated by individuals. In case of species, which cannot be kept in groups due to behavioural or biological reasons, separate enclosures shall be provided for each animal. The enclosures shall not be smaller than the dimensions given in Annexure I & II of these rules.

9. Rescue Centre operators shall provide appropriate screening between the adjacent enclosures to safeguard against the animals getting exited or stressed because of the visibility of animals in other enclosures.

10. Every mammal in the rescue centre shall be provided food inside a feeding cell/ retiring cubicle or feeding kraal. The number and size of feeding cells or kraals will also be such that the dominant animals do not deprive other animals from getting adequate food. The endangered mammalian species shall be provided individual feeding cells or night shelters of the dimensions as specified in Appendix I to these rules. Each cubicle or cell shall have resting, feeding, drinking water and exercising, facilities according to the biological needs of the species. Proper ventilation and lighting for the comfort and well being of animals shall be provided in each cell or cubicle or enclosure.

11. Each rescue centre shall ensure timely supply of wholesome and unadulterated food in sufficient quantity to each animal according to the requirement of the individual animals, so that no animal remains undernourished.

12. Every rescue centere shall provide for a proper waste disposal system for treating both the solid and liquid wastes generated in the zoos.

13. All left over food items, animals excreta and rubbish shall be removed from each enclosure regularly and disposed of in a manner congenial to the general cleanliness of the zoo.

14. The rescue centre operators shall make available round the clock supply of potable water for drinking purposes in each cell / enclosure / cubicle.

15. Periodic application of disinfectants in each enclosure shall be made according to the directions of the authorised veterinary officer of the zoo.

16. The animals shall be handled only by the staff having experience and training in handling the individual animals. Every care shall be taken to avoid discomfort, behavioral stress or physical harm to any animal.

17. The condition and health of all animals in the rescue centre shall be checked every day by the person in-charge of their care. If any animal is found sick, injured, or unduly stressed the matter shall be reported to the veterinary officer for providing treatment expeditiously.

18. Routine examination including parasite checks shall be carried out regularly and preventive medicines including vaccination be administrated at such intervals as may be decided by the authorised veterinary officers.

19. The rescue centre operators shall arrange for medical check-ups of the staff responsible for upkeep of animals at least once in every six months to ensure that they do not have infections of such diseases that can infect the zoo animals.

20. Each rescue centre shall maintain animal history sheets and treatment cards in respect of each animal of endangered species, identified by the Central Zoo Authority.

21. Every rescue facility shall have a treatment room with basic diagnostic facilities, comprehensive range of drugs and a reference library on animal health care and upkeep. Each veterinary unit shall have isolation and quarantine wards to take care of newly arriving animals and sick animals as to minimize the chances of infections spreading to other animals of the zoo.

22. Every rescue centre operator shall provide one qualified lab assistant / compounder for assisting the veterinarian in health care of the zoo animals.

23. Every rescue centre shall have facilities for restraining and handling wild animals.

24. Any animal that dies in a rescue centre shall be subjected to a detailed post-mortem operation by a Veterinarian registered with State Veterinary Council or Veterinary Council of India and the findings of such operation shall be recorded and maintained for period of at least six years.

25. Each rescue centre shall have proper facility for disposal of carcasses without affecting the hygiene of the zoo. However, carcasses of large cats shall be disposed off only by burning in presence of director or an officer not bellow the rank of a curator duly authorised by the director.

26. Every zoo shall keep in its collection only such number of animals and such species for which appropriate housing facility exists. The zoo operators shall be responsible for ensuring that the number of animals of any species does not go beyond the holding capacity of the enclosures available in the zoo and housing standards are not compromised for keeping the excessive numbers.

27. To safeguard against uncontrolled growth in the population of prolifically breeding animals, every rescue centre shall implement appropriate population control measures like separation of sexes, sterilization, vasectomy and implanting of pallets etc.

28. Every rescue centre shall keep a record of the birth, acquisitions, sales, disposals and deaths of all animals. The inventory of the animals housed in each rescue centre as on 31st March of every year shall be submitted to the Central Zoo Authority by 30th April of the same year.

29. Every rescue centre shall also submit a brief summary of the death of animals in the zoo for every financial year, alongwith the reasons of death identified on the basis of post-mortem reports and other diagnostic tests, by 30th April of the following year. In case of death of critically endangered species, a report along with details specified above shall be submitted to Central Zoo Authority within twenty four hours.

Annexure I

MINIMUM PRESCRIBED SIZE FOR FEEDING/RETIRING CUBICLE FOR IMPORTANT MAMMALIAN SPECIES OF CAPTIVE ANIMALS							
Name of species	**[1]Size of feeding cubicle/night Shelter(meters)**			**Name of Species**	**Size of feeding cubicle/night Shelter(meters)**		
	Length	Breadth	Height		Length	Breadth	Height
Family - Felide				**Family - Equidae**			
Tiger and Lions	2.75	1.80	3.00	Wild Ass	4.0	2.0	2.5
Panther	2.00	1.50	2.00				
Colouded Leopard & Snow Leopard	2.00	1.50	2.00	**Family - Ursidae**			
Small Cats	1.80	1.50	1.50	All type of Indian Bears	2.5	1.8	2.0
Family - Elephantidae				**Family - Canidae**			
Elephant	8.0	6.0	5.5	Jackal, Wolf, and wild dog	2.0	1.5	1.5
Family - Rhinocerotidae				**Family - Vivirridae**			
One-horned Indian Rhinoceros	5.0	3.0	2.5	Palm Civet	2.0	1.0	1.0
Family - Cervidae				Large Indian civet & binturong	2.0	1.5	1.0
Brow antlered deer	3.0	2.0	2.5	**Family - Mustellidae**			
Hangul	3.0	2.0	2.5	Otters All Types	2.5	1.5	1.0
Swamp Deer	3.0	2.0	2.5	Ratel/Hogbadger	2.5	1.5	1.0
Musk Deer	2.5	1.5	2.0	Martens	2.0	1.5	1.0
Mouse Deer	1.5	1.0	1.5				
Family - Bovidae				**Family - Procyonide**			
Nilgiri tahr	2.5	1.5	2.0	Red Panda	3.0	1.5	1.0
Chinkara	2.5	1.5	2.0				
Four Horned Antelope	2.5	1.5	2.0	**Family - Lorisidae**			
Wild Buffalo	3.0	1.5	2.0	Slow Loris and slender Loris	1.0	1.0	1.5

[1] Substituted vide amendment rules 2001, w. e. f. 10. 7. 2001

Annexure II

MINIMUM PRESCRIBED SIZE FOR OUTDOOR OPEN ENCLOSURE FOR IMPORTANT MAMMALIAN SPECIES OF CAPTIVE ANIMALS

SI No.	Name of the Species	Minimum size of outdoor enclosure (per pair)	Minimum area extra per additional animal
			Square meter
	Family - felidae		
1.	Tiger and lions	1000	250
2.	Panther	500	60
3.	Clouded leopard	400	40
4.	Snow leopard	450	50
	Family - Rhinocerotidae		
5.	One-horned Indian Rhinoceros	2000	375
	Family - Cervidae		
6.	Brow antlered deer	1500	125
7.	Hangu	1500	125
8.	Swamp deer	1500	125
	Family - Bovidae		
9.	Wild buffalo	1500	200
10.	Indian bison	1500	200'
11.	Bharal, Goral, Wild sheep and Serow	350	75
	Family - Equidae		
12.	Wild Ass	1500	200
	Family - Ursidae		
13.	All types of Indian bears	1000	100
	Family - Canidae		
14.	Jackal, Wolf and Wild dog	400	50
	Family - Procyonidae		
15.	Red panda	300	30
	Family - Cercopithecidae		
16.	Monkeys and langurs	500	20

Ed Note: These 29 points are only extracts of the 51 standards and norms laid down by CZA. For entire list of standards and norms, subject to which recognition under section 38H of the Act shall be granted, please visit CZA website at http://www.cza.nic.in/index1.html

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Email: thulsirao@yahoo.co.in
Contact No.: 08524-285327 (O), 040-23064771 (R), Mobile: 9440810187
Office: Asst. Conservator of Forests, Biodiversity, Project Tiger, Srisailam - 518 102.

Currently posted at the Nagarjunasagar-Srisailam Tiger Reserve, Mr. Rao has many years of experience in captive care and management of wild animals. He was associated with the crocodile rehabilitation project in Andhra Pradesh and is currently involved in the management of the great Indian bustard and in making an assessment of the biodiversity of the Tiger Reserve.

24. Ms. Kadambari Mainkar
Programme Officer, Wildlife Trust of India.
Email: kadambari@wti.org.in
Contact No.: 011 26326025/26; Mobile: 09818979699
Office: A-220, New Friends Colony, New Delhi-110065.
Residence: Q319, Jalvayu Vihar, Sector 21, NOIDA.

Working since three years with the Wildlife Trust of India, Ms. Mainkar manages the wildlife welfare projects especially the "Captive Elephant Care" project. Her specialisation and area of interest is wildlife rehabilitation and hand-raising wildlife orphans.

25. Dr. Karen Trendler
Director, Wildcare Africa Trust.
Email: karojay@global.co.za
Contact No.: 0027128080592
Office: P.O. Box 15121, Lynn East, 0039 South Africa.

Founder and Director of Wildcare Africa Trust, Dr. Trendler is one of the leading wildlife rehabilitators in the world. Actively involved in the rescue and rehabilitation of thousands of wild animals, she also travels worldwide to attend to wildlife emergency relief operations and train rehabilitators worldwide.

26. Dr. Mewa Singh
Professor of Psychology, University of Mysore.
Email: msingh@psychology.uni-mysore.ac.in
Contact No.: 91 8212518772 (O); Fax. 91 822514239 (R)
Office: Department of Psychology, University of Mysore, Manas Gangotry, Mysore, Karnataka- 570006.

A professor in psychology, Dr. Singh has worked on nine species of primates for the past two decades. His basic research interest lies in ecology, behaviour and conservation. The species of his special interest are lion-tailed macaque, slender loris, bonnet macaque, Hanuman langur, Nilgiri langur and rhesus macaque.

27. Mr. Mrigen Barua
Range Forest Officer, Gitanagar Wildlife Range.
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Office: Range Forest Officer, Gitanagar Wildlife Range, Guwahati, Assam.

Working in the Forest Department of Assam since 1987, Mr. Barua has worked in Jatinga, Kaziranga National Park, Assam State Zoo, Deepar Beel WLS and Pabitora WLS. He has undergone training on captive breeding of endangered wildlife at the Gerald Durrel Wildlife Preservation Trust, UK and has also done the Wildlife Management Course at the Smithsonian Institute.

28. Mr. Niranjan Kumar Vasu
Director Kaziranga National Park,
Email: unicornis@sancharnet.in
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Office: Office of the Director, Kaziranga National Park, Bokakhat, Assam

An Indian Forest Service Officer, Mr. Vasu is currently holding the post of Director, Kaziranga National Park at Assam. His dynamism and able leadership is now the key force of successful management of this world heritage site. He is also the Project Leader for Centre for Wildlife Rehabilitation and Conservation (CWRC), located near Kaziranga National Park.

29. Dr. Naim Akhtar
Field Officer, Wildlife Trust of India.
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Office: C/o Divisional Forest Officer, Pakke Tiger Reserve, Seijosa town, East Kameng District, Arunachal Pradesh- 790103.
Residence: S/o Mohd Yusuf, H.No. 228, Mohalla Bhatan, District Bijnor, Uttar Pradesh- 246701.

Currently working with WTI, Dr. Akhtar got his doctorate on sloth bear ecology while working in Wildlife Institute of India, Dehradun . He has also worked as a biologist in the US Fish & Wildlife sponsored project on "rhino corridor assessment in Terai area between Dudhwa NP and Katerniaghat WLS" for the Bombay Natural History Society and is a member of the sloth bear specialist group of IUCN.

30. Dr. Parag Jyoti Deka
Deputy Project Manager, Pygmy Hog Conservation Programme,
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Office: Indira Nagar, Forest Enclave, Basistha, Guwahati 781029, Assam.

Specialising in conservation medicine, Dr. Deka joined the Pygmy Hog Conservation Programme in 1997 and is currently its Deputy Project Manager. He is a member of IUCN/ SSC PPHSG and the Conservation Breeding Specialist Group, and coordinates the activities of the Wildlife Health Unit of Ecosystems-India. Dr. Deka has received training in conservation breeding of endangered species at the Jersey-based International Training Centre of Durrell Wildlife Conservation Trust.

31. Dr. Prajna Paramita Panda
Programme Officer-Planning, Wildlife Trust of India.
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Residence: C-387, Kendriya Vihar, Sector-56, Gurgaon, Haryana.

Currently working in WTI, Dr. Panda has completed her Masters in Wildlife Science from the Wildlife Institute of India, Dehradun. She had worked on the behaviour of captive cervids in four zoos of Southern India and had also served the State Government of Orissa as a Veterinary Officer for over a year.

32. Mr. Pravin C. Tyagi
Director, Arignar Anna Zoological Park, Vandalur.
Email: aazp@vsnl.net
Contact No.: 044 2275 1089
Office: Arignar Anna Zoological Park (AAZP) , Vandalur, Chennai, Tamil Nadu.

Serving as Director of AAZP at Vandalur for the past three and a half years, Mr. Tyagi is an Indian Forest Service officer who has also served at the Wildlife Institute of India and Indira Gandhi Wildlife Sanctuary before taking up this appointment.

33. Mr. R. Manickam
Horticulture Assistant, Coimbatore Zoological Park.
Email: nbrpark@eth.net
Contact No.: 4255 200 109
Office: Coimbatore Zoological Park and Conservation Centre, 1318, Avinashi Road, Peelamedu, Coimbatore.
Residence: Chittampalam, Palladam P.O., Coimbatore.

A horticulturist at the Coimbatore Zoological Park since 1997, Mr. Manickam had earlier worked as a research assistant at Forest Genetics Research Circle and Institute of Forest Genetics and Tree Breeding. Having worked as a tour guide in the Anamalai Wildlife Sanctuary he was selected as a regional tour guide by the Tamil Nadu Tourism Development Corporation.

34. Dr. R. Thirumurugan
Assistant Veterinary Officer, Wildlife Trust of India.
Email: thirushenbagam@rediffmail.com
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Office: A-220 New Friends Colony, New Delhi-110065.
Residence: Kamandapatti, Pachanampatti Post, Omalur District, Salem, Tamil Nadu- 636 455.

A veterinarian who worked at the Rescue and Rehabilitation Centre of Arignar Anna Zoological Park (AAZP), Vandalur for two years, Dr. Thirumuugan recently joined WTI as trainee veterinarian at CWRC, Assam.

35. Mr. Rajjyoti Deka
Faculty member, State Institute of Rural Development, Assam.
Email: jnm6573@sify.com
Office: State Institute of Rural Development, Guwahati, Assam, India.

Mr. Deka has worked on the feeding habits of rhinoceros in Pabitora Wildlife Sanctuary and Assam Zoo and has also worked as a volunteer in CWRC and has experience in tranquilization of elephant and other wild animals.

36. Dr. Rathin Barman
Manager, Centre for Wildlife Rehabilitation and Conservation (CWRC), Kaziranga National Park, Assam.
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Office: Centre for Wildlife Rehabilitation and Conservation, Wildlife Trust of India, Kaziranga National Park, Borjuri, Bokakhat 785612,Assam, India.
Residence: Krisnanagar, Pathsala 781325, Dist.: Barpeta, Assam, India.

A biologist by profession, Dr. Barman has been associated with various wildlife conservation and research programmes in north-east India. Other than his present engagement as the manager of the CWRC in Assam and his expertise on wetlands, he has also worked on human elephant conflict. He was also instrumental in formulating the "National Biodiversity and Strategy Action Plan" for Assam.

37. Mr. Sergey Valentine Pazhetnov
Scientist, Central Forest Biosphere Nature Reserve and Project Executive, Orphan Bear Cubs Rehabilitation.
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Contact No.: +7(082) 682 1958
Office: 172862 Tver Region Toropets District, P.O. Box Pozhnya, Russia.

Since 1990, Mr. Pazhetnov has been working with the orphaned bear cubs rehabilitation project in Bubonitsa. At present working on his Ph.D. thesis on bear cubs social behavior, adaptation mechanisms of the rehabilitated bears in the wild and restoration of the degraded local population of brown bear in the Bryansk Region, Mr. Pazhetnov is the son of Valentin Pazhetnov, the legendary Russian conservationist.

38. Mr. Shimanta Kumar Goswami
Founder Director of Green Guard Nature Organization, Nagaon, Assam
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Office: Lakhinagar, P.O. Haibargaon, Nagaon, Assam- 782 002.

Mr. Goswami has been responsible for the successful completion of various projects on behalf of Green Guard, a local Assamese NGO funded by national and international funding agencies. He is also the Project coordinator of the Greater Adjutant Stork Conservation Project, run in collaboration with Aaranyak. He is associated with the Hoolock Gibbon Project under the Animal Ecology & Wildlife Biology Lab, Department of Zoology, Gauhati University since 2003.

39. Dr. Suhada Jayawardena
Veterinay Surgeon, Elephant Transit Home, Colombo.
Email: suhada_dwlc@yahoo.com
Contact No.: 0094472233292
Office: Dept. of Wildlife Conservation, Gregory' s Road, Colombo.

One of the three veterinary surgeons attached to the Dept. of Wildlife Conservation, Dr. Jayawardena is in-charge of the elephant transit home in Udawalawe. He looks after the Southern and Eastern wildlife regions of Sri Lanka and carries out translocation operations of problem elephants and animals that need the support of the veterinary and Forest Department.

40. Mr. Vivek Menon
Executive Director & Ex-Officio Trustee, Wildlife Trust of India.
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Contact No.: 011 2632 6025/ 26
Office: A-220, New Friends Colony, New Delhi-110065.

Wildlife conservationist, author and photographer, Mr. Menon has founded or co-founded five environmental and conservation organizations in India. The winner of the prestigious Rufford Award for Nature Conservation 2002, he is currently the Executive Director of the Wildlife Trust of India, one of the leading NGOs in the country. He has served as Honorary Wildlife Warden of Delhi for the past 5 years, is a member of four specialists groups of the IUCN and author of five books on Indian wildlife.

41. Dr. Werner Kaumanns
Curator of Primates, Cologne Zoo
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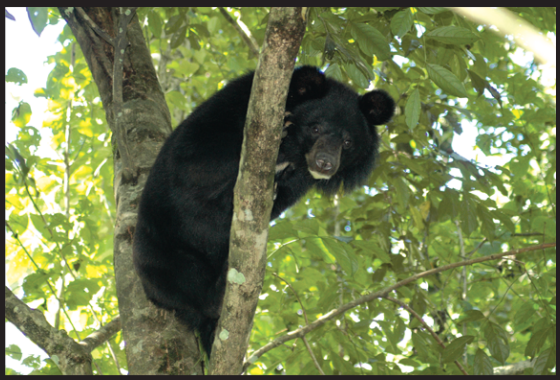
Contact No.: x49 - (0)221-7785-157
Office: Zoologischer Garten Koln (Cologne Zoo), Riehler Strabe 173, 50735, Koln (Cologne), Germany
Residence:Steinweg 1, D-37130 Gleichen, Germany.

From 1982 to 1999, Dr. Kaumanns worked at German Primate Center where he was in charge of the breeding colonies of the center. Since 2000, he is working as the curator of primates and head of the Working Group of Primatology at Cologne zoo. He is also acting as the European coordinator for ruffed lemurs, douc langurs and lion-tailed macaques breeding programme. He is associated in field projects in Madagascar, Vietnam and works in cooperation with Prof. Mewa Singh in South India. He is specifically interested in the study of the long term development of captive primate populations and of fragmented wild populations.

BACK TO THE WILD



Fragmentation, degradation, and destruction of India's wildlife habitats have reduced the living space for wild animals. Natural calamities like forest fires, floods and cyclones have further compounded their problems, hindering their movement to safer habitats. The result of such man-made pressures and natural calamities is animals getting displaced from their habitats, necessitating human intervention. This paper describes the major issue of wildlife displacement in India arising due to man-wildlife conflict, the possible options for the placement of different species, and the problems and prospects of taking up rehabilitation as a possible mitigation strategy.

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