The Value of Captive Breeding Programmes to Field Conservation: Elephants as an Example

Brandie Smith and Michael Hutchins

American Zoo and Aquarium Association, 8403 Colesville Road, Suite 710,
Silver Spring, MD 20910-3314, USA, e-mail: bsmith@aza.org

ABSTRACT

Wildlife conservation is among the highest priorities of professionally managed zoological parks and aquariums. Even if reintroduction is not the goal of a captive breeding programme, zoos and aquariums can contribute to wildlife and habitat conservation in a number of ways, including public education, scientific research, development of relevant technologies, professional training and technology transfer, ecotourism, political action and involvement in field conservation. Here, we use elephants as an example of how such efforts support conservation activities.

RESUME

La conservation de la faune sauvage fait partie des premières priorités des parcs zoologiques et aquariums gérés professionnellement. Même si la réintroduction n'est pas l'objectif d'un programme de reproduction en captivité, les zoos et aquariums peuvent contribuer à la protection de la faune sauvage et des habitats de diverses façons, comprenant l'éducation du public, la recherche scientifique, le développement de technologies adaptées, la formation professionnelle et le transfert de technologies, l'écotourisme, l'action politique et un engagement dans la protection sur le terrain. Ici, nous prenons les éléphants comme exemple pour montrer comment de tels efforts soutiennent les activités de protection.

INTRODUCTION

Professionally managed zoological parks and aquariums play an important role in conserving the world's imperiled species. Although these facilities once sought to fulfill this role by serving as modern "Noah's Arks", where many taxa would be bred in captivity for eventual release (Foose 1986), rapidly increasing numbers of endangered species and loss of wildlife habitat have rendered this approach less tenable. Although modern zoos no longer view captive breeding for reintroduction as a panacea for the endangered species problem, there is still a necessity for scientifically-managed captive breeding programmes (Hutchins and Conway, 1995; Hutchins et al., 1995a; Hutchins et al., 1996a).

The American Zoo and Aquarium Association (AZA) originally developed the Species Survival Plan (SSP®) as a co-operative breeding programme to help sustain selected species of wildlife in captivity. More recently the SSP has evolved to include associated field conservation, education, and research efforts (Wiese and Hutchins, 1995). As a result, many species benefit from captive propagation, even when reintroduction is not the immediate or even the ultimate goal.

The AZA Elephant SSP is an excellent example of a programme where reintroduction is not currently a priority, but where captive breeding and exhibition programmes can be of great value to *in situ* conservation, both directly and indirectly. With careful genetic and demographic management, zoos are able to maintain populations of

Photo credit: *Rick Barongi*

***Photo 1**. A research team working on assisted reproduction techniques.*

elephants that have the potential to contribute to conservation in numerous ways. These include public education, scientific research, development of relevant technologies, professional training and technology transfer, ecotourism, political action, and involvement in field conservation (Hutchins and Conway, 1995; Hutchins et al., 1996a).

PUBLIC EDUCATION

Informing the general public about the plight of endangered species is an important aspect of conservation. It is difficult to make conservation work if people are unconcerned with nature and wildlife, or are unaware of the problems (DeLapa, 1994; Kellert, 1993). AZA member institutions attract 121 million visitors each year (AZA, 1999), many of whom have the opportunity to observe live elephants and learn about the conservation problems facing these animals. Research has demonstrated that the presence of live animals does stimulate interest and curiosity (Saunders and Young, 1985) and that contact has a positive impact on affective learning (Sherwood et al., 1989). The vast majority of zoo visitors are urban dwellers who may know little about wildlife conservation issues and would never have an opportunity to see elephants in the wild.

Many institutions have specialized displays on elephant biology and conservation, which reach millions of people annually. For example, New York's Bronx Zoo/Wildlife Conservation Park recently renovated its historic Elephant and Rhino Building. Inside this structure is an extensive graphic presentation, including computerized displays which depict the loss of elephant populations over the past century. Similarly, the Oregon Zoo in Portland, Oregon has an elephant museum in its grounds which educates people about elephant biology and conservation. The National Science Teachers Association supports and advocates this type of informal science education - and it singles zoos and aquariums out as important and effective centers for science education (AZA, 1999).

AZA member zoos also have outreach programmes which allow them to spread their conservation message beyond those people who come through their gates. Some specifically target elephant conservation. "Suitcase for Survival", a co-operative educational programme developed by the AZA, World Wildlife Fund, and the US Fish and Wildlife Service, has reached thousands of school children and adults across the United States (Hardie, 1987). The programme is intended to discourage people from purchasing wildlife products. Confiscated

items, such as products made from elephant ivory, are used in this educational programme along with lectures and written educational materials. The "Elephant Ivory Trade Worksheet" provides data on why elephants are endangered, what laws are protecting them, and what the average person can do to help.

SCIENTIFIC RESEARCH

Zoos also play an important role in conservation through scientific research. As a group, AZA institutions are estimated to invest $51 million in scientific research each year. Since 1990, zoo scientists and their university collaborators have also produced more than 4,000 publications on wildlife topics, including peer-reviewed scientific papers, conference proceedings, book chapters and books (AZA, 1999).

Successful conservation programmes require a detailed knowledge of the animals involved. Field studies can be complemented by captive studies, providing a more detailed picture of an animal's biology and ecology. Field studies also benefit from the technical support of zoo-based specialists, such as nutritionists, physiologists, veterinarians, pathologists, and reproductive biologists (Hutchins et al., 1996b).

Most research on elephant reproductive biology has been conducted at zoos, and due to this work we now have a detailed understanding of elephant oestrus cycles and the physiology of the reproductive system (Hess et al., 1983; Jainudeen et al., 1971; Olsen et. al., 1994), and chemical signals associated with oestrus and musth (Rasmussen and Schulte, 1998). Information on chemical communication is currently being examined for its effectiveness as a repellent against crop-raiding wild elephants in Zimbabwe (Osborn and Rasmussen, 1995).

Nutritional analyses have been conducted on captive populations of elephants to determine the type and amount of foods consumed (Dierenfeld, 1995). Using zoo-based analytical laboratories, nutrient assays can be performed to find out how animals meet their nutrient requirements. This information could potentially be used to determine adequacy of food resources in the wild.

Photo credit: *Walt Disney World Co.*

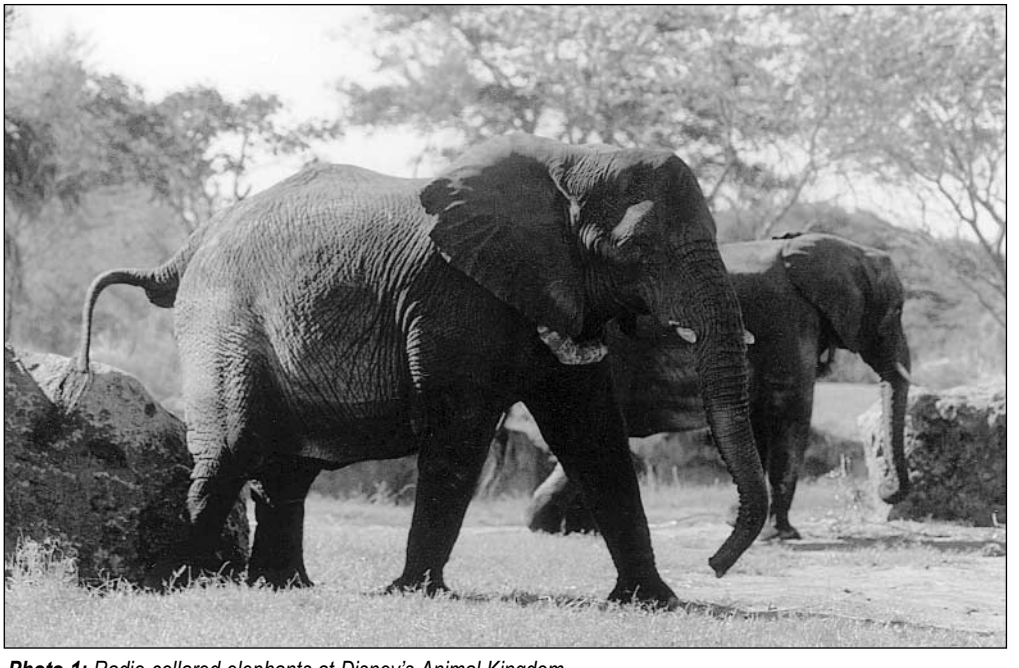

Photo 1: *Radio-collared elephants at Disney's Animal Kingdom.*

Infrasonic communication in elephants was first discovered and studied in captive elephants (Payne et al., 1986). This knowledge is vital for understanding how wild elephants coordinate their movements over great distances. Disney's Animal Kingdom is currently analyzing vocalizations and behavior of a herd of captive African elephants (Savage, pers. comm.). The goal is to develop a comprehensive vocal repertoire that incorporates both the behavioral and functional aspects of communication.

Basic biometric data on Asian elephants was accrued by zoo-based scientists from research on captive elephants in India and Nepal. Systematic collection of this information provides a basis for morphological comparison and enhances our understanding of elephant biology (Wemmer and Krishnamurthy, 1992).

DEVELOPMENT OF RELEVANT TECHNOLOGIES

Technologies relevant to field conservation can also be tested on captive animals before being used in nature (Hutchins and Conway, 1995). For example, research on elephant reproduction has led to technologies for both enhancing and preventing reproduction. Contraceptive methods - although not a panacea for population problems - might prove to be useful for controlling the numbers of free-ranging elephant populations (Brown et al., 1992; Fayrer-Hosken et al., 1997). Culling programmes, although often deemed necessary in fragmented habitats and isolated national parks (Pienaar, 1969), are strongly opposed by politically powerful animal welfare and animal rights groups and may not always be a viable management option (Poole, 1992).

Advances have been made in artificial reproduction techniques, as evidenced by the recent successful artificial inseminations of two African cows (Olson, 1999) and successful live birth from artificial insemination of one Asian cow. Further development of these technologies would be valuable not only to captive management, but also potentially to wild populations, where genetic variability could be increased in small, isolated or highly fragmented populations that have little possibility of natural genetic interchange. Technology developed in zoos to detect fecal steroid concentrations (Wasser et al., 1996) can also be used to non-invasively monitor reproductive status in wild populations.

Development of methods for tracking the movements of elephants has also been conducted at zoos such as the Bronx Zoo/Wildlife Conservation Park and the National Zoological Park. Radio and satellite tracking programmes have been developed to follow animals through a variety of habitats. The satellite tracking technique, developed and tested by Bronx Zoo scientists on Asian elephants in the Wild Asia exhibit, is now being used successfully to track the movements of forest-dwelling elephants in central Africa (Nobbe, 1992).

Zoo-based veterinarians and pathologists have done much to advance our knowledge of exotic animal diseases, including methods to diagnose and treat various pathogens. This has important implications for monitoring and controlling disease in free-ranging populations (Hutchins et al., 1991; Cook et al., 1995).

One of the most important technologies to arise from zoos is the collection of DNA samples using non-invasive techniques (Ryder, 1990). Dr. Samuel Wasser of the Woodland Park Zoological Gardens in Seattle, Washington, has recently obtained genetic information from elephants through DNA collected from fecal samples. This technique may make it possible to construct a geographic map of gene frequencies of wild elephant populations. Zoo researchers have also developed a technique for collecting DNA from ivory (Wasser, pers. comm.). By comparing ivory DNA to gene frequency maps, scientists may be able to determine the region where the ivory originated. This, in turn, may make it easier to track its origin and allow controlled culling of elephants in countries with excellent track records in conservation. With the CITES decision of 1997 to downlist elephants from Botswana, Namibia, and Zimbabwe from Appendix I to Appendix II, it will be important to determine if ivory has originated from these

countries, or if it comes from countries where trade remains illegal.

Knowledge of small population biology and management also has relevance to *in situ* conservation. Habitat loss and fragmentation continues unabated, and some African national parks are surrounded by fences to prevent poaching and human/animal conflicts. Because of this, loss of genetic diversity is a risk that even wild elephants face. Zoo-based geneticists, such as Dr. Robert Lacy of the Brookfield Zoo in Chicago, Dr. Jon Ballou of the National Zoological Park, and Dr. Robert Wiese of the Fort Worth Zoo, have been leaders in the development of genetic management techniques for small populations, as well as methods for Population Viability Analysis (PVA). Dr. Lacy developed the VORTEX software program, which is now widely used as a basis for many such analyses (Lacy, 1993).

PROFESSIONAL TRAINING AND TECHNOLOGY TRANSFER

Training local conservation professionals is an important part of protecting and managing wildlife and wildlife habitats for the future (Wemmer et al., 1993). Several zoos participate in range country programmes which train resident biologists to address local conservation needs.

For example, the Wildlife Conservation Society (WCS), which operates the Bronx Zoo/Wildlife Conservation Park, Aquarium for Wildlife Conservation, Central Park Wildlife Center, Prospect Park Wildlife Center and Queens Wildlife Center, sponsors a field veterinary programme, which augments continuing conservation efforts by dealing with current health concerns of wild populations (Gorman, 1994; Cook et al., 1995). Zoo-sponsored veterinarians travel to many countries to monitor and assess the health of wild populations and to train local veterinarians in topics such as anatomy, physiology, genetics, nutrition, pathology, and clinical medicine. They also provide training in animal capture, restraint, transport, and record keeping. In addition, WCS conducts extensive training programmes in field conservation methods worldwide (Rabinowitz, 1993).

Similarly, the National Zoological Park's Conservation and Research Center (CRC) has also developed an innovative programme to train professionals from developing countries in the field of wildlife biology (Wemmer et al., 1990). Experts from the CRC travel to other countries and host classes at their facility to share their knowledge on the development and use of the latest techniques in radio-telemetry, computer modelling, population management, non-invasive monitoring of reproductive cycles, and Geographic Information Systems (Jhala, 1994).

ECOTOURISM

Many zoos have travel programmes that, when properly administered, can help provide an economic incentive for wildlife and habitat conservation in developing countries. They also build support for conservation by allowing participants to see and experience wildlife in nature. African countries are a major destination for zoo-based travel programmes, and a closer connection between such programmes and wildlife conservation efforts is possible (Hutchins et al., 1995b).

POLITICAL ACTION

AZA accredited zoos and aquariums have close relationships with local and state governments, and have become a powerful lobbying force for conservation. The AZA Department of Government Affairs has developed a legislative alert network consisting of 185 member institutions and over 7,000 zoological professionals. When important legislation is being considered by the US Congress, this network can spring into action, providing timely comments that can influence pending legislation. For example, AZA member institutions wrote letters of support and AZA staff and representatives testified on behalf of the African Elephant and Asian Elephant Conservation Acts, both of which eventually were passed. The African Elephant

Photo credit: *Walt Disney World Co.*

Photo 3. *Researcher studying elephant vocalizations.*

Conservation Act has provided millions of dollars to support in situ research and conservation initiatives (Phillips, 1998) and the Asian Elephant Conservation Act has the potential to do the same. In addition, the AZA teamed with other partners, such as World Wildlife Fund and Wildlife Preservation Trust International, to organize receptions for Congressional Representatives and their aides to help promote this legislation.

DIRECT SUPPORT OF FIELD CONSERVATION

Zoos are also able to benefit wild populations with their ability to raise money for field conservation and habitat protection (Hutchins and Conway, 1995). AZA institutions supported or conducted nearly 700 field conservation and research projects in 80 countries during 1997 alone (AZA, 1999).

Some AZA members have provided substantial direct support for elephant field conservation and related research. The WCS has a long history of supporting elephant conservation in Africa, having provided financial and logistical support for many relevant projects, including David Western's "African Elephant Action Plan" and Richard Barnes' study of forest-dwelling elephants in Ghana (Barnes et al., 1995a) and his review of the status of forest elephants in central Africa (Barnes et al., 1995b). Similarly, the Minnesota Zoo has "adopted" Way Kambas National Park in Sumatra, Indonesia, and is providing support to improve the park's infrastructure. The park is an important refuge for Asian elephants in Sumatra (WWF, 1998). Disney's Animal Kingdom established the Disney Wildlife Conservation Fund in 1995. Through the Fund, annual cash awards are distributed to nonprofit organizations to protect and study endangered and threatened animals and their habitats. To date more than $3 million has been dedicated to programmes in more than two dozen countries under the auspices of 40 nonprofit environmental and conservation organizations. Several of the projects involve elephant

conservation. North Carolina Zoological Park has joined with WWF-Cameroon to initiate a joint study on human/elephant interaction. The zoo provides veterinary expertise in anesthetizing elephants to place tracking collars on them and supplies collars, receivers, and satellite time to track the elephants from space.

CO-OPERATION BETWEEN AZA AND IUCN/SSC

AZA and IUCN/SSC already have a solid partnership. AZA and 15 of its member institutions are members of IUCN. In addition, AZA zoo and aquarium professionals chair several taxonomic SSC specialist groups (e.g. Dr. Chris Wemmer, National Zoological Park, Deer Specialist Group; Wendy Worth, Zoo Atlanta, Hornbill Specialist Group and Dr. George Rabb, Director of the Chicago Zoological Society, is a member of the SSC Steering Committee, which he chaired for seven years.)

In situ elephant conservation could be furthered if the AZA were able to develop even stronger ties with the SSC African and Asian Elephant Specialist Groups. This could be achieved by designating IUCN/SSC liaisons to the AZA Elephant SSP to communicate current research and conservation needs. Information exchange and IUCN/SSC participation in SSP planning could help the SSP strengthen the link between zoos and elephant field conservation. IUCN could also partner with the AZA Conservation Action Partnership (CAP): East Africa and CAP: Southeast Asia to help organize co-operative field projects in those regions. CAPs are special committees designed to help coordinate the conservation and scientific activities of AZA institutions working in specific geographical regions of the world. The chairs of the AZA CAPs: East Africa and Southeast Asia have considerable experience with African and Asian conservation and are just beginning to develop their programmes.

IUCN could also improve zoo-based education and public relations programmes by keeping zoo educators informed about recent issues and developments in elephant field research and conservation. In response, the AZA and its members could potentially assist IUCN/SSC Elephant Specialist Groups with developing educational materials for use in range countries. For example, the Bronx Zoo/Wildlife Conservation Park's exhibit design and education staff recently redesigned the Nairobi Animal Orphanage, which is now being renovated with support from the WCS; and, North Carolina Zoological Park, in their partnership with WWF-Cameroon, is working to educate people living in and around the study areas.

The timing for intensified co-operation is excellent, since modern, professionally-managed zoos are in a transitional period. AZA is currently engaged in an Elephant Planning Initiative which is examining critical issues in zoo based elephant management and conservation, such as population management, husbandry and management, importation from range countries, and links to in situ conservation (Smith and Hutchins, 1999). The ultimate goals of this initiative are to improve accepted standards of professional conduct and elephant care and to increase contributions to conservation. The elephant initiative is just one example of how zoos are in the process of developing a stronger link between their living collections and the fate of animals and their habitats in nature (Wiese and Hutchins, 1995; Hutchins and Conway, 1995; Hutchins et al., 1996b).

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