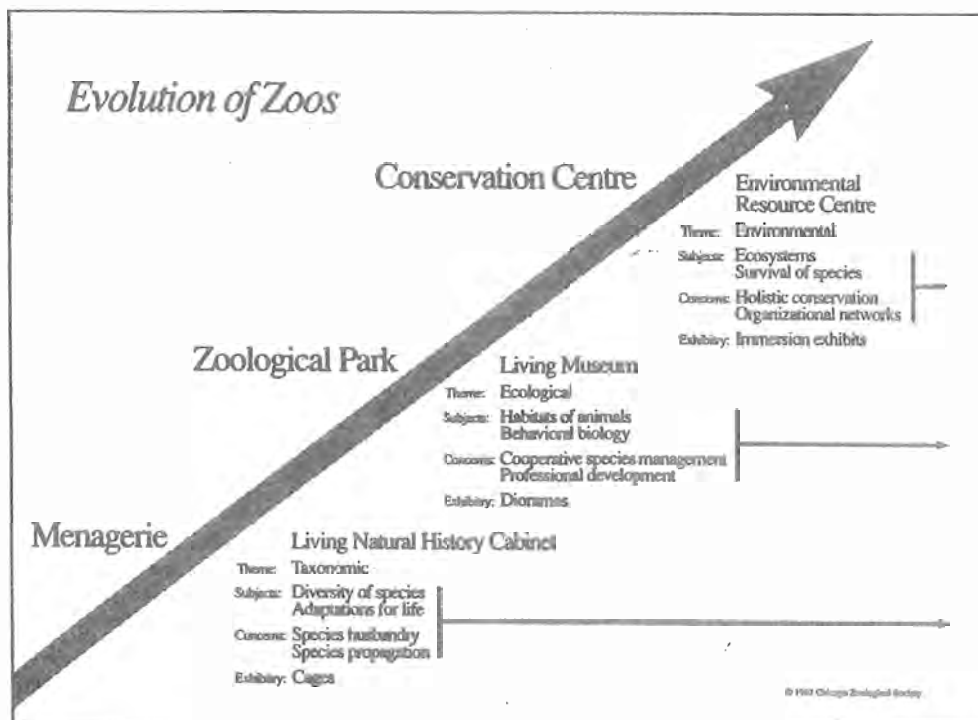


CONSERVATION BREEDING IN THE GLOBAL WILDLIFE PERSPECTIVE

Paper presented at Seminar Zoos of the Future and Wildlife Conservation, Kuala Lumpur
George Rabb



Zoos are rapidly evolving to serve in multiple ways as conservation centres. The horizontal arrows indicate that professional capacities of concern and subjects communicated to the public in earlier phases of zoo development are now vital services to conservation. As conservation centres, zoos must additionally address sustainable relationships of humankind and nature, explain the values of ecosystems and the necessity of conserving biological diversity, practise the conservation ethic throughout zoo operations, and cooperate within the world zoo network and with other conservation organisations. Immersion exhibits involve zoo visitors in the environmental circumstances of the animals, and such experiences are conducive to favourable reception by visitors of strong conservation messages.

From the World Zoo Conservation Strategy

The history of zoos goes back to very ancient times in China and in the Middle East, but zoos for the public as we think of them today are rather recent — a matter of a couple of centuries. In a diagram that has been widely published I indicated the course of development of these organizations in this relatively brief time: from menagerie to zoological park to conservation center for the future. This diagram reminds us that zoos came from collecting activities around the world, with display of the captured living animals much as in the natural history cabinet — as curiosities to be looked at and marveled over for their diversity and marvelous adaptations. Breeding of species in captivity was largely fortuitous.

Gradually, zoos shifted to become zoological parks or bio parks, with some suggestion in their exhibition to the visiting public that the animals came from particular places or habitats. This trend to being a living museum with dioramas for displays took a hundred years to become dominant, partly because there was little external pressure or resources for zoos to change more rapidly. The idea of such naturalistic exhibits had been around since 1802 when the French zoologist Lacepede put it forward. It was not until the end of the 19th century, however, that sufficient technology was available to replicate environmental backgrounds, and the landscape skills of the Hagenbeck family were first employed for this purpose. In more recent years new technologies have enabled the durable simulation of many aspects of habitats

beyond the landscape itself. In other words, plastics as well as concrete have added to our capacity to make environments appropriate for the animals. At the same time more living plant materials have been utilized for exhibits as veterinary knowledge and drugs enabled coping with parasites and other problems resulting from keeping animals in close confinement on natural substrates.

The ecological theme is now widespread in zoos, and the public is informed of the behavioral characteristics of the animals as well as their habitat requirements in the wild. The evolution of zoos as conservation centers has come about because of a changed perspective on people's relationship to nature. As human pressures on natural environments have escalated, more and more species and ecosystems have become imperiled. This situation is now widely appreciated around the world, thanks to media such as television. In keeping with this awakening, zoos have begun to change their exhibition programs to immerse visitors in the experience of the environments of the animals and to reinforce awareness of the impacts that humans are having on the ecosystems that the exhibits are based on.

In thinking about how zoos should act as conservation centers, we have identified four roles: model citizen, wildlife conservationist, mentor, and instructor and inspirer of the public. As model citizen, a zoo must demonstrate good practices in its building, maintenance and operations. These

responsibilities include water and energy conservation, recycling of organic and other materials minimization of use of toxic chemicals as herbicides and pesticides, and use of durable and recycled materials in construction. The prime consideration here is that a zoo must be consistent in its practices if it is to be credible in advancing the cause of environmental conservation. This is particularly true as zoos are looked to by young people as models for good organizational behavior. Other arguments for this role include the very practical one of achieving economies by such practices.

As wildlife conservationist, the role of the zoo can be multifold. In these times, the immediate circumstances of many species demand intervention to prevent their extinction. Zoos have been playing such a role as survival refuges since early in this century in the case of species such as the European bison, American bison, and Father David's deer. More recent examples include several species of birds extirpated on Guam by an invasive species, the brown tree snake. In recent years some zoos have extended the idea of a refuge to include genome reservoirs — frozen seed banks of sperm and ova of endangered species.

Another part of the role as wildlife conservationist is in maintaining populations of animals in zoos in viable condition for long term maintenance of the species involved. Here zoos have been making very substantial contributions to knowledge of small population biology and genetics. Originally focussed on the deleterious effects of inbreeding, these studies now extend from stress measures to sophisticated analyses of genetic variation utilizing DNA sequencing. The practical maintenance of highly desirable genetic variation in zoo populations has involved development of record-keeping systems, analyses of pedigrees, and forecasts to maintain genetic diversity in breeding programs.

A third aspect of being a wildlife conservationist is outreach to wildlife biologists, national park officials, and others concerned with management of wildlife and habitats. Beginning with study of genetic and demographic factors that influence survival of small populations, zoo biologists have contributed models for predicting the effects on population survival of a multiplicity of factors, including ecological cycles, environmental catastrophes, and taking of animals by humans, as well as the genetic and demographic ones. As national parks become more conspicuous as islands in more developed landscape, they become in essence megazoo. In some national parks, management is as intense as in any zoo, including keeping animals populations within the carrying capacity of the environment, food and water provisioning of large species, and monitoring and treating wildlife diseases. The population models mentioned are already being utilized for the long term management programs for some species such as African rhinos in the confined wilds of national parks and reserves. In addition zoo biologists and veterinarians are increasingly working alongside park and wildlife biologists to investigate the biology and conservation status of particular threatened species.

Another major role of zoos as conservation centers is being mentor to future conservation biologists and wildlife managers. Training students and others in techniques for determining genetic variation in populations, in up-close behavioral observation skills, in animal health assessment,

and in modelling animal population futures — all are important components to equip those who will be responsible for wildlife in zoos and in wild going forward.

The most important role of zoos as conservation centers will continue to be of an educational kind. Although zoos called informal education institutions, many zoos actually offer programs for visitors and school classes. Yet the informal, casual transmission of information is their main mode of education. As to what is being communicated, there is still a need for teaching people about the diversity of life, the requirements of animals and plants for basic elements in their environments, the interdependence of life — subjects zoos have been conveying to their publics for a long time. What is new to communicate is in relating everything environmental to people, and instilling appreciation of how human influence affects the welfare of all species and the environment.

Although a visit to a zoo may be only an occasional part of most people's lives, it can be a very illuminating experience. In this regard, the advantage zoos have in their living teaching aides — the animals — should not be underestimated. The challenge is in taking full advantage of the appeal and attraction of the animals to make the needed points about people's relationship to the welfare and future of other species. This can be done by involving the visitor more deeply, as in this sensation of being immersed in the environment, and posing questions that require engagement by the visitor to answer, and repeating relevant informational messages at every opportunity. Some of the messages should relate to the individual zoo's efforts as a conservation center: model citizen, wildlife conservationist, and mentor as well as educator. People can be inspired by the example of zoos to take on seriously the challenge of living sustainably and harmoniously with nature. This is an immense and important undertaking, for fundamentally we have to bring about a progressive shift of values held by societies everywhere if there is to be sufficient change in our relationships with the natural world to insure the future of nature in all its diversity.

Global Wildlife Conservation Perspective.

Since the early 1980's, major private and intergovernmental organisations have been debating and developing plans for bettering the status of environments worldwide. Documents from the conservation community such as the World Conservation Strategy have been paralleled by other from the political leadership such as Our Common Future, the report of the Brundtland Commission. In 1992, the United Nations Conference on Environment and Development took place, with fresh reviews by conservation and political leaders, and with accompanying documents such as Caring for the Earth and Agenda 21. The idea of sustainable development — advancing the economic and social well-being of people while maintaining environmental integrity and its capacity for self-renewal — was core to the discussions. Although many felt that central issues of consumption and human population growth were not really examined this so-called Earth Summit did produce an agenda for change by nations and peoples. It also produced some specific instruments for facilitating conservation action. In particular, the Convention on Biological Diversity. This convention calls for nations to assess their biological diversity. It also commits signatory nations to sustainable use practices and to fair and equitable sharing of benefits from biological diversity.

With this background, globally we are still in much ignorance as to practices to follow in living in a more sustainable fashion. The World Conservation Union — IUCN — faltered in its initial attempt to develop a set of principles for sustainable use of wild living natural resources. It has since set about trying to learn from local communities and regions about successes in maintaining biological resources while exploiting them in various ways. The goal is to discover what working principles can secure wild living resources for the future. Meanwhile, the IUCN has provided a reassessment of the imperiled fauna and, soon, the threatened flora, of the world. The animal species were reviewed with a new set of standards using population biology and geographical distribution factors as measures of threat of extinction. As in the past, the conspicuous creatures — mammals, birds, reptiles, amphibians, and fishes, with a small sampling of molluscs, butterflies, and other invertebrate animals. The alarming news from the 1996 Red List is that one-fourth of all species of mammals are threatened to one degree or another with extinction. A similar number of birds are threatened, about 1100 species, but because there are more kinds of birds than mammals this means only 11% of the avifauna is threatened.

The other vertebrates have not been completely assessed, but of those that have, the proportion threatened is more like the mammals than the birds. The principal cause for extinction threats was habitat destruction, fragmentation and degradation, followed by invasive alien species, direct taking, pollution, and climate change. The largest orders of groups of species of birds and mammals have the highest numbers of threatened species, but the proportions are not exact, with some large relatively low in numbers of threatened species, others high (for example, 16% of rodents, but 45% of primates). The top hot spots of endangerment for the birds and mammals on a national basis were Indonesia, China, Brazil, India, Philippines, and Mexico. For Malaysia 42 of 286 species of mammals were considered threatened, and 34 of 735 bird species. Malaysia, of course, has relatively few endemic species, but the general situation for the vertebrate fauna in this part of Asia is not reassuring and therefore it is important that Malaysia gives serious attention to all species within its borders, not just endemic species.

Conservation Breeding.

In light of these recent general findings on the status of vertebrate species, it is imperative to consider available conservation responses, and captive breeding is one such response. Recently in the professional journals *Conservation Biology*, *Zoo Biology*, *Bio diversity and Conservation*, and in other publications there have been voluminous debates and discussions on the subject of breeding species in captivity for conservation. Several sociopolitical concerns are evident in these discussions, although not all are detailed. These concerns include: the use of captive breeding of endangered species by zoos as a way to obtain a conservation image without full commitment to all dimensions of conservation of the species; the use of captive breeding by government agencies as a way to escape responsibility for maintenance of species in their natural habitats through protection of species and their habitats; the notion that financial resources devoted to captive breeding could as early go towards conservation in the wild; the idea that captive breeding programs be prioritized to achieve maximum conservation effect by considering criteria of like hood of reintroduction,

costs, and specific reproductive capacities of candidate species and groups of species. There have also been charges of ill-informed assessments of large taxonomic groups for the development of captive breeding priorities by the Conservation Breeding Specialist Group of the Species Survival Commission / IUCN. Knowing the subject is fraught with some controversy, policy makers and wildlife managers should nevertheless be open to proposals for employment of captive breeding of the biota may be lost forever. At the same time, there should be expectation that proposals for captive breeding will be soundly argued, with consideration of the several objections raised in the recent exchange of published views.

In determining the applicability of captive breeding in any instance, it is useful to put it and alternative strategies in a frame work for decision-making. The elements of such a frame work are first, a conservation status assessment of the species or ecosystem involved, including, for species, population numbers, geographic distribution pattern, and trends in the populations; analyses of the nature degree of threat and of the potential alternative conservation responses, which may range from simple educational measures to law enforcement, from setting up natural reserves to captive breeding, from exterminating invasive species to reducing pollution. A second element in conservation decision-making is valuing, or looking at intrinsic and extrinsic values of a species or ecosystem. The intrinsic values include, for a species, its evolutionary position in respect to all other species and to close relatives; its ecological functions and ecosystem role; the distinction of its biology, as in particular physiological, morphological or reproductive features; its contribution to the biological diversity of the region and biome. Extrinsic values are those that people attach, including cultural values, such as symbolic and biophilic values; ethical values, such as intra- and intergenerational obligations to preserve natural resources; and economic values, which encompass the monetary values that may be ascribed to ecosystem services as well as to consumptive and non-consumptive usages of species. A final element in conservation decision-making is estimation of resources required for any applicable conservation strategy. These include human resources (technical people, volunteers, local people and their leaders) as well as financial resources. Additionally, other factors need to be considered; legal, logistical, and institutional among them. Any particular case must be balanced against other options for utilization of the same or other resources. Obviously a general evaluative and directional plan for environmental conservation in a region of country can be of great assistance in the determination to proceed with a particular strategy for particular species or ecosystems.

If we accept that ideally this or a similar framework should be employed, there are still the realities of our usual ignorance of much of the biology involved, of the habitats, and the urgency of some situations. These considerations especially apply to some of the so-called charismatic megavertebrates such as the giant panda, the rhinos, and other long lived species of limited fecundity. I suggest that the appropriate rule here is to keep options open or, in the words of the ecophilosopher Aldo Leopold, the first rule of intelligent tinkering is to save all the parts. Such species as the Sumatran rhino, already in captive breeding compounds in Malaysia, require a long-term commitment to alleviate the conditions that militate against

its existence. These include illegal hunting, the conversion of habitat to other usages, and the consequent very low numbers of the species in widely dispersed areas. Difficulties in this instance include the generally poor record for breeding rhinos in small compounds, the need for international control of illegal trade in rhino parts; the costs and complexity of a communications and educational program for conservation of the species and its preferred environments. As to the argument that, for the same expenditure of resources, many smaller creatures could be bred in captivity and more readily returned to a natural environment, it is valid. Yet if we value the Sumatran rhino and similar large creatures highly for their intrinsic qualities and also recognize their extrinsic value in serving as flagship species helping to make the conservation of many less conspicuous species possible, then we must commit to their conservation in full measure. That enclosed and protected areas of large sizes may be required for successful breeding and maintenance of species such as the Sumatran rhino is an open question that needs full attention.

Of a different order of concern than large flagship or umbrella species is the situation where unknown factors are negatively impacting many species of frogs and perhaps other amphibians. Some species of frogs have disappeared and in other species their populations have severely declined.

This phenomenon has been witnessed in temperate North America and in rather pristine tropical montane environments in Central America, South America, and Australia. Epidemic agents appear to kill off the frogs, but the precursory factors in the environment are still undetermined. Unfortunately there is little capacity to mount the collective captive breeding effort that might salvage the various species at risk, and some species are certainly lost, whatever values we might assign them in retrospect. An example of what we may have lost in the course of this mysterious phenomenon is the gastric brooding frogs of Australia, which somehow had the ability to stop the operation of their digestive system to allow for the development of offspring in the stomach of the mother. The biomedical research opportunity implicit here may be forever lost. Whatever tinkering we may have done to the global environment in this instance, we have already lost pieces to put back.

Summary.

Zoos are evolving as conservation organizations, with several roles to play; model citizen, wildlife conservationist, mentor for young conservationists, and educator-communicator-inspirer of their visiting publics. Zoos around the world have the potential for changing public attitudes and behaviour for the benefit of environmental conservation, but must be consistent in their activities to carry on credible communications for conservation. Zoos operate in a demanding climate for effectiveness in wildlife conservation. The global picture for maintaining species diversity and natural environments has not perceptibly improved, and recent assessment indicates that the vertebrate animals are more seriously under threat of extinction than we had previously recognised. One aspect of the wildlife conservation role of zoos is captive breeding for the purpose of reintroduction of depleted species to the wild, or for safe refuge of some species until sufficient restoration of habitat occurs

or sufficient provisions are put in place for protection or management of the species and its environment. The decisions on what captive breeding programs to undertake should ideally be made in a framework for prioritization, including conservation status assessment, analysis of threats and available conservation responses, valuing and resourcing. Practically, many decisions on employment of captive breeding must be made before a great deal of information is at hand. It is suggested that it is better not to lose species if captive breeding can be used at least as an effective temporary conservation action while longer term issues involved in particular cases are worked out. ■

continued from Report on seminar

importance of zoos in breeding wild animals for reintroduction and having facilities which are capable of meeting this challenge.

Dr. Thomas J. Foose gave an overview of how zoos in the western world today are addressing the problems of some of their tropical counterparts both in the zoo and in the field by providing technology and training and developing solutions to problems of small populations. He focused on the rhino as a case study and showed very interesting slides of different individuals throughout the world which were significant in some way to the zoo breeding programmes. He also discussed plans for reintroduction in some areas and described programmes in which western zoos support field projects.

Sally Walker had been given the assignment of The Role of Government in Creating Future Zoos and irritated everyone by suggesting that zoos focus on invertebrates and amphibians at least as much as mammals. Dr. George Rabb implied a similar message, and his presentation as well as Walker's is included in this issue.

In the afternoon session, Sri Lyn de Alwis made a presentation entitled "The Effects of Urbanisation on Current Zoos Worldwide and the Need to Create Zoos of the Future". In this presentation Mr. Alwis discussed the trend of zoos to move outside the city where larger tracts of land are available and where they have room to create more naturalistic habitats for animals.

After tea, the seminar again came together for a panel discussion of some of the concepts and ideas promoted by the speakers. In his presentation, the Minister expressed interest in a Night Safari and wished that some of the discussion could be to ascertain whether it was a good idea for Malaysia. As the author of the concept, Sri Lyn D. Alwis, Design Consultant, Singapore Zoo Night Safari, and the implementor, Sri Bernard Harrison, Director, Singapore Zoo were both present at the Seminar it was an excellent opportunity to discuss this idea. Alwis and Harrison both supported the concept of a Night Safari in principle but added cautionary notes.

The audience had a variety of questions regarding zoo conservation, animal welfare, wildlife management and recovery which were answered by the panelists.

The programme ended with a Vote of Thanks. ■