Welcome

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AVMA President-Elect

Good morning. It is my pleasure to welcome you to the thirteenth annual Animal Welfare Forum on behalf of the more than 68,000 members of the American Veterinary Medical Association. The Animal Welfare Forum is held each year as the highlight of Animal Welfare Week, which is a public awareness program designed to promote the welfare of animals. For more than a decade, the Forum has served as a useful platform for highlighting and exploring important animal welfare concerns affecting a variety of species. This year the AVMA is pleased to present "The Welfare of Zoo Animals" in partnership with the American Association of Zoo Veterinarians.

Today's speakers will take us on a guided tour of the world of zoo animal welfare. We'll explore whether zoos are arks or archaic, why monkeys can't run in the monkey house, how an entire zoo collection can be managed to maximize individual welfare, why it is necessary to accredit zoos and aquariums, the realities of modern wildlife conservation, and whether animals maintained humanely can serve as ambassadors for those in the wild.

Attempting to touch on all the welfare issues affecting zoo animals during a one-day Forum is incredibly ambitious. Although we don't pretend to have all the answers, the AVMA's Animal Welfare Committee has assembled an excellent panel of speakers to provide all of us with scientifically based information that we can use to understand and improve the welfare of zoo animals.

Our goal for this Forum, as it has been for all previous Forums, is to promote the well-being of animals. The AVMA is proud of the vital role veterinarians have played in advancing the welfare of animals in captivity.

In defense of zoos and aquariums: the ethical basis for keeping wild animals in captivity

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America's zoos and aquariums have been the focus of recent criticism by some animal rights and welfare advocates and in print and electronic media.[1-7] These critics have characterized zoos and aquariums as animal prisons or, even worse, as exploiters and traffickers of wildlife. These accusations have fueled growing public and governmental concern about the welfare of zoo and aquarium animals and the appropriate use of these animals by public institutions.

Critics often generalize their claims to include all zoologic facilities, regardless of their quality or accomplishments. It is important to understand that there are 2 different kinds of wildlife facilities in the United States: those that are accredited by the **American Zoo and Aquarium Association (AZA)** and those that are not. The AZA is the only zoo and aquarium association in the world with an effective accreditation program that helps ensure quality animal care, a code of professional ethics that helps guide and regulate its members' actions, and a dedicated conservation vision.[8-10] Of the more than 2,300 animal exhibitors licensed by the USDA's **Animal and Plant Health Inspection Service (APHIS)**, fewer than 10% are qualified to be AZA members. Our comments are restricted to zoos and aquariums accredited by the AZA.

Although critics of zoos and aquariums tend to receive plenty of media attention, their generalizations about public perceptions of accredited zoologic facilities are not supported by the facts: more than 135 million people visit AZA-accredited institutions annually,[11] more than 58,000 people volunteer more than 5 million hours annually at AZA facilities,[12] a 1992 Roper poll identified zoos and aquariums as the third most trusted messenger on wildlife conservation and environmental issues (trailing only National Geographic and Jacques Cousteau),[13] and reputable print and electronic media outlets produce numerous positive reports about the conservation, scientific, and educational efforts of AZA institutions.[14-17] Given these often disparate perspectives, how should ethically mature, caring people view accredited zoos and aquariums today? Are accredited zoos and aquariums justifiable? If so, under what conditions are they justifiable?

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Some zoo and aquarium opponents are more extreme in their criticism than others. For example, some animal rights advocates are vehemently opposed to all forms of captivity, arguing that individual sentient animals have an intrinsic right to liberty.[2] For some people, even domestic pets are subjugated by their human owners; in their view, animals should interact with humans only as voluntary companions. It is highly unlikely that arguments presented here will change the minds of those who currently believe that zoos and aquariums are inherently wrong and should be eliminated.

More mainstream animal welfare advocates are not intrinsically opposed to zoos and aquariums; instead, they contend that the welfare of wild animals is diminished under human care and that it is impossible for zoos and aquariums to provide the richness of experience, freedom of movement, and quality of life animals would experience if left in nature.[1] They have also challenged zoos' and aquariums' reasons for existence, contending that, by itself, recreation is not a sufficient justification for maintaining captive wild animals, especially endangered species. The basis of the argument is that zoos and aquariums and their captive breeding programs do little to support wildlife and habitat conservation. Being conservationists and animal welfare advocates, we believe these arguments provide the most valid and difficult ethical challenges to zoos and aquariums today and, as such, they will be the focus of this report.

It is not our intent to provide a final answer to these complex questions. One cannot resolve moral questions for others, as different people have different opinions, depending on their own experiences, attitudes, and vantage points. Our intent is to contribute to the continual process of critical discussion and deliberation by providing an ethical justification for the existence of accredited zoos and aquariums at the beginning of the 21st century.

Context

In assessing the strengths and weaknesses of our arguments, it is important to understand that we are not moral absolutists (ie, we believe that human concepts of right and wrong may vary with context). Consider, for example, the Biblical commandment "thou shalt not kill." This is a clear and unambiguous statement of a moral belief that is supported by the legal framework of nearly every human society. However, context is everything. What if someone is attempting to kill you or someone you care about? Most human societies consider the taking of human life in self-defense or in the defense of others morally justifiable. Thus, even our most sacrosanct moral edicts are highly context-sensitive.

Why is this relevant to an ethical justification for accredited zoos and aquariums? Once again, context is everything. Before we can evaluate ethical arguments for or against accredited zoos and aquariums, it is important to understand the realities facing wild animals and their habitats today. Here are a few facts about the status of wildlife and nature in our human-dominated world:

- The current global human population is around 6 billion. The human population continues to grow at an exponential rate. Its total is not expected to peak for 50 years, when the population may reach 8 to 11 billion or more.[18]
- Habitat destruction, alteration, and fragmentation to meet humans' needs continue largely unabated. As a result, wildlife is being pushed into islands of habitat surrounded by a sea of human activity. These relatively small, isolated populations have a high risk of extinction because of genetic and demographic factors, chance events, and natural catastrophies.[19]
- Many of the world's national parks and reserves, particularly those in developing countries, are havens for wildlife in name only. Lack of appropriate infrastructure to enforce laws or maintain park integrity renders such paper parks largely ineffective.[19]
- Human exploitation of wildlife for meat and other products is growing, particularly in regions where widespread poverty and lack of economic alternatives push poor people to use wild animals as a "free" source of protein and income.[20]
- Conflict between humans and wild animals is increasing, as humans encroach on natural habitats and animals are moved out of protected areas. Scores of people are killed annually in Africa and Asia while attempting to protect their crops from elephants.[21,22] Similarly, conflicts between people and large carnivores, such as wolves, bears, and cougars, continue to make news in the United States.[23]
- The threat of bidirectional disease transmission between domestic animals and humans and wild animals is growing.[24] Factors responsible include increasing human encroachment on wildlife habitat, air travel, and international trade. The latter 2 have resulted in the constant movement of plants, animals, people, and pests from one continent to another. The emergence of West Nile virus in the United States is just 1 example of how diseases can cross borders, and even oceans, by natural and artificial means with devastating effects on people and wildlife.[25]
- Exotic species (those introduced intentionally or accidentally to non-native habitats) continue to proliferate, resulting in ecologic changes that threaten native organisms.[26] For example, the accidental introduction of the brown tree snake to Guam resulted in the extinction of nearly every endemic forest-dwelling bird species on the island. Only 2 species, the Guam rail and Micronesian kingfisher, survive because of rescue efforts by zoos.
- The number of endangered and threatened species continues to grow. The International Union for Conservation of Nature and Natural Resources–The World Conservation Union now lists 43% of all crocodilian, 45% of all primate, 25% of all carnivore, and 38% of all turtle species as threatened with extinction.[27]
- Burning of fossil fuels and release of other industrial air pollutants are contributing to global cli-

mate change and deterioration of the Earth's ozone layer. The resultant climatologic and ecologic shifts could have a catastrophic effect on wildlife habitats and wildlife.[28]
- The cumulative effect of the trends previously cited is creating a need for unprecedented human intervention to stave off the most substantial loss of biological diversity since the extinction of the dinosaurs some 65 million years ago.[29-31]
- Humans are becoming more urbanized, and fewer people have a deep personal understanding or appreciation for wildlife and nature.[32,33] This makes it even more difficult to develop the political will to address mounting environmental problems.

We do not want to give the impression that all is lost. Conservationists must be optimists, and with the cooperation of governmental and nongovernmental organizations, academia, and industry, much can be done to reverse current trends or ameliorate their effects. We are clearly in an emergency situation, and time is of the essence. The options available in 10 years will almost certainly be more limited than the ones available to us now.

Conservation Role of Zoos and Aquariums

Zoos and aquariums that value biological diversity have a clear moral obligation to support wildlife and habitat conservation efforts worldwide. The missions of professionally managed zoos and aquariums are complex, but generally include conservation, education, research, and recreation.[34] Although providing wholesome recreational opportunities for the public is important, most people would likely agree that recreation (entertainment) alone is not sufficient justification for the existence of zoos and aquariums or for holding wild animals in captivity.[35] In fact, many animals held by zoos and aquariums are endangered in the wild, and their commercial use exclusively for entertainment purposes would be distasteful, if not illegal. Entertainment is an even less convincing justification if one assumes that the welfare of individual animals may be compromised to some degree as a result of captivity.[1,2]

Conservation, education, and research are other matters. If zoos and aquariums demonstrate an ability to study, manage, preserve, and restore wild animals and their habitats in nature, it would provide a powerful ethical justification for their continued existence.[36-38] This is particularly true given the many serious and pervasive threats facing wildlife and nature today. Wild animals in zoos and aquariums are ambassadors for their species, helping to raise public awareness and funds to support education, research, on-the-ground conservation activities in range countries, and a host of other relevant activities.[36-38] Zoos and aquariums must display and sustainably breed some animals to meet their conservation goals.

The following is a brief overview of some of the numerous conservation activities in which AZA and its members are currently engaged. In 1999 and 2000, AZA and its member institutions supported more than 1,400 field conservation and related scientific research and educational initiatives in more than 80 countries worldwide.[39]

Reintroduction

Zoos and aquariums of the 1980s and early 1990s viewed and described themselves as modern Noah's Arks and organized cooperative breeding programs to sustain populations of endangered species until they could be reintroduced to nature.[40] During the past several years, zoo and aquarium professionals have begun to question this notion, adopting a much broader definition of zoo- and aquarium-based conservation. Central to this concept is the assumption that zoos and aquariums must do more to support in situ conservation in range countries.[36-38,41,42] There are far too many endangered species and not nearly enough space to breed them all in captivity and, in many cases, far too little habitat remaining in which to reintroduce them. In addition, reintroduction programs are difficult and expensive, and they amount to treating the symptoms of species loss rather than the causes.[43-45] Though this shift in focus has been well documented,[37-39] critics imply that zoos and aquariums are not active conservation organizations, because they are not releasing a steady stream of animals into the wild. This argument reflects an ignorance of the breadth, scope, and goals of conservation itself.

Even as our view of zoo- and aquarium-based conservation expands, captive breeding for reintroduction will continue to play a limited, though critical, role.[33,36,37] Populations of some species have become so small and fragmented that they cannot persist without human intervention. Well-known examples include the California condor and black-footed ferret, along with many other less publicized species, such as the Ramsey Canyon leopard frog, American burying beetle, and Oregon silverspot butterfly. State and federal wildlife agencies have often called on accredited zoos and aquariums for help with recovery efforts, including captive propagation and reintroduction. Zoos and aquariums are unique in their ability to respond to these crises, because their day-to-day care of animals allows them to conduct research on husbandry, rehabilitation, and release techniques and to construct specialized off-display breeding and holding facilities to support recovery efforts.

Endangered Species Recovery

In nature, living organisms are interconnected, and ecosystems cannot function unless they retain most of their essential parts. Endangered species must persist until essential habitat can be restored, better protected, or expanded. Because there are so many species in need of help, zoo and aquarium efforts are often focused on flagship species (those that have the ability to capture the public's attention and help preserve habitat and other taxa). Examples of the many zoo- and aquarium-sponsored efforts to recover endangered species include the Toledo Zoos for the Mona/Virgin Islands boa[46]; Atlanta, National, and San Diego Zoos for the giant panda in China[47]; Fort Worth Zoos for the Jamaican iguana[48]; and Minnesota Zoos for the Sumatran tiger.[49]

Habitat Restoration

Many of the world's natural habitats have been fragmented, altered, or lost because of human activity,

with devastating effects on wildlife. In some cases, attempts to conserve biological diversity can be aided through habitat restoration. Restoration activities by zoos and aquariums have, among other things, involved the reestablishment of native vegetation and elimination or control of invasive exotic species.[50]

Member institutions of the AZA are increasing their involvement in habitat restoration. For example, the Toledo Zoo, in cooperation with the Nature Conservancy and state and federal wildlife biologists, has assisted in restoring the oak savanna habitat in Ohio[51]; the National Aquarium in Baltimore is collaborating with the Chesapeake Bay Foundation to restore local salt marsh habitats[50]; the Florida Aquarium is helping to restore native vegetation on an island wildlife reserve in Tampa Bay[50]; the Baltimore Zoo restored a native bog habitat on its grounds to serve as a refuge for endangered bog turtles[52]; and the Vancouver Aquarium is assisting with marine shoreline restoration in the Vancouver metropolitan area.[53]

Scientific Research

Scientific research is critical to wildlife conservation and for improving zoo and aquarium animal management. In situ and ex situ conservation efforts cannot succeed in the absence of knowledge.[54] Unfortunately, our knowledge of most wild animals and their habitats is far from complete. Contemporary zoos and aquariums are investing enormous resources in research, estimated at $50 million annually.[12] Zoos and aquariums offer unique opportunities to study animal behavior, physiology, reproduction, growth, and development of a wide variety of taxa under semicontrolled conditions. Many of these studies would be difficult, if not impossible, to conduct in nature, because of practical or ethical limitations. For example, much of what we know about the biology of arboreal, fossorial, and wide-ranging aquatic species has come from studies[54] of captive animals.

Development of Relevant Technologies

Many technologies developed or tested by zoo and aquarium biologists are relevant to field conservation, a largely unrecognized benefit of maintaining collections of wild animals.[37] As remaining wildlife habitats become progressively smaller and more isolated, the need for active management of wildlife and their habitats grows. Consequently, technologies developed by zoos and aquariums, including those for small population management, ecologic restoration, contraception, and veterinary care, are becoming increasingly relevant to the conservation of wildlife and their habitats.[33,36,37]

Improved veterinary technology in zoos has made important contributions.[55] For example, free-ranging animals must often be moved from 1 isolated reserve to another for conservation purposes. Capture and translocation of wild animals can be traumatic and potentially risky, often involving the use of tranquilizing drugs. Many techniques and effective dosages for safe chemical immobilization of wild animals have been developed by zoo veterinarians.[55]

High-tech methods for monitoring the movements of free-ranging animals are also becoming important in field conservation, and zoos and aquariums are on the cutting edge of these advancements. Satellite-telemetry devices were improved by testing them on Asian elephants at the Bronx Zoo before they were used to monitor the movements of forest-dwelling elephants in central Africa.[56] Radio-tracking devices have also been developed and used to monitor the movements of captive-bred Puerto Rican crested toads following their release into the wild.[57] This involved the invention of a specialized backpack to house the transmitter and battery.

Methods of individual animal identification developed by zoos and aquariums are also being used to support field conservation. The New York Aquarium assisted the Fisheries and Oceans Department of Canada in the development of a flipper band for marking free-ranging Beluga whales.[58] The Canadian Director of Fisheries and Habitat Management called this "an excellent example of how captive beluga can be studied and the knowledge gained used to directly enhance the management of free-ranging stocks."

Support of Protected Areas

Habitat loss and lack of law enforcement in and around protected areas are major factors contributing to species endangerment around the world, especially in developing countries.[19] Consequently, there is a recognized need for North American zoos and aquariums to increase their support for conservation on a landscape level.[36-38,41-45] The AZA and its member institutions are moving in this direction, both individually and collectively.

Some of the earliest examples of this approach are the support of the Wildlife Conservation Society for Amboseli National Park in Kenya,[59] the Chicago Zoological Society for Brookfield Conservation Park in South Australia,[60] and the Minnesota Zoo for Ujung Kulon National Park on the island of Java in Indonesia.[61] Some more recent examples include the North Carolina Zoo's work in Kibali National Park, Uganda,[62] and the Roger Williams Park Zoo's efforts to establish a Wildlife Management Area on the Huon Peninsula in Papua, New Guinea.[63] Zoos and aquariums are providing financial and logistic assistance for park personnel to buy equipment; obtain needed training; repair or build park infrastructure; survey, study, and monitor endemic fauna and flora; and develop educational and assistance programs for local communities. The ultimate goal is to empower local communities and governments to implement and manage their own programs and build international partnerships for conservation.

Conservation Education

Raising public awareness about endangered species and other environmental issues is an important aspect of conservation. If conservation efforts are to be successful, people must be interested in nature and be made aware of the problems and potential solutions facing wildlife and their habitats. With 135 million visitors each year, accredited zoos and aquariums are unique among conservation organizations, because they have a direct connection to the public.

The educational efforts of AZA members are numerous, and accredited zoos and aquariums are continually striving to evaluate their impact on visitors' behavior. Evidence indicates that zoo and aquarium educational programs are effective, at least in the short term, in building public appreciation and understanding of wildlife and wildlife conservation issues.[64] The AZA **Conservation Education Committee (CEC)** has initiated a major study[65] to assess the impact of zoo- and aquarium-based educational efforts on public knowledge, attitudes, and perceptions, with the goal of ensuring that critical conservation messages and concepts are reaching visitors in the most effective way.

Fundraising to Support Conservation

For conservation to succeed, it is critical that it be put on a solid financial base. The AZA and its member institutions are developing improved mechanisms to support conservation and the related scientific and educational activities of its members and collaborators. In this regard, the AZA was the first zoologic association to establish a fund dedicated to supporting wildlife and nature conservation.[66] During the past decade, the AZA Conservation Endowment Fund has provided over $2.5 million to support 164 projects in more than 30 countries. Furthermore, 14 accredited zoos and aquariums have developed their own grant programs to support local and global conservation.

Conservation Planning and Coalition Building

The AZA and its member institutions are becoming increasingly active in conservation planning and coalition building, which are the first steps in effective conservation. Partnerships can greatly enhance organizations' abilities to take action, because expertise and expenses can be shared.

The AZA and its members have been involved in creating 2 major conservation coalitions: the **Bushmeat Crisis Task Force (BCTF)** and the **Butterfly Conservation Initiative (BFCI)**. The BCTF is a coalition of 34 conservation and animal protection organizations and accredited zoos committed to curbing illegal commercial trade of wild animals for meat in Africa.[67] The coalition was created as the result of a 1998 meeting organized by the AZA. In just over 2 short years, BCTF's accomplishments have been substantial and too numerous to list here. To learn more about this project, please visit the BCTF website at www.bushmeat.org.

A similar initiative was launched in 2001 to facilitate butterfly conservation in North America.[68] Forty-two AZA member institutions, in cooperation with the United States Fish and Wildlife Service, National Wildlife Federation, Environmental Defense, the McGuire Center for Lepidoptera Research, and the Xerces Society, support the BFCI. The goal of this coalition is to support recovery of the 22 federally listed species of butterflies in the United States and to increase public awareness of and involvement in butterfly and habitat conservation. By planning cooperatively and pooling financial and human resources, zoos and aquariums can greatly enhance their conservation impact.

Animal Welfare—the Critical Caveat

The evidence presented here illustrates that zoo and aquarium contributions to wildlife and habitat conservation are substantial. However, the crux of the debate over zoos and aquariums comes down to a question of focus. Animal rights advocates believe in the intrinsic rights of individual animals, whereas conservationists focus their attention on populations, species, and ecosystems.[69] While we believe that individual animals are morally considerable, we also believe that conservation must be our highest priority. The irreversible loss of populations, species, or ecosystems will not only result in the untold suffering of many individual animals (including humans), it will also result in the loss of millions of future lives. We acknowledge that this broader perspective might appear callous to those who are strict adherents to animal rights philosophy, but zoos' and aquariums' commitment to conservation is matched by an equally strong commitment to animal welfare.[33,38,70,71] This increased focus on animal welfare helps ensure that the collective benefits derived from wildlife conservation outweigh the costs to individual animals. No reputable zoo or aquarium professional would defend an institution that contributed to conservation, but abused or provided substandard care for its animals. A conservation-oriented mission and staunch commitment to maintaining the highest standards of animal care are the core values of accredited zoos and aquariums.[70,71]

One of the founding fathers of animal rights, Tom Regan, refers to any attempt to usurp the rights of individual sentient animals (be they endangered or common) to preserve populations, species, or ecosystems as "environmental fascism."[72] Several prominent environmental ethicists and conservationists have challenged this view. For example, Warren[73] writes, "It is less important to maintain that other animals have moral rights than to maintain that we have moral obligations to them," and Norton[74] argues, on ethical grounds, that we must balance our obligations to individual animals with our obligations to perpetuate and conserve natural processes. Because there is often a conflict between what is good for individual animals and what is good for populations, species, or ecosystems, this will sometimes mean compromising the welfare of some individuals for the greater good.[74,75]

The following are some examples of how accredited zoos and aquariums are addressing ethical issues related to animal care and propagation.

Providing Appropriate Environments

One of the biggest criticisms from zoo and aquarium detractors is that animal welfare is diminished in captivity, simply because the wild can never be duplicated exactly. This is true. However, zoos and aquariums make up for these inadequacies by creating an environment that offers some of the accouterments of the wild while providing shelter from some of the stresses, such as predation and starvation.[71] Some accredited zoos and aquariums have been criticized for having older, inadequate facilities and care programs for specific taxa. Many of these institutions are in the process of building newer and more naturalistic animal

exhibits or renovating existing ones. This is often a very time-consuming and expensive process, with new exhibits for some megamammals costing millions of dollars. In the interim, there is much being done to enhance existing enclosures and care programs so that they better meet the animals' physiologic and psychologic needs.

The comparatively new science of environmental enrichment has been embraced by accredited zoos and aquariums and provides numerous techniques for improving the lives of captive animals.[76] Enrichment is the species-appropriate enhancement of the physical and social environment. Accreditation by the AZA now requires that all member institutions develop and implement an environmental enrichment plan that improves the quality of life of captive animals by providing novel experiences and a variety of stimuli that encourage a range of natural behaviors.[70] These programs demonstrate accredited zoos' and aquariums' commitment to continually improving the welfare of animals in their care.

Ensuring Quality Animal Care

Animal care is being improved and standardized through creation and distribution of husbandry manuals and thorough, scientifically based animal care standards that define appropriate management practices. The AZA Board of Directors approved management and care standards for elephants in 2001,[77] and the AZA Animal Welfare Committee is formulating standards for all remaining mammals.[70] Experts on reptile, amphibian, bird, and invertebrate husbandry have been called on to develop resources for captive management of these taxa as well. Ultimately, standards will be developed for all major taxa in AZA institutions' collections. This is not a trivial task and will take years to complete, especially since we are simultaneously working to fill the gaps in our knowledge about the biology of many species in our care. Although animal welfare is notoriously hard to define and measure,[78] zoo biologists are investigating new and practical methods to evaluate well-being in zoo and aquarium animals.[79] Such tools should help accredited facilities monitor the quality of animal care.

Training and Use of Animals in Public Education

Training and the use of animals in education pose some difficult animal care issues for zoos and aquariums. When does training compromise or enhance animal welfare? What kinds of training techniques are appropriate? When is the use of animals in entertainment (including onsite shows and television programming) educational, and when is it exploitative or harmful to public attitudes? Is putting diapers on chimps for late-night talk shows acceptable? Do animal demonstrations compromise animal welfare? Can marine mammal shows on aquarium grounds enrich the lives of performing animals while exposing visitors to quality conservation messages? The zoo and aquarium community is continually assessing the impact of professional practices on the animals under our care, and these questions are the subject of considerable debate among the members of the AZA and its Animal Welfare Committee. The Committee is currently working on a draft policy on animals in entertainment to be considered by the AZA Board. If they are to be justified, animal shows, training programs, and exhibit design must contribute to the overall conservation and education goals of the association and not diminish animal welfare.

Surplus Animals

The zoo and aquarium profession uses the term surplus to refer to animals that are not needed to meet the population management or conservation goals of an institution or program. It is not that these animals are unwanted or neglected, and despite the penchant of certain critics for misinterpreting the word, surplus does not mean superfluous. All AZA facilities dedicate themselves to providing quality care to all animals in their custody for as long as necessary. Zoos and aquariums make known the availability of their surplus animals in case they can be of conservation or education value to another institution. The AZA also requires that all accredited facilities complete an institutional collection plan to ensure that populations stay within the captive carrying capacity (ie, the available holding space). Institutional collection plans also help zoos and aquariums define the conservation goals for all of the species in their collections.[80]

Some accredited zoos and aquariums have been accused of breeding animals irresponsibly and knowingly sending them to unscrupulous dealers, animal auctions, canned hunts, and the exotic pet trade. The AZA has developed an **Animal Acquisition/ Disposition (A/D)** policy that guides members' activities regarding animal transactions and for many years has banned members from sending animals to wildlife auctions and canned hunts.[70] Violation of these policies can result in ethics charges and may lead to expulsion from the AZA. Association member facilities are required to develop their own A/D policies with the caveat that such policies must meet or exceed AZA's guidelines. The AZA's Code of Professional Ethics cautions members to take great care in ensuring that animals do not end up in places that are unqualified to care for them. However, there is concern that no method currently exists to monitor transactions, so there is no effective enforcement of the full extent of the A/D process.[6] Toward that end, AZA is working with numerous partners to develop more detailed and accurate animal records by creating a new zoologic information management system that will be international in scope.[70] In addition, AZA supports centers for population management and wildlife contraception to provide members with the best possible advice on genetic and demographic management and use of contraception to prevent unwanted births.

Beyond AZA

To demonstrate the zoo and aquarium profession's commitment to animal welfare, AZA supports legislation banning roadside animal attractions and canned hunts.[70] The AZA's Accreditation Commission has established a mentorship program for nonaccredited facilities that would like help reaching their goals of

improving animal care and qualifying for accreditation. However, for those attractions that simply will never meet its standards, the AZA has taken a more vocal stance in support of animals languishing in substandard or inappropriate roadside facilities.[70] It has also developed, and is promoting, model state legislation intended to close the worst of these facilities. The AZA continues to help train USDA-APHIS inspectors and lobby for increased funding for the agency.[70] Inspectors are responsible for evaluating animal display facilities under the United States Animal Welfare Act, so this support is for increased vigilance regarding the quality of facilities maintaining live animals in the United States.

Discussions of zoo and aquarium relevance in today's world often come down to issues of individual animal welfare versus overall species and ecosystem conservation. While we believe that conservation must be the primary mission of modern zoos and aquariums, we also contend that to be morally defensible, zoos and aquariums must demonstrate an equally unwavering commitment to maintaining high standards of animal welfare.

Conclusions

In this report, we have argued that a strong commitment to wildlife conservation and animal welfare provides a powerful ethical justification for accredited zoos and aquariums. As true ambassadors for their species, zoo and aquarium animals play an increasingly important role in securing a future for wild animals and their habitats in nature. This is particularly true given the current global context. The future of wildlife and the ecosystems on which they depend is in grave and immediate danger, and as we have documented in this report, zoos and aquariums contribute to conservation efforts in a wide variety of ways.

One question that must be resolved is how much conservation is enough, and how can these contributions be measured? What is a reasonable investment in conservation: 1, 5, or 10% or more of zoos' and aquariums' budgets? Even a 1% investment in conservation out of an estimated combined budget of over $1 billion would mean that accredited zoos and aquariums contribute $10 million per year to conservation. However, factoring in personnel time, facility costs, and all funds currently being spent on projects, the cumulative investment in conservation, research, and education by accredited zoos and aquariums would easily exceed that amount.[12] Regardless of their financial contribution, how do we measure the quality and impact of zoo- and aquarium-based conservation efforts? We must be committed to evaluating proposed and ongoing projects if zoos and aquariums are to spend their limited conservation resources wisely.

Also, how much should zoos and aquariums be required to improve animal welfare, short of completely replicating the wild? Zoos and aquariums are in a position to greatly increase quality of life for captive animals through improvements in exhibit design, scientifically based animal care programs, and policy. As we expand our accomplishments in these areas, the benefits of exhibiting animals in zoos and aquariums are increasingly likely to vastly outweigh the costs, as measured in terms of individual animal welfare. There will always be a gray area where costs and benefits are arguably equal, and it is here that ethical considerations should be carefully weighed when deciding whether a captive program is necessary. This is similar to the ethical considerations used by biomedical researchers when weighing the benefits of the research against the costs to individual animal welfare,[81] but in those cases, the cost to the animals is weighed against the benefit to humans and other animals. In this case, the cost to the individual animals is weighed against the benefit of the very survival of their species and the habitats on which they depend.

Like evolutionary change in any profession, the complex transformation of accredited zoos and aquariums into conservation and animal welfare organizations is being fueled in part by self-preservation, need, changing societal expectations, our increasing knowledge, and internal pressures. While external critics have certainly played a role in this process, much recent change has been generated from within. There has been a vast influx of talented, extremely well-educated people into accredited zoos and aquariums during the past decade. Some have come directly out of graduate school and others from responsible positions in academia, business, government, or the military. They have come to the zoologic profession with a love for animals and nature and a strong commitment to conservation and animal welfare. One consequence of this recent migration of new, highly trained personnel has been a growing professionalism, which has also led to an abundance of critical thinking and self-evaluation, including useful debate on the ethical basis for keeping wild animals in captivity.[82] We hope this report will continue the growth process by spurring additional discussion and debate throughout and beyond the zoologic community.

References

1. Jamieson D. Zoos revisited. In: Norton BG, Hutchins M, Stevens EF, et al, eds. *Ethics on the Ark: zoos, animal welfare and wildlife conservation*. Washington, DC: Smithsonian Institution Press, 1995;52–66.

2. Regan T. Are zoos morally defensible? In: Norton BG, Hutchins M, Stevens EF, et al, eds. *Ethics on the Ark: zoos, animal welfare and wildlife conservation*. Washington, DC: Smithsonian Institution Press, 1995;38–51.

3. Malamud R. *Reading zoos: representations of animals and captivity*. Washington Square, NY: New York University Press, 2000.

4. Goldston L. Animals to go. *San Jose Mercury News* 1999;Feb:7–10.

5. Farinato R. Another view of zoos. In: *The state of the animals 2001*. Washington, DC: Humane Society of the United States, 2001;145–147.

6. Satchell M. Investigative report: cruel and usual. *US News and World Report* 2001;133:26–33.

7. Green A. *Animal underworld: inside America's black market for rare and exotic species*. New York: Center for Public Integrity, 1999.

8. *Guide to certification and standardized guidelines*. Silver Spring, Md: American Zoo and Aquarium Association, 2001.

9. Taylor S. Why accreditation? in *Proceedings*. Annu Conf Am Zoo Aquar Assoc 2000;7–12.

10. *AZA long-range plan 2001–2006*. Silver Spring, Md: American Zoo and Aquarium Association, 2001.

11. Ballentine J, ed. *The 2003 AZA membership directory*. Silver Spring, Md: American Zoo and Aquarium Association, 2003.

12. *The collective impact of America's zoos and aquariums*. Silver Spring, Md: American Zoo and Aquarium Association, 1999.

13. *Public attitudes towards aquariums, theme parks and zoos*. Storrs, Conn: The Roper Center for Public Opinion Research, 1992.

14. Tarpy C. New zoos: taking down the bars. *National Geographic* 1993;Jul:2–37.

15. Sundquist F. End of the Ark? Captive breeding is out; conservation in the wild is in. *Int Wildl* 1995;Nov/Dec:22–29.

16. Cohn JP. Working outside the box. Zoos and aquariums are shifting their conservation focus to the wild. *Bioscience* 2002;50: 564–569.

17. Ebersole RS. The new zoo. *Audubon* 2001;Nov/Dec:64–70.

18. Bongaarts J, Bulatao A, eds. *Beyond six billion: forecasting the world's population*. Washington, DC: National Academy of Sciences, 2000.

19. Wilson EO. *The future of life*. Cambridge, Mass: Harvard University Press, 2001.

20. Robinson JG, Bennett EL. *Hunting for sustainability in tropical forests*. New York: Columbia University Press, 2000.

21. Sukumar R. The management of large mammals in relation to male strategies and conflicts with people. *Biol Conserv* 1991; 55:93–102.

22. Waithaka J. The elephant menace. *Wildl Conserv* 1993;96: 62–63.

23. Sillero-Zubiri C, Laurenson K. Interactions between carnivores and local communities: conflict or co-existence? In: Gittleman J, Funk SM, Macdonald D, et al, eds. *Carnivore conservation*. Cambridge, England: Cambridge University Press, 2001;282–312.

24. Woodroffe R. Managing disease threats to wild mammals. *Anim Conserv* 1999;2:185–193.

25. Milius S. Animal whodunit, medical mystery: scientists cross species barriers to diagnose West Nile encephalitis. *Sci News* 1999;156:378–380.

26. Bright C. *Life out of bounds: bioinvasion in a borderless world*. New York: WW Norton & Co, 1998.

27. *Red list of threatened animals*. Gland, Switzerland: International Union for Conservation of Nature and Natural Resources, 1996.

28. Peters RL, Lovejoy TE, eds. *Global warming and biological diversity*. New Haven, Conn: Yale University Press, 1992.

29. Budiansky S. *Nature's keepers: the new science of nature management*. New York: The Free Press, 1995.

30. Kenny J. Control of the wild. *Natl Parks* 1990;65:21–25.

31. Adams JS, McShane TO. *The myth of wild Africa: conservation without illusion*. New York: WW Norton & Co, 1992.

32. Brown LR, Renner M, Flavin C. *Vital signs: the environmental trends that are shaping our future*. New York: WW Norton & Co, 1998.

33. Hutchins M. Zoo and aquarium animal management and conservation: current trends and future challenges. *Int Zoo Yearbook* 2003;38:14–28.

34. Croke V. *The modern Ark: the story of zoos: past, present and future*. New York: Scribner, 1997.

35. Hancocks D. *A different nature: the paradoxical world of zoos and their uncertain future*. Berkeley, Calif: University of California Press, 2001.

36. Conway W, Hutchins M. Introduction. In: Conway WG, Hutchins M, Souza M, et al, eds. *AZA field conservation resource guide*. Atlanta, Ga: Zoo Atlanta and Wildlife Conservation Society, 2001;1–7.

37. Hutchins M, Conway WG. Beyond Noah's Ark: the evolving role of modern zoological parks and aquariums in field conservation. *Int Zoo Yearbook* 1995;34:117–130.

38. Hutchins M, Smith B. Characteristics of a world class zoo or aquarium in the twenty-first century. *Int Zoo Yearbook* 2003;38:130–141.

39. Lankard J, ed. *Annual report on conservation and science, 1999–2000*. Silver Spring, Md: American Zoo and Aquarium Association, 2000.

40. Foose TJ. Riders of the last Ark: the role of captive breeding in conservation strategies. In: Kaufman L, Mallory K, eds. *The last extinction*. Cambridge, Mass: The MIT Press, 1986;141–165.

41. Wiese R, Willis K, Hutchins M. Is genetic and demographic management conservation? *Zoo Biol* 1994;13:297–299.

42. Smith B, Hutchins M. The value of captive breeding programmes to field conservation: elephants as an example. *Pachyderm* 2000;28:101–109.

43. Hutchins M, Willis K, Wiese R. Author's response. *Zoo Biol* 1995;14:67–80.

44. Hutchins M, Wiese R, Willis K. Why we need captive breeding, in *Proceedings*. Reg Conf Am Zoo Aquar Assoc 1996;77–86.

45. Synder NFR, Derrickson SR, Bessinger SR, et al. Limitations of captive breeding in endangered species recovery. *Conserv Biol* 1996;10:338–348.

46. Tolson P. The Mona/Virgin Islands boa SSP, the US Fish and Wildlife Service and the Departmento de Recursos Naturales de Pureto Rico. In: Conway WG, Hutchins M, Souza M, et al, eds. *AZA field conservation resource guide*. Atlanta, Ga: Zoo Atlanta and Wildlife Conservation Society, 2001;177–180.

47. Hudson R. The Jamaican iguana recovery story: rediscovery to recovery, 1990–1998. In: Conway WG, Hutchins M, Souza M, et al, eds. *AZA field conservation resource guide*. Atlanta: Zoo Atlanta and Wildlife Conservation Society, 2001;42–48.

48. Maple TL. *Saving the giant panda*. Atlanta, Ga: Longstreet Press, 2000.

49. Tilson R, Franklin N, Bastoni P, et al. In situ conservation of the Sumatran tiger (*Panthera tigris sumatrae*) in Indonesia. *Int Zoo News* 1996;43:71–79.

50. Tolson P. Partnering to restore biodiversity: a vision for AZA institutions. *AZA Communique* 2002;Jan:7–8.

51. Tolson P, Magdich M, Seidel T, et al. Return of a native. *End Spec Bull* 1999;24:14–15.

52. Wisnieski A, Poole VA. Creating a bog: an on-site wetland restoration project at the Baltimore Zoo, in *Proceedings*. Annu Conf Am Zoo Aquar Assoc 1999;171–176.

53. Marliave JB, Dudas SE, Nightingale JW. Marine and estuarine shoreline restoration in British Columbia, in *Proceedings*. Annu Conf Am Zoo Aquar Assoc 1999;142–144.

54. Hutchins M. Research. In: Bell CE, ed. *Encyclopedia of the world's zoos*. Vol 3. Chicago: Fitzroy Dearborn, 2001;1076–1080.

55. Hutchins M, Foose T, Seal US. The role of veterinary medicine in endangered species conservation. *J Zoo Wildl Med* 1991;22:277–281.

56. Nobbe G. Going into orbit. *Wildl Conserv* 1991;95:62–64.

57. Johnson RR. Model programs for reintroduction and management: ex situ and in situ conservation of toads of the family *Buffonidae*. In: Murphy JB, Alder K, Collins JT, eds. *Captive management and conservation of amphibians and reptiles*. Ithaca, NY: Society for the Study of Amphibians and Reptiles, 1994;243–254.

58. Orr JR, Haiatt-Saif M. A flipper band for individual identification of beluga whales (*Delphinapterus leucas*). *Can Tech Rep Fish Aquat Sci* 1992;1856:iv–9.

59. Conway W. A zoo based international conservation program. Wildlife Conservation Society, in *Proceedings*. Annu Conf Am Assoc Zoo Parks Aquar 1991;381–390.

60. Parker P. The Brookfield Zoo's affair with Australian conservation. *Bison* 1992;9:12–19.

61. Tilson RL. In support of nature: the Minnesota Zoo's adopt-a-park program. In: Wemmer C, ed. *The ark evolving: zoos and aquariums in transition*. Washington, DC: Smithsonian Institution Press, 1995;180–195.

62. Armstrong B. The Kibale chimpanzee project and the Columbus Zoo: a collaborative partnership. In: Conway WG, Hutchins M, Souza M, et al, eds. *AZA field conservation resource guide*. Atlanta: Zoo Atlanta and Wildlife Conservation Society, 2001;124–127.

63. Evei K. Tree kangaroo conservation in Papua New Guinea. *AZA Communique* 2002;Jan:10–13.

64. Stoinski YT, Ogden J, Gold KC, et al. Captive apes and zoo education. In: Beck BB, Stoinski TS, Hutchins M, et al, eds. *Great apes and humans: the ethics of coexistence*. Washington, DC: Smithsonian Institution Press, 2001;113–132.

65. Ogden J. Measuring our impact: what MIRP can mean to you. *AZA Communique* 2002;Sep:23–24.

66. Hutchins M, Souza M. AZA Conservation Endowment Fund: zoos and aquariums supporting conservation action. In: Conway WG, Hutchins M, Souza M, et al, eds. *AZA field conservation*

resource guide. Atlanta: Zoo Atlanta and Wildlife Conservation Society, 2001;281–297.

67. Eves H, Hutchins M. The Bushmeat Crisis Task Force: cooperative efforts to curb the illegal commercial bushmeat trade in Africa. In: Conway WG, Hutchins M, Souza M, et al, eds. *AZA field conservation resource guide*. Atlanta: Zoo Atlanta and Wildlife Conservation Society, 2001;181–186.

68. Allard R, Hutchins M, Harrelson D. The Butterfly Conservation Initiative: partnerships for pollinators, in *Proceedings*. Annu Conf Am Zoo Aquar Assoc 2001;139–144.

69. Vrijenhook R. Natural processes, individuals, and units of conservation. In: Norton BG, Hutchins M, Stevens EF, et al, eds. *Ethics on the Ark: zoos, animal welfare and wildlife conservation*. Washington, DC: Smithsonian Institution Press, 1995;74–92.

70. Hutchins M. What is AZA doing to enhance the welfare of captive animals? in *Proceedings*. Annu Conf Am Zoo Aquar Assoc 2001;117–129.

71. Maple TL, McManamon R, Stevens E. Defining the good zoo: animal care, maintenance and welfare. In: Norton BG, Hutchins M, Stevens EF, et al, eds. *Ethics on the Ark: zoos, animal welfare and wildlife conservation*. Washington, DC: Smithsonian Institution Press, 1995;219–234.

72. Regan T. *The case for animal rights*. Berkeley, Calif; University of California Press, 1988.

73. Warren MA. The moral status of great apes. In: Beck BB, Stoinski T, Hutchins M, et al, eds. *Great apes and humans: ethics of coexistence*. Washington, DC: Smithsonian Institution Press, 2002;313–328.

74. Norton B. Caring for nature: a broader look at animal stewardship. In: Norton BG, Hutchins M, Stevens EF, et al, eds. *Ethics on the Ark: zoos, animal welfare and wildlife conservation*. Washington, DC: Smithsonian Institution Press, 1995;102–121.

75. Hutchins M, Wemmer C. Wildlife conservation and animal rights: are they compatible? In: Fox MW, Mickley LD, eds. *Advances in animal welfare science 1986/87*. Boston: Martinus Nijhoff Publishing, 1987;111–137.

76. Shepherdson D, Mellen J, Hutchins M, eds. *Second nature: environmental enrichment for captive animals*. Washington, DC: Smithsonian Institution Press, 1999.

77. *AZA standards for elephant management and care*. Silver Spring, Md: American Zoo and Aquarium Association, 2001.

78. Broom DM, Johnson KG. *Stress and animal welfare*. London: Chapman & Hall, 1993.

79. Shepherdson D, Carlstead K. New approaches to the evaluation of animal well-being using multiple institutions, assessment of behavior and temperament, and non-invasive physiological measures, in *Proceedings*. Annu Conf Am Zoo Aquar Assoc 2001;131–136.

80. Thompson SD, Bell KJ. Institutional collection planning. *Zoo Biol* 1998;17:55–57.

81. Orlans B, Beauchamp TL, Dresser R, et al, eds. *The human use of animals: case studies in ethical choice*. New York: Oxford University Press, 1998.

82. Norton B, Hutchins M, Stevens EF, et al, eds. *Ethics on the Ark: zoos, animal welfare and wildlife conservation*. Washington, DC: Smithsonian Institution Press, 1995.

Strategic collection planning and individual animal welfare

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In the summer of 1984, Atlanta's city zoo was entangled in an ugly, highly visible management crisis. Indeed, it may have been the most public and visible scandal ever experienced by any American zoo. The story was zealously covered by local, regional, national, and international investigative reporters from print and electronic media. A *Parade* writer, using information gathered by the Humane Society of the United States, exposed the Atlanta Zoo and 9 other institutions in his list of the nation's 10 worst zoos. Even the *New York Times* offered an opinion: "Atlanta has given neither money nor thought to its disintegrating zoo. How a community treats animals says something about the human beings who run it. Unless Atlanta wants to commit itself to a professionally operated zoological park, would it not be better to forget about having one at all?"[1]

In retrospect, the zoo crisis was neither sudden nor unexpected. It had been building for decades, fueled by neglect, mismanagement, and incompetence. At the height of the crisis, it was difficult to affix blame, because the zoo had been overwhelmed by massive "diffusion of responsibility." Nobody was willing to be accountable. Even a local grand jury failed to find fault with a single zoo employee. But 1 contributing factor was indisputably clear. Located in Atlanta's Grant Park since 1889, the venerable institution had operated without a clear vision from its inception.[2] Comprising an unplanned population of animals, the Grant Park facility was more a menagerie than a zoo. With passage of time and an accumulation of depreciation and neglect, individual animals suffered the damaging effects of social deprivation, spatial restriction, sheer boredom, and inappropriate, ubiquitous, hard architecture.[3] To make matters worse, the Atlanta Zoo had underachieved in conservation and education and failed (with the exception of the herpetological staff) to recruit qualified curators. A few reptile species benefited from zoo breeding efforts, but the poor condition of zoo facilities contributed to high stress, reproductive lethargy, morbidity, and mortality in primates, bears, and big cats. To take its proper place among the community of responsible, ethical zoologic parks, Atlanta's zoo required a complete restructuring, and its operating standards had to be substantially revised and upgraded.

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