FORUM

THE EVOLUTION OF ZOOS FROM MENAGERIES TO CENTERS OF CONSERVATION AND CARING

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The business of zoos and aquariums has certainly changed from a century ago, when the primary focus was displaying a wide variety of exotic animals solely for the recreation of the public. Today, leaders in the business are aware that more must be done to promote the very survival of the charismatic megavertebrates that constitute the principal attractions of most of our zoological institutions. The evolution of zoos and aquariums into conservation centers is an ideal generally accepted by those managing or operating such facilities (IUDZG/ CBSG 1993). When 1,100—one of every four—species of mammals are considered threatened (Baillie 1996; Rabb 1997), and likely one of every three amphibians, the alternative of conducting business as usual in menagerie or zoological park settings without investments in conservation and research is not realistic. Without these investments, this course leads to arrays of animals insufficient to attract public interest and support, and therefore, perhaps, to institutional extinction.

The responsibilities of a conservation center have been spelled out over the last decade (Hutchins and Conway 1995; Hutchins 2002; Rabb 1994; 2000). As conservation centers, zoos strive to help society achieve a more sustainable and harmonious relationship with nature by doing four things: 1) ensuring that their operations are as environmentally friendly as possible, 2) contributing to the careful management of the earth's biological resources, which includes captive and wild animal populations and viable ecosystems, 3) inspiring others to celebrate and conserve nature, and to adopt earth-friendly lifestyles, and 4) building human capacity by mentoring and training others. These four roles (model citizen, wildlife conservationist, agent for conservation, mentor and trainer) have been further described by Rabb and Saunders (in press). Although we cannot expect all institutions to measure up at this time in all these roles, every facility can contribute to the collective effort that is now seen as needed on a nationwide, indeed global, basis. Reasonable measures of achievement in this vein have been spelled out by Miller et al. (2004).

MODEL CITIZEN

This role highlights the commitment of zoos to be internally consistent regarding their conservation values. By applying common sense to conserve natural resources and energy whenever possible, and sharing both challenges and successes, zoos can serve as models for their various audiences. Composting and recycling are commonplace evidence of engagement in such conservation, and saving rain and water generally are readily appreciated by the visiting publics. Lately more organizations have also been planning and retrofitting facilities to save or actually produce energy in the course of operations. Wind, solar, and deep thermal bases as well as structure of materials should be considered. There are guides and gurus available to help (McDonough and Braungart 2002; Benyus 1997). The notion that

in this kind of conservation we are basically emulating nature and natural processes (biomimicry) has its own appeal.

WILDLIFE CONSERVATIONIST

Over the last two decades, much of the available time and resources for developing conservation programs has gone into the wildlife conservationist role, improving the science and management applied to maintaining zoos' animal collections long-term. There have been clear advances in the treatment of animals during this phase of the development of zoological parks, including attention to full expression of natural behaviors as well as appropriate diets and veterinary medical care.

Perhaps the most striking change over the last half-century is the pooling and analysis of data. This has allowed collective cooperative efforts in maintaining genetically healthy populations of various species, especially those threatened with extinction. In 1974, Ulie Seal launched the International Species Information System for pooled data (Seal, Makey and Murtfeldt 1976). Species Survival Plans of the American Zoo and Aquarium Association (AZA) took up the management challenges of individual taxa. While studbooks for a few species had been set up in the 1920s and 1930s, it was not until geneticist Herman Slatis (1960) analyzed the European bison studbook that the value of such data became obvious. His findings on inbreeding in this small population inspired some zoo scientists to become similarly engaged. Ralls, Harvey, and Lyles found inbreeding was reflected in the detailed records of animals at the National Zoo (1979); Bob Lacy (1993) developed Vortex, a PVA model for managing the population genetics of the usual small populations held in captivity. Now there is an AZA population management center to help species managers and institutions analyze the conditions of their animal populations and recommend choices for the future.

There is also much more rigorous and definitive identification of the level of endangerment of individual species, thanks to the work of Georgina Mace and conservation colleagues (IUCN 2000). Unfortunately, no other agencies or institutions have taken on the responsibilities of maintaining endangered species indefinitely, and zoos and aquariums have been hard-pressed to care for the megavertebrates (Conway 1986), much less the numerous small species that also need such close continuing care.

Much of the wildlife conservation work done by zoos has been well-documented, from the pioneering work with American bison by William Hornaday at the Bronx Zoo (begun nearly a century ago), to more recent successful reintroductions to the wild from captive populations of Przewalski's horse, Arabian oryx, golden lion tamarin and others. Zoos have become more active and involved in field studies for some years, with the contributions of George Schaller being particularly notable for increasing our understanding and appreciation of important elements in the environment for several megavertebrates. As noted above, zoos are now being looked to for last minute rescues of very small species as well as the larger, charismatic creatures.

From the middle of the last century, various aspects of the biology and medical handling of the animals commonly held in zoos received attention, benefiting individ-

Children meet a snow leopard in the Brookfield Zoo. *Photo courtesy of Jim Schulz.*

ual animals and zoo populations. Subjects included animal behavior, nutrition and reproduction, as well as exotic animal medicine. The updated Crandall compendium on mammals in captivity by Kleiman, Allen, Thompson, and Lumpkin (1996) is rich with such materials. And, as wild populations have become more fragmented and reduced in numbers, it has been evident that lessons learned in zoos could be applied to these populations to good effect (Lacy, Seal, Medley, Seal, and Foose 1991).

A recent example of a scientific discipline affecting the behavior and general welfare of species is behavioral endocrinology. It happens that a record of stress levels is excreted regularly by most vertebrate animals in the form of certain hormones in their feces. For some species difficult to keep in good condition, such as the clouded leopard, this has led to improvements in exhibits to give the animals more security (Wielebnowski, Fletchall, Carlstead, Busson, and Brown 2002). Almost immediately, upon such changes in various zoos, stress levels dropped very low and self-mutilating behavior disappeared. Whether there will be an increase in successful reproduction is yet to be seen.

A brief note about the evolution of zoo environments: As early as 1801, Lacépède stated that we should present animals in as close to natural conditions as feasible. It wasn't until the end of the nineteenth century that simulation of natural environments with sufficiently strong materials was possible (Piland 2001). Developed in Switzerland, the cementitious material called gunite or shotcrete was first applied

at landscape scale by Urs Eggenschwiller at the Hagenbeck's new Tierpark outside Hamburg in the first decade of the twentieth century. Much later in the century, in the 1960s, epoxy materials were used for fine detailed appearance of vegetation as well as earth and rock surfaces. Often, combinations of these cement and plastic materials and live plants have been used effectively to replicate natural environments. The result is beneficial for both the animals and the public. A recent unpublished nationwide survey of the American public (MacWilliams, Robinson and Partners, Inc. 2004) confirms that people understand that the maintenance of the native habitat for a species is crucial to its survival.[1]

AGENT FOR CONSERVATION

While there is undeniably significant value to having zoos engaged in development and application of pertinent biological and husbandry knowledge, both in-situ and ex-situ, there is also another kind of opportunity available to zoos to improve the chance of survival of many creatures and their habitats. This opportunity lies in audiences who visit zoos, and nowadays, the remote audiences tapping into materials available on a zoo's Web site. This is the role of being an agent for conservation. In this role we are educating, informing, and inspiring our constituents to care. One of the most compelling things that zoos can do is to let the public experience the many ways we care about and for animals, plants and people in all of our activities.

Why this emphasis on functions as an agent of conservation? Because the majority of people are in urban locales, and governmental leaders eventually have to respond to their public's interests to stay in office. A public committed to conservation can make an enormous positive difference in our government's treatment of our natural resources and support of conservation programs.[2] Another benefit of this role may be stimulating and assisting the participation of our publics in maintenance of local wild habitat, whether volunteers are working in the field or supporting advocates of policies to restore or maintain a healthy environment. An example of this kind of community-based effort is shown by Chicago Wilderness, an informal coalition of 170 agencies and institutions devoted to restoration and maintenance of 200,000 acres of public lands and their marvelous biodiversity. Shedd Aquarium, Lincoln Park Zoo and Brookfield Zoo are part of the coalition, and their staffs devote considerable effort to serving in the Chicago Wilderness programs.

In the course of assessing how well we are satisfying our publics, it has become evident that we need to understand the relationship of people to the animal world much better if we are to improve their regard for that world. This realization has led to initial steps in the development of an interdisciplinary field labeled conservation psychology. Following an exploratory workshop in 2002 with a diversity of colleagues, Saunders and Myers (2003) have brought together a set of papers that lay out the challenges ahead as we develop this body of knowledge and practice parallel to the field of conservation biology. As an agent for conservation, zoos need to study their audiences to discover what are the most effective ways to get their attention and participation in conservation issues.

Zoos can use an assortment of methods to assess how close they are to mission goals and their vision as conservation centers. Multiple evaluation approaches are desirable at this stage in our institutional developments (Rabb and Saunders 1999). There are devices such as beeper units to help measure the emotional dimensions of a zoo visit (see Myers, Saunders, and Birjulin in this issue), drawing studies to explore how children of different ages conceptualize animals' needs (Myers, Saunders and Garrett 2003), metaphor studies (Klenosky 2003), and card sorts to document what actions visitors intend to adopt in their own homes (Saunders, Birjulin, Bacon and Gieseke 1999). There are many other examples, such as those described in this issue of *Curator: The Museum Journal*.

Why are zoos around in this day and age when the electronic images of television can spread the case for conservation of species and their habitat very rapidly, and at appropriate levels for the audiences? For one thing, real animals offer a three-dimensional, sensory aspect that television cannot. It seems that much of the direct appeal of zoo animals is rooted in our deep behavioral inheritances, variable as they may be. E. O. Wilson (1984) has reflected most extensively on this aspect of our behavior—the biophilic connection, or innate tendency to affiliate with life or life-like processes. For zoo staff, the most compelling evidence for biophilia is observing mothers expose their newborn infants to animals.

In terms of conservation, we (Rabb and Saunders, in press) have posited that words conveying different forms of engagement with the natural world are also gauges of biophilia: caring that . . . (intellectual), caring about . . . (emotional), caring for . . . (active behavioral expression). Although these terms seem to encompass the natural dimensions of caring, which we regard as the essence of conservation (Rabb 2001a), there are other considerations. Most pertinently, caring can be "discounted" because of distance or the passage of time: the more distant the relationship, the less tendency to care. This is true whether we are speaking of bridging relationships with places (environments), people, or the rest of the biota (see Hannon 1987, 1994; Rabb and Saunders, in press, fig. 3). Also, there is an adult form of ecophobia (disengagement from direct involvement with environmental concerns, no matter how well-informed a person may be) that we must recognize and deal with if we want to enroll most citizens in conservation actions (Finger 1993a; 1993b).

A concluding observation about caring and conservation is that we must learn how to complement the gloom and doom picture of the ongoing destruction of biological diversity with positive views and reasons to celebrate and conserve the natural biotic wealth around us. Kiester (1996) has offered such a viewpoint, and, on behalf of all endangered species, I have joined the refrain (Rabb 2001a). Ecological, economic, and ethical benefits may be involved, but more and more we need to attend to the emotional, biophilic dimension. Parallels to our own behaviors may be one way of reinforcing such bonds. A recent example is the sense of fairness shown by female capuchin monkeys (Brosnan and de Waal 2004).[3] Mullen and Marvin (1999) suggest that it is the oscillation between "like us" and "not like us" that accounts for much of the fascination of watching the varied activities of animals in a zoo.

We are continuing to develop under-

standing of the psychology behind a zoo visit. Several decades ago, zoos began to recognize that messages about human relationships with nature were being communicated by how animals were displayed. These messages were encoded in the perspective from which one looks upon the animals, and in the types of enclosures, whether barred cages, dioramas, or most recently, immersion experiences. Visitor research confirms that there are many reasons people say they visit zoos. Seeing and learning about animals, spending time with family, and relaxing are chief among them. As might be expected, there are important cultural circumstances that determine the immediate relationships expressed by individuals (Kellert 1997; Kellert and Wilson 1993). Alas, these may simply obscure and complicate determination of deeper, unstated reasons. This opens the subject of biophilic connections, if only we knew how to measure those. We assume such connections happen, but what do they mean and can they lead to conservation action? Studies such as the national effort by the AZA (see Ogden, Vernon and Wagner 2002) to honestly examine what impact zoos and aquariums are having on conservation knowledge, attitudes and behaviors are critical. If we can develop a more accurate vocabulary for how people connect to the natural world, it will offer a technological breakthrough equivalent to what gunite and epoxy offered to exhibit realism.

MENTOR AND TRAINER

In all of the preceding roles, zoos and aquariums should consider themselves mentors and trainers of new generations of conservation-minded citizens and scientists. Programs can start with very young children (bearing in mind the phenomenon of ecophobia—see Sobel 1995, 1998; Slivovsky 2001, 2002), and extend to postdoctoral students. At the early end of this equation, we have made a start in this kind of investment in developments such as the Hamill Family Play Zoo at Brookfield Zoo, which is devoted to promoting caring behavior by young children (Winsten 2001). At the other end of the spectrum, a few zoos have been able to mount formal training in conservation science and field techniques for advanced students, including foreign nationals. This kind of capacity building has been carried on most extensively at the Conservation and Research Center of the National Zoo at Front Royal, Virginia, where 3,000 people have been trained over 25 years (see Wemmer, Rudran, Dallmeier and Wilson 1993).

SUMMARY

This essay recounts significant events in the evolutionary development of zoos. There have been breakthrough events in terms of the scientific basis for conservation of species that are of great concern to zoos and, because of their popularity, to all people: first, the recognition of inbreeding effects in small populations; second, the cooperative organization of data required to manage the genetic and demographic health of small populations. Many other aspects of the biological welfare of animals in zoos have benefited from scientific inputs ranging from ethology to pathology to stress endocrinology.

The latest conservation breakthrough is the recognition that we should be encouraging an understanding of the other party

in zoo relationships—people, especially visitors with youngsters, but also visitors to our informative and entertaining Web sites—who will make the conservation impact of our institutions meaningful. The first workshop on conservation psychology was organized in a zoo in 2002. The subsequent stimulation of scholarly efforts in interdisciplinary, non-academic fields has great potential for making the development of our institutions as conservation centers meaningful for the survival and maintenance of the diversity of life.

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NOTES

1. Zoo exhibits are now considered embassies in which ambassadors of other species reside—an idea reflecting growing sensitivity to our ethical obligations to other beings. It has helped engender a new generation of wild-like immersion experiences such as the Congo Gorilla Forest at the Wildlife Conservation Society Bronx Zoo.
2. Of all the forces leading to further environmental deterioration and to a retreat from pursuit of sustainability, economically-driven globalization is prime (Speth 2004). There is hope for offsetting this pervasive force with modern communications originating in bottom-up community conservation groups and with enlightened top-down changes in governance of natural resources. Zoological institutions and museums can play a major role in these efforts through their Web sites and membership e-mail networks.
3. Emory University researchers trained capuchin monkeys to hand over small rocks in exchange for "rewards" of cucumber slices. But when the researcher began to give some of the monkeys a tasty grape instead, the cucumber-receiving monkeys either rejected their reward or refused to trade at all. Some even threw their cucumber slices back at the researchers! The scientists believe this is the first time a sense of fair play has been identified in a nonhuman species.

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