PROGRAMMATIC GUIDELINES FOR ENHANCING WILDLIFE CONSERVATION EDUCATION IN ZOOS

by

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(Under the Direction of Carolyn L. Ehardt)

ABSTRACT

In order to address the question of how zoos can effectively enhance wildlife conservation education among visitors such that broader conservation goals are acknowledged and acted upon, this thesis contributes a systematic review and analysis of the literatures on the educational context of zoos and on environmental and conservation education, in order to discern the principles and techniques that should programmatically function to effectively educate zoo visitors about wildlife conservation. Analytical deductions derived from this systematic review are developed into a set of specific, programmatic guidelines that should function to foster and enhance wildlife conservation education within the zoo setting. A model delineating the use of lemur exhibits in zoo-based conservation education constructively applies this research to illustrate how the application of the ecological and conservation information of a particular taxon can be utilized to actualize the goal of enhancing wildlife conservation education in zoos.

INDEX WORDS: Wildlife conservation, Zoo education, Conservation education, Environmental education, Conservation ecology, Lemur, Zoo

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TABLE OF CONTENTS

Page

ACKNOWLEDGEMENTS iv

CHAPTER

1 INTRODUCTION 1

Research Question and Outline of the Thesis 4

Significance 6

2 THE EDUCATIONAL CONTEXT OF ZOOS 7

Zoos and the Visiting Public 7

Zoo Exhibits and Their Potential for Conservation Education 10

Environmental Enrichment 12

Targeting General Zoo Visitors for Conservation Education 15

The Role of Zoos in Wildlife Conservation Efforts: Messages for Education 17

Conclusion 20

3 ENVIRONMENTAL AND CONSERVATION EDUCATION 21

Theoretical Background and Developments Within Environmental and Conservation Education 21

Direct Experience and Guided Inquiry Education 24

Targeting Individuals in a Diverse Population: Making Education Personally Relevant 26

Connecting Conservation Education to the Science of Conservation Ecology 29

4 PROGRAMMATIC GUIDE FOR WILDLIFE CONSERVATION EDUCATION IN ZOOS 31

5 WILDLIFE CONSERVATION EDUCATION IN ZOOS USING LEMUR EXHIBITS 36

6 CONCLUSION 51

Summary and Implications of the Present Thesis 51

Implications for Future Work 52

REFERENCES 54

CHAPTER 1

INTRODUCTION

Many environmental and sociocultural problems are rooted in the lack of public awareness, understanding, and concern about natural resources and wildlife during a time of human-induced degradation and exhaustion of these resources (Aveling 1987; Hancocks 2001; Mangel *et al.* 1996). The general public obtains most of their knowledge about wildlife and natural systems from various types of media, including print, radio, and television. This knowledge, however, is largely informational, presented as scientific facts with few messages connecting this information to conservation-related issues, let alone opportunities for personal involvement in the lives and future of wildlife. Encouraging respect for wildlife and natural systems is arguably one of the most important aspects in fostering a conservation-conscientious public (Kassas 2002; St. Clair 2003; van Weelie and Wals 2002). Zoos in Western nations serve as places of non-formal learning and affective connection to wildlife for an increasingly urban population to address and correct this public lack of knowledge. Zoos have a mandate to educate and encourage behavioral change among their visitors if they are to make any impact toward their goals of wildlife and habitat conservation, since people will not conserve wildlife unless they understand and appreciate it. Furthermore, zoos provide an ideal venue for combining academic, experiential, and applied learning; to introduce and develop a solid understanding of and an appreciation for wildlife conservation concerns and strategies; and to encourage behavioral change toward achieving wildlife conservation goals.

However, a significant gap currently exists between what those directly associated with zoos believe that zoos are designed to accomplish and what the public perceives as the function of zoos. Modern zoos in the West often cite four principal roles in justifying their existence: conservation, education, research, and entertainment (Conway 2003; Crowe 1997; Hancocks 2001). These roles are listed in decreasing order of priority, from the perspective of zoos. Conversely, more than eighty percent (Coll *et al.* 2003) of zoo visitors say they go to the zoo for 'fun.' Moreover, none of the people surveyed by Reade and Waran (1996) cited conservation as a factor in encouraging a zoo visit. Despite the fact that wildlife conservation has been promoted as the highest priority of zoos belonging to the American Zoo and Aquarium Association (AZA) since 1980, zoos have lagged behind in explicitly educating their visitors about this particular mission.

Recognizing this incongruence, the need for the development of effective public conservation education has been acknowledged from various perspectives. Questions of how zoos can more effectively communicate their conservation messages to the public have been frequently raised in recent research (e.g., Andersen 2003; Coll *et al.* 2003; Conway 2003; Crowe 1997; Dierking *et al.* 2001; Gold 1997; Gutierrez de White and Jacobson 1994; Hancocks 2001; Hutchins 2003; Koontz 1997; Kreger and Mench 1995; McPhee *et al.* 1998; Morgan and Hodgkinson 1999; Reade and Waran 1996; Stoinski *et al.* 2001; Swanagan 2000; Wallis 1997; Weisberg 1999; Whitehead 1995; Wiese and Hutchins 1997; Wilson *et al.* 2003; Wood 1998; Woollard 1995). Within the context of the zoo environment, but not necessarily directly related to educational programming, those concerned with animal husbandry (e.g., Hare *et al.* 2003; Shepherdson *et al.* 1998; Wood 1998) similarly emphasize the need to develop ways to educate the public about the principles underlying captive management methods and strategies. The call

for research on the development of effective conservation education has also been made by those working outside the context of zoos. For example, those working in the fields of general environmental and conservation education (e.g., Brewer 2001; Brewer 2002; Fien *et al.* 2001; Galbraith 2003; Luck 2003; St. Clair 2003) stress the need to reach broader segments of the public in order to achieve increased conservation-related awareness and influence behavioral changes among society at large. While these criticisms originate from diverse concerns and vantage points, they collectively illustrate the current inadequacy of effective public conservation education and indicate a pressing need for the development of such. This inadequacy must be addressed within the zoo setting in particular if zoos plan to actualize their often-cited goal of promoting wildlife conservation among society at large. Indeed, zoo-based conservation education must be more explicit in discerning the connections between zoo animals and broader conservation-related strategies, and in providing suggested courses of action for visitor involvement, linking basic factual information to the conservation of wildlife represented by species on exhibit; such overt connections and conservation messages are characteristically absent from current zoo education (Dierking *et al.* 2001; Stoinski *et al.* 2001). Explicit demonstration of the role of zoo animals in wildlife conservation strategies is also particularly important as human populations and habitats become increasingly urbanized, with a consequent disconnect between humans and wildlife in natural ecosystems.

A need exists to explicitly discern guidelines for the effective delivery of ecological and conservation messages and the scientific and sociocultural principles underlying them for educators such that the affective responses to zoo visits are situated firmly within the broader realm of conservation ecology. By focusing and developing such, zoo education may result in a greater understanding of the role of zoos in the larger realm of wildlife conservation. Increased

visitor understanding is essential if zoos are to actualize their mission of fostering conservation education, awareness, and action among the general public for the benefit of wildlife at large.

Research Question and Outline of the Thesis

This thesis addresses the absences outlined above by discerning guidelines for effective wildlife conservation education in the context of zoos, such that visitors may more readily recognize zoos in the West as conservation organizations and understand the role of zoo animals in broader wildlife conservation strategies. The purview of the thesis is restricted to zoos in the West, as approaches to conservation education goals and strategies may need to vary in other cultural contexts.

In order to address the question of how zoos can effectively enhance wildlife conservation education among visitors such that broader conservation goals are acknowledged and acted upon, this thesis contributes a systematic review and analysis of the literatures on the educational context of zoos and on environmental and conservation education, in order to discern the principles and techniques that should programmatically function to effectively educate zoo visitors about wildlife conservation. The results that I have deduced to be the most significant and contributory knowledge from my analysis of these complementary literatures are highlighted in Chapters 2 and 3. In Chapter 2, the educational context of zoos is examined in order to demonstrate what is currently being done to promote wildlife conservation education within the zoo setting and what is currently known about the advantages and difficulties of reaching the visiting public with these messages. In addition to examining the available methods and suggestions for zoo education, the literature regarding zoo visitors, specifically, is analyzed in order to discern potential ways that conservation education messages can more effectively be transmitted to and received by the visiting public. In Chapter 3, research on general

environmental and conservation education is analyzed, revealing the techniques that have been developed and which are most effective, as well as what theoretical considerations are necessarily relevant to educating individuals about environmental and conservation-related issues. Although this literature is not specifically focused on education in zoo-based settings, the lessons derived from general environmental and conservation education have the potential to illustrate significant possibilities for the effective transmission of conservation messages in these settings. It is a basic premise of this thesis that the synthesis of these distinct, but I believe, highly complementary, literatures regarding zoo-based education and conservation education will provide a new and contributory approach designed to enhance the efficacy of wildlife conservation education in the context of zoos.

The analytical deductions from the synthesis of these two literatures are summarized in Chapter 4, and developed into a set of specific, programmatic guidelines that I believe should function to foster and enhance wildlife conservation education within the zoo setting. These derived guidelines are then constructively applied by a model, in Chapter 5, delineating the use of lemur exhibits in zoo-based conservation education. This model illustrates how the application of the ecological and conservation information of a particular taxon, here exemplified specifically by lemurs, can be utilized to effectively actualize the goal of enhancing wildlife conservation education in zoos. The construction of the model follows from a synthesis of what is currently understood about lemur ecology, and is designed to exemplify how lemurs can specifically and effectively convey important wildlife conservation messages to general zoo visitors through the application of the derived guidelines for zoo education.

Zoo education takes myriad forms, depending upon the resources available at a given institution. Therefore, rather than design specific educational curricula, interpreter-facilitated

programming, or informational signage, this thesis seeks to develop a broadly applicable programmatic guide for effective wildlife conservation education to be incorporated into zoo education in the format most appropriate for each particular zoo, based on their individual resources (e.g., constraints, opportunities, and objectives). These deduced guidelines and the applied model exemplified by lemurs are aimed at educators, both zoo personnel (e.g., docents, interpreters) and others such as school teachers who utilize the zoo as a place of non-formal learning.

Significance

The development of guidelines for effective wildlife conservation zoo education, through the synthetic research embodied in this thesis, is an important step in promoting wildlife conservation and ecology education among zoo visitors and the general public. It will be my contention that the affective aspect of zoo learning through animal exhibition can be enhanced by the cognitive aspect of education programs aimed at illustrating the science behind the design and function of these exhibits (Stoinski *et al.* 2001; Swanagan 1993; Swanagan 2000).

CHAPTER 2

THE EDUCATIONAL CONTEXT OF ZOOS

Zoos and the Visiting Public

Zoos are part of the entertainment and leisure industry (Woollard 1999a), conferring a certain advantage over other conservation-oriented organizations with regard to public outreach and appeal. Zoos are considered to be the most important source of contact between people and animals in modern society. Over 100 million people visit North American zoos and nearly 600 million people visit zoos worldwide each year (IUDZG 1993; Morgan and Hodgkinson 1999), and it is reasonable to estimate that over ninety percent of people living in Western societies visit zoos at least once during their lifetime (Hamilton and Phelps 1992). The total number of zoo visitors indicates a considerable audience for conservation education by these institutions, and zoos collectively represent among the most prominent venues for environmental education (Whitehead 1995).

The conservation educational potential of zoos, however, is still not being fully recognized. Education in zoos continues to reflect their earlier approaches to housing and exhibiting animals, often delivering little more than scientific facts about the species in their collections (e.g., what the animals eat, where they live in the wild, the typical size of a family group). Zoo education has traditionally focused on scientific (biological) facts regarding animals (Tunnicliffe 1999). Visitors are encouraged to observe characteristics for classifying animals, compare the behavior and morphology of various species, and identify species-typical responses to different aspects of the physical environment (Woollard 1995). Zoo education, however,

should not limit its focus to zoological information, but rather incorporate conservation-related issues in an entertaining and personal format (Swanagan 2000) such that visitors form a personal connection to the issues being conveyed. Zoo education currently focuses on facts concerning the taxonomy, life history traits, geographical distribution, and threatened status of the species on exhibit, without elaborating on the latter or providing explicit linkages between these animals, the zoo, and wildlife conservation efforts. Education is typically an independent discipline within the zoo context, usually represented by a different department and by different personnel than those concerned with conservation science and animal husbandry.

Few people consciously think of zoos as conservation organizations (Dierking *et al.* 2001), suggesting that conservation messages are insufficiently presented to the public by these institutions, despite the fact that zoos promote wildlife conservation as their highest priority, according to the AZA. Educational messages typically lack any mention of the role of zoos in broader wildlife conservation strategies. Conway (2003) notes that the conservation education in zoos today is remote and indirect from the perspective of visitors. This discrepancy is unfortunate since the long-term and broad-scale success of conservation strategies depends upon the awareness and involvement of a larger segment of society than merely those directly associated with conservation organizations and zoos (Adler and Wirth 1994; Bjorkland and Pringle 2001).

Zoos have a mandate to educate and encourage involvement among the public if they are to actualize their goals of wildlife conservation. Solutions to environmental problems need to be more explicitly presented to the public, especially since the majority of zoo visitors cite recreation rather than education (let alone conservation) as the primary stimulus behind their visit, and therefore may not be actively searching for educational or conservation-related

messages themselves. The World Zoo Conservation Strategy (IUDZG 1993) states that the importance of wildlife conservation should be expressed more directly and creatively in zoo education, particularly given the diversity and size of the total population of zoo visitors attracted to the interesting and potentially effective venues for conservation education.

Research suggests that visitors do not visit zoos specifically to learn about wildlife conservation-related issues, but they are willing to do so if the conservation messages are presented in the context of seeing animals. Swanagan (2000) demonstrated that visitors who have a more active experience with animals on exhibit and who were introduced to more explicit conservation messages were more likely to support conservation efforts than those who have a more passive experience at the zoo. Despite the underlying presumption that Western zoo education should not be too obvious since people visit the zoo for entertainment and not learning, disguising or minimizing messages, especially those unfamiliar to visitors, can defeat their intended educational purpose (Walker 1998) and undermine the conservation-related goals of increasing public awareness and involvement that they are meant to promote. Moreover, education and entertainment are not necessarily dichotomous variables underlying a zoo visit. Education can be entertaining, and, indeed, should be entertaining (i.e., incorporated into the main reason for visiting a zoo) in order to reach the largest possible proportion of the target population of visitors. Zoos that are reticent to incorporate explicit conservation-related messages into zoo education based on the common assumption that such messages will contribute to a 'negative' experience for visitors should be reminded that wildlife conservation itself is not negative, and, in contrast, that wildlife conservation presents considerable potential to be among the most challenging and rewarding movements of the next century (Conway 2003).

Zoos with active education programs have significant potential for shaping public opinion, encouraging more responsible and sustainable behavior among visitors (Woollard 1999b), and facilitating the involvement of the general public in wildlife conservation efforts (Woodside and Kelly 1995). Zoo education should be clear about the messages it intends to convey such that these messages are understood as either issues, problems, or neutral subjects with discernible outcomes and opportunities to be acted on by visitors (Whitehead 1995). Conservation education messages are more likely to be retained by visitors if they are presented in both entertaining and informative ways. Effective zoo education should use the perceptions of zoo visitors rather than zoo professionals to convey new concepts and conservation-related messages. At its most basic level, conservation education in zoos should inform visitors about the status of *in situ* (wild) counterparts of the animals represented on exhibit; the factors contributing to declines in wildlife and natural habitats; the importance of slowing, stopping, and reversing these factors; and the specific actions visitors can take to become involved in wildlife conservation efforts.

Zoo Exhibits and Their Potential for Conservation Education

Zoos provide an ideal venue to educate the increasingly urban public about wildlife conservation principles, strategies, efforts, and goals; and enriched, naturalistic exhibits are particularly illustrative tools (Norton *et al.* 1995). Exhibits should instill knowledge about and concern for animals in captive environments and those in natural habitats represented by zoo animals. Animal exhibits provide a valuable introduction for visitors to issues of wildlife conservation. Participatory zoo exhibits (Morgan and Hodgkinson 1999), where visitors are provided with opportunities to connect with and support issues concerning the animals, are becoming increasingly common as zoos recognize the benefits they confer on visitors. Visitors

are attracted to highly naturalistic exhibits and demonstrate a strong interest in obtaining more information about wildlife conservation following their interaction with such displays as compared to more traditional (i.e., unenriched) animal exhibits (Reade and Waran 1996; Stoinski *et al.* 2001). An animal's environment has a significant effect on the characteristics visitors associate with that animal (Wilson *et al.* 2003). This perception, in turn, affects visitors' willingness to participate in and support conservation efforts. It follows, then, that an animal's environment should strive to evoke the most positive responses possible among visitors to promote an interest in support for conservation efforts.

Research (e.g., Morgan and Hodgkinson 1999; Swanagan 2000; Walker 1998) suggests that while visitors do not visit zoos specifically to learn about wildlife conservation-related issues, they are willing to do so if the conservation messages are presented in the context of seeing animals. In fact, visitors do want to know about the specific problems wildlife face, how not caring about conservation issues influences wildlife and the environment, and what can be done by individuals to address these concerns (Dierking *et al.* 2001). Woollard (1998) states that visitors consider learning about these concepts to be more important than learning scientific facts about animals, which is the traditional focus of zoo education. Yet despite this general interest in wildlife conservation issues, most visitors are unable to provide details when expressing their concern or to associate their concerns with specific root causes of problems facing wildlife (e.g., Andrews *et al.* 1995), indicating a significant gap that should be addressed by zoo education.

Based on these findings, it can be concluded that effective conservation education in zoos should incorporate animal exhibits such that visitors' preferences are not incompatible with educational agendas. But the construction and use of these exhibits need to be informed by what is known about the target audience of zoo visitors and the stimulus behind zoo visits. In general,

the more positive the response generated by an exhibit, the more effectively its intended messages are conveyed, by directly encouraging interest in the details of the exhibits or by increasing the amount of time visitors spend at the exhibit and therefore influencing the level to which visitors can be educated about wildlife conservation (Wilson *et al.* 2003). It is clear that naturalistic presentations of animals generate the most positive public response. These more naturalistic exhibits also benefit the animals and promote public understanding of natural systems and conservation issues.

Environmental Enrichment

Zoo environments are designed to provide the optimal experience for the animals both while in captivity and in case the animals are destined for release in natural systems. Naturalistic exhibits create a perceptual link between animals and habitats, enhancing the educational value of captive environments in inspiring understanding of and appreciation for broader wildlife and conservation issues (Gold 1997). In other words, naturalistic exhibits serve as an effective context for the presentation of educational and guided messages regarding wildlife and habitat conservation messages. Appropriate captive environments (i.e., those that benefit the animals inhabiting them and provide visitors with relevant stimuli of both entertaining and educational value) should reproduce at least some of the salient features of the animals' wild habitat and create opportunities for animals to display, maintain, or develop species-typical (natural or normal) behavior. The conservation of species-typical behavior and ability to cope with contingencies in the environment is also essential to the expressed goal of zoos to maintain animals that are capable of successful placement in natural habitats in the future (Markowitz 1997). It follows, then, that captive environments should strive to encourage species-typical behavior and discourage species-atypical or otherwise abnormal behavior. Environmental

enrichment is the animal husbandry principle that encompasses these goals (Shepherdson 1998). In addition to benefiting the animals, enriched exhibits are beneficial in conveying educational and conservation messages to visitors (Gold 1997).

Environmental enrichment seeks to improve the quality of life for captive animals, increase breeding success, and enhance the aesthetic and educational value of exhibits (Rapaport 1998). Specific goals of enrichment include increasing the range of behavior displayed by animals; providing opportunities for physical exercise, exploration, and visibility to visitors; and decreasing stereotypical and aggressive behavior (Hare *et al.* 2003). Enrichment often entails changes in one of the various aspects of the animals' environment, such as the available diet items and foraging options, physical elements of the exhibit, and social groupings.

Enrichment can have a motivational carry-over effect for the animal (Swaisgood *et al.* 2001), demonstrated by the noticeable modification of behavior after interactions with enrichment have ceased. Such modifications indicate that enrichment has a more significant impact on animals than the superficial provision of novel activities and items in an otherwise stimulus-poor and unchanging captive (as compared to dynamic, wild) environment. In other words, enrichment seems to promote species-typical behavior and reduce abnormal and stereotypical behavior during and well after interaction with enrichment has occurred, increasing the exhibition of species-typical behavior overall and thus increasing the likelihood that visitors will see animals engaged in such behavior.

Effective education requires the proper management and husbandry of animals such that their physiological and psychological well-being is cared for. Animals that appear to be suffering (c.f., Fraser 1999; Mench 1998) can harm the educational impact of exhibits since visitors are more likely to care for, learn about, and respond positively when attracted to animals

displaying a variety of species-typical behavior in a naturalistic environmental setting. The public is increasingly exposed to species-typical behavior through various forms of media that depict animals in their natural habitats. Zoo visitors thus expect animals to behave in accordance with these predetermined ideals such that captive animals are seen as ambassadors for their wild counterparts (Duncan 1997).

Management and husbandry decisions are often based on the assumption that the public only appreciates 'natural' enrichment items and rejects 'non-natural' items as negatively affecting their impression of the exhibit. However, research indicates that the type of enrichment object has little impact on visitors' perceptions of the exhibit (McPhee *et al.* 1998; Wood 1998). While interactions between captive animals, enrichment activities and items, and the perceptions of visitors cannot be explained by simple causal links (Wood 1998), it seems that the animal behavior displayed is more important to the formation of visitors' perceptions and in conveying the intended educational message than the inclusion or specific type of enrichment. Zoo visitors can become frustrated by the lack of animal behavior, especially since seeing animals engaged in species-typical activity is one of the primary motivations for zoo visits.

It follows, then, that enrichment should be included to elicit species-typical behavior from the animals on exhibit, regardless of the specific type of the enrichment itself, in order to provide visitors with appropriate stimuli to encourage learning about and appreciating the natural (species-typical) behavioral repertoire of animals. Along these lines, it is also important to explicitly connect the importance of providing enrichment to preserve the animals' species-typical behavioral repertoire and not simply to provide distracting activities to alleviate 'boredom' among animals in captivity. Appropriate enrichment programs should meet both

animal and visitor needs (McPhee *et al.* 1998). If this outcome is achieved, the value of the exhibit in fostering conservation education will clearly be enhanced.

Targeting General Zoo Visitors for Conservation Education

Considerable attention in the educational literature has been given to the education of young children as an important mechanism for redressing environmental problems and creating an ecologically well-informed society for a sustainable future. While the merit of targeting children for education is certainly recognized, focus on children as the target audience of zoo education should not be exclusive. Current trends in the declines of wildlife and natural habitats demand more immediate focus and cannot wait until the educated children of today become politically active adults and are able to participate proactively in conservation-related strategies and efforts. Moreover, adults must change in accordance with the implications of environmental and conservation education if such education is to have credibility with children (St. Clair 2003). It is important, therefore, to target all zoo visitors for education to the greatest extent possible (IUDZG 1993).

As visitors to entertainment attractions, the largest proportion of the general visiting population to zoos is composed of family groups (Morgan and Hodgkinson 1999). Andersen (2003) states that nearly eighty percent of the total number of zoo visitors is comprised of family groups and therefore 'informal' visitors (i.e., not part of an organized group and principally motivated to visit zoos for entertainment). In terms of education, most adult visitors cite teaching their children about wildlife rather than learning about animals themselves as an important reason for a zoo visit. However, educational messages such as those regarding environmental awareness and stewardship behavior have been found to encourage interest in

conservation-related issues among adults, particularly as they can be used by parents to educate their children about animals and the environment (Coll *et al.* 2003; Reade and Waran 1996).

While animal exhibits are the main attraction of zoos and represent the strongest potential for conservation education, education should not be assumed to be an intrinsic quality of exhibits. Visitors may have varied attitudes and knowledge regarding wildlife and conservation, some of which may not be consistent with current concepts and strategies of wildlife conservation. Encouraging change of these possibly erroneous perceptions, and reinforcing affirmative ones, requires the development and implementation of effective, explicit conservation-oriented education. Actively attracting attention and conveying messages that are likely to be retained and acted upon must accompany animal exhibits used as part of zoo education. The messages conveyed by animal exhibits should be stated as explicitly as possible in order to contribute most appreciably to the impressions and knowledge gained by zoo visitors and maximize their educational impact on visitors.

Non-traditional and non-formal learning environments have often been considered to be more effective than traditional and formal settings for influencing and improving environmental and conservation-related knowledge, attitudes, and behavior (Bogner 1999). Learners in non-formal settings are more internally motivated (Luck 2003) with regard to synthesizing and then acting upon the knowledge gained and attitudes formed by the educational experience. Visitors' perceptions and understanding of the connections between wildlife conservation issues and their personal lives underlie the formation of attitudes regarding wildlife conservation and influence subsequent behavior on behalf of these issues.

One evaluation of zoo-based conservation education (Gutierrez de White and Jacobson 1994) revealed that the affective aspect of zoo education may be more significant than the

cognitive aspect, and that learning was enhanced by providing directed questions or cues for feedback. As will be shown in Chapter 3, guided inquiry education aims to stimulate interest and enthusiasm through direct experience and illustrative media rather than simply to communicate scientific or factual knowledge (Luck 2003). In light of the known value of the affective and experiential aspects of zoo education, an approach such as guided inquiry might prove highly effective in conveying conservation messages in the zoo setting. If carried out in a context of direct experience with wildlife in enriched, naturalistic exhibits, such techniques should enhance the educational impact on visitors.

The Role of Zoos in Wildlife Conservation Efforts: Messages for Education

Current and projected trends in habitat destruction and wildlife declines require that zoos take proactive, positive action in order to sustain their animal collections and to conserve the wild counterparts and habitats of these animals (Conway 2003). Indeed, the ultimate conservation goals of zoos are to preserve *in situ* populations of wildlife within ecologically functional natural systems with minimal human intervention or interference, not to maintain perpetually captive, *ex situ* populations (Hutchins 2003). While zoos obviously lose purpose without live animals to exhibit, zoos likewise lose purpose if the wild counterparts of zoo animals and their habitats are destroyed. Similarly, habitat conservation is a requisite component of wildlife conservation, but does not necessarily or solely guarantee the successful conservation of wildlife. Successful wildlife conservation efforts will require a larger, integrated, holistic approach including habitat conservation and conservation education (Hutchins 2003) to increase awareness and support. In order to achieve *in situ* conservation goals, zoo-based activities will need to be more explicitly linked to field conservation and natural habitat preservation. It follows, then, that zoo education should explicitly demonstrate the link between *ex situ*

populations and the conservation concerns of their *in situ* counterparts such that zoo visitors are aware of these connections and goals.

Given the facts that the loss of wildlife and natural habitats is likely to continue and that human populations are likely to become increasingly urbanized for some time into the future, zoos will remain important centers for wildlife management and conservation research and efforts (Hutchins 2003). "Continued urbanization of the global human population will result in a progressive alienation from nature. Lack of knowledge and experience with the natural world will become commonplace, particularly in developed countries. People are not going to conserve wildlife unless they appreciate it and understand its value. Such appreciation is becoming increasingly rare as people become more urbanized and isolated from nature" (Hutchins 2003:22). For that reason, zoos are becoming an increasingly important and utilized place for urban populations to establish a sense of connection to the natural environment and wildlife through naturalistic exhibits, and one of the most significant roles can zoos play in wildlife conservation efforts is public education about the importance of conserving natural biodiversity. Zoos uniquely provide accessible opportunities for visitors to closely experience wildlife from various regions of the world (Whitehead 1995). Zoos cannot protect and preserve wildlife from extinction by themselves, given the rapidly increasing numbers of endangered and threatened taxa, the limited capacity of zoos to house animals, and the technical difficulties and lack of suitable habitat for reintroductions (Hutchins and Conway 1995). Zoos must therefore work in coordination with *in situ* conservation efforts in order to impact wildlife conservation goals.

Zoos play a variety of roles in wildlife conservation efforts, and these roles should be explicitly explained to visitors. Animal husbandry and medical techniques are developed and

refined in zoos using captive animals such that the life cycles and health status of animals both in captivity and *in situ* can be more appropriately monitored and evaluated, providing valuable tools in the assessment and even the recovery of declining wildlife populations. As such, zoos provide a valuable learning and training environment for professional conservation ecologists, wildlife biologists, and field researchers, and the importance of these settings should be made apparent to visitors to educate them about the roles played by zoos beyond public entertainment.

Zoo visitors should also be educated about the positive, proactive actions zoos take to maintain their animal collections through captive breeding programs and cooperative population management. These coordinated efforts entail planning collections across institutions to share genetic materials or individuals such that 'surplus' animals do not present a major problem for any given zoo and species-typical social groupings are maintained, and such that extra animals do not need to be removed from their natural habitats for exhibition or research purposes. Zoos take steps to preserve wildlife by maintaining these captive wildlife populations in case *in situ* populations need to be supplemented or replaced with novel genes or with individuals, or in case their habitats are threatened or destroyed in the wild. The connections between zoo animals and how their management relates to broader wildlife conservation efforts should be explicitly illustrated to visitors in order to facilitate an appreciation for zoos as proactive conservation organizations. An explicit connection between zoo visitors engaging with these animals and broader conservation efforts should be provided by zoo education; this connection can then serve as the foundation to introduce specific opportunities for zoo visitors to become personally involved in such conservation efforts.

Conclusion

The efficacy of zoo education, defined as the power to encourage change among visitors (Stoinski *et al.* 2001), is still largely untested. Zoo education is in a state of transition between presenting scientific and factual information about animals to inspiring conservation-related knowledge gains and encouraging behavioral changes. As such, the literature on the educational context of zoos, examined above, offers some suggestions for future advances, but is lacking in actual data on currently effective methods for achieving intended conservation-related goals among zoo visitors. What has been deduced are general observations about the target population, including their motivations and education-relevant characteristics, as well as the value of naturalistic and enriched exhibits. What follows is an attempt to identify relevant theory and methodology within the literature on general environmental and conservation education which, when integrated with these deductions about the educational environment of zoos, may help actualize effective conservation education in the zoo setting.

CHAPTER 3

ENVIRONMENTAL AND CONSERVATION EDUCATION

Theoretical Background and Developments within Environmental and Conservation Education

Ecological awareness through environmental and conservation education among the general public may represent the greatest potential for effecting changes in declines in wildlife and natural habitats worldwide (Bogner 1999). Environmental and conservation education seeks to guide people as individuals and as members of a global society toward making informed decisions regarding the sustainable consumption and management of natural resources (Disinger and Monroe 1994; Rosenthal 1991). In order to influence and inform such decisions, education should incorporate cognitive, attitudinal, and behavioral components (Thompson and Mintzes 2002), following two fundamental assumptions of educational theory: that knowledge and attitudes are strongly related, and that together these components influence behavior. A broad understanding of ecological concepts such as the complexity of nature and biodiversity is generally regarded as an essential basis for environmental education. But accumulation of factual knowledge alone is insufficient to develop awareness and concern about environmental issues, let alone to generate behavioral change on behalf of such issues.

What is clear from the research to date is that the relationship between environmental and conservation-related knowledge, attitudes, and behavior is complex. Merely teaching awareness of environmental and conservation-related problems and issues is insufficient to encourage changes in environmental and conservation-related behavior (Roy and Petty 1997) since such behavior is influenced not only by knowledge, but also by attitudes, perceived locus of control,

and opportunity for action. Information can serve as a foundation for designing effective conservation education, but is not adequate by itself to promote attitudinal and behavioral changes. Research indicates that attitudes are associated with behavior more predictably and consistently when the attitudes are shaped through direct experience and can be strengthened through repetition. It follows, then, that education striving to encourage positive behavioral action toward wildlife conservation goals should utilize direct experience with wildlife and, in the zoo setting, should also incorporate representative elements of the natural environment in enriched, naturalistic exhibits.

The inconsistent relationship between environmental attitudes and behavior may be explained in part by the fact that environmental behavior may not be part of a single construct (Swanagan 1993), and, perhaps more pertinently, may be due to the seemingly large disconnect between personal behavior and the consequences of individual human behavior on wildlife and the natural environment (Stewart and Craig 2001). Attitudes about specific conservation-related issues are influenced by the way those issues are (or are not) related to a personal sense of interest and control (Aipanjiguly *et al.* 2003).

The theory of planned behavior states that intentions to perform certain behavior and the actual performance of that behavior are influenced by the perceived ease (or difficulty) of performing the behavior, while the theory of rational intentional behavior focuses on the strength of belief in the relationship between perceived consequences and personal behavior (Stewart and Craig 2001; Swanagan 1993). Together, these theories imply that individuals are more likely to act in particular ways when they feel that the behavior is relatively easy to perform, and when they feel a personal connection to the consequences of their behavior.

Given the complexity of the relationships between conservation-related knowledge, attitudes, and behavior, along with the urgency of conservation education to effect changes in the degradation and declines in wildlife and natural habitats on a broad scale, effective education should be developed to intervene in attitudinal and behavioral variables rather than merely to increase knowledge. In terms of how this intervention can be achieved, Novak (2002) demonstrates that science education can be particularly effective when deliberate efforts are made by educators to provide clear and explicit connections of how to incorporate the scientific concepts being taught into learners' individual conceptual hierarchies, or the way an individual conceptualizes new knowledge in the context of previously-held knowledge, such that the information is more readily synthesized by learners and appreciated as personally relevant and valuable. The integration of new knowledge into conceptual hierarchies increases the meaning of this knowledge to the individual learner. Such meaningful learning implies a consequent shift in the emotional connotation associated with the possession of this knowledge and an increased likelihood that subsequent behavior will be influenced by these changes (Novak 2002; van Weelie and Wals 2002).

Following these theories, it can be concluded that providing explicit connections between the personal relevance and impact of ecological and conservation-related principles in zoo education can help further meaningful learning among zoo visitors with discernible consequences in attitudes and behavior. Also, conservation education in zoos should strive to address the issue of scale of perceived environmental problems by providing visitors with direct experience and personal connection to wildlife conservation issues through enriched, naturalistic exhibits with guided, explicit messages of what issues are important and how individuals can personally become involved in conservation-related efforts. As a consequence of providing

readily available behavioral opportunities and personalizing the consequences of performing such behavior, the broader issues of environmental degradation and declines in wildlife should be refocused within the individual's sphere of comprehension and perceived locus of control.

Direct Experience and Guided Inquiry Education

These strong correlations between environmental knowledge gained and attitudes formed through direct experience and pro-environmental behavior were clearly demonstrated in a meta-analysis of research on environmental education efforts by Zelezny (1999). He concluded that educational interventions using direct experience could effectively and significantly influence positive environmental behavior. These principles are also evident in modern education pedagogy, which argues that active and involved learning, rather than the traditional unilateral transmission of factual information, is the most appropriate strategy for effective environmental and conservation education (Feinsinger *et al.* 1997; Krasny and Lee 2002).

As discussed in Chapter 2, knowledge gained and attitudes formed by environmental and conservation education are also more likely to be sustained if learning takes place in the context of direct experience with wildlife in enriched, naturalistic exhibits, and is reinforced with opportunities for personal involvement to act in accordance with the concepts learned (Swanagan 2000). Conversely, research suggests that lack of experience is likely to lead to the development of weak attitudes and values regarding the natural environment. Education is further enhanced if learners become familiar with these ecological and conservation-related concepts through direct experience in meaningful contexts. Contexts are considered meaningful if learners are able to personalize the content and implications of the educational messages. Guided inquiry education, defined as a educational process in which the educator explicitly provides the framework and

methodology to learners (Feinsinger *et al.* 1997), presents considerable potential in producing meaningful contexts for learning at a zoo.

Guided inquiry education facilitates learning by illustrating concepts through example and by asking guided questions (Marcellini and Murphy 1998). This facilitation is accomplished through techniques such as asking questions of visitors that are answerable within a reasonable time limit; providing examples that are comparative in nature, requiring the learner to link general concepts to alternative consequences of different actions; raising points that are neither overly obvious nor overly tedious, in order to promote a sense of self-satisfaction in the learner when the correct conclusion is reached; and avoiding unnecessary scientific and academic jargon, in order to avoid intimidating learners (Feinsinger *et al.* 1997). For example, Feinsinger and his colleagues (1997) demonstrate how guided inquiry has been an effective approach for educating tourists to a nature park near San Carlos de Bariloche, Argentina. Nature park tours are structured such that tourists stop at specific points along the trail (as prompted by a guide or, in the case of self-guided tours, by signposts) where they are then explicitly asked questions that encourage them to reflect upon their role within the natural environment in which they are now immersed, and enticing them to relate this experience to their personal lives. Tourists are asked, for instance, to envision what the area around them would look like if it were not protected as a nature park, and to compare the park with their own neighborhood in terms of vegetative cover, noise, and pollution. Educators (or signposts) then provide examples of how tourists can integrate the knowledge gained and attitudes formed by this experience into personal behavior such that the ultimate goal of fostering an ecologically literate public is achieved. According to preliminary observations, this approach has been effective in generating positive behavioral changes around the nature park and in the surrounding community, where tourists have

organized workshops on composting and encouraged local schools to incorporate lessons on local ecology, such as those introduced at the nature park, into the science curriculum.

Guided inquiry education would seem to be especially relevant to zoo education since, like tourists to a nature park, zoo visitors are under no obligation to learn during a zoo visit. In such a setting of non-formal learning, education must be handled in explicit yet enticing ways in order to meet both the visitors' demand for entertainment and the zoo's objective of conservation education. As explained by Lundmark (2002), free-choice learning is voluntary and guided by individual interests and needs. Due to its characteristically personal quality, such learning has a profound impact on individuals and can more readily influence subsequent attitudes and behavior. The combination of cognitive, affective, and attitudinal factors is especially important for conservation education, where the ultimate goal is to positively affect behavioral intentions and actions, since an increase in knowledge alone will not significantly change attitudes and values (Luck 2003). By directing visitors' impressions of messages conveyed by an exhibit and emotions elicited by the animals toward an action-oriented goal, guided inquiry education should effectively demonstrate how visitors can incorporate these elements into their personal lives. If successfully done, providing personal connections between individuals, wildlife, and nature through direct and guided experience can be expected to improve understanding of and attitudes toward natural environments and encourage pro-environmental behavior (Stewart and Craig 2001).

Targeting Individuals in a Diverse Population: Making Education Personally Relevant

Conservation ecologists and educators must take more proactive responsibility for translating the results and significant implications of their research into accessible messages for the general public that move beyond anecdotal and 'trickle-down' approaches (Brewer 2001),

and instead produce demonstrable gains in conservation-related knowledge, concern, and action. The imperatives of wildlife conservation education must reach a diverse variety of audiences (van Weelie and Wals 2002) who are individually shown why they should care about the specific issues being conveyed since individuals tend to be more motivated to behave in accordance with issues they personally value and are not motivated by abstract, disconnected concerns (St. Clair 2003). It is the role of educators to demonstrate the importance and personal relevance of conservation-related concerns to individuals, recognizing the diversity among the target audience of learners. In other words, educators are challenged to meaningfully incorporate and thus accommodate this variability among individual learners (Falk and Adelman 2003) in order to effectively achieve educational goals.

Following a national survey of American knowledge, attitudes, and behavior regarding wildlife and environmental issues, Kellert (1976, reviewed in Thompson and Mintzes 2002) developed nine fundamental attitudinal typologies, characterized by differential appreciation and awareness of these issues by individuals:

1. naturalistic: interest in direct experience with wildlife and the environment;
2. ecologistic: interest in the interdependence between wildlife and natural systems;
3. humanistic: strong affection for and emotional attraction to animals;
4. moralistic: concern for the ethical treatment of animals;
5. scientific: interest in the physiological and biological attributes of animals;
6. aesthetic: interest in the artistic and symbolic qualities of animals;
7. utilitarian: concern for the material and practical value of animals;
8. dominionistic: interest in controlling animals (e.g., for sporting events)
9. negativistic: indifference, dislike, or fear of animals.

These attitudinal typologies are consistent with the classic reasons for conserving wildlife and natural habitats given by conservation ecologists (e.g., Callicott *et al.* 1999; Caro *et al.* 2003), including consumption, ecosystem services and interdependence, environmental baselines, inherent (moral or ethical) value, medicine, science, education, economic value, tourism, and human cultural heritage. Educating the public about the reasons to conserve biodiversity and wildlife can be accomplished by illustrating the ways in which humans are, have been, and will continue to be dependent upon the diverse array of essential services provided by the products of biodiversity.

Recognition of the fact that individuals perceive, conceptualize, and value wildlife and environmental issues in various ways is notably relevant to the development of effective conservation education targeted toward a diverse audience, such as the total population of zoo visitors. Approaches will be more successful in encouraging both cognitive gains and behavioral changes among the greatest possible number of learners (i.e., visitors) if they incorporate appeals to a variety of the attitudinal typologies rather than restrict the scope and transmission of educational messages to only one or a few of these ways of appreciating wildlife and the environment. In other words, more productive education may need to include messages pertaining to the moralistic reasons for wildlife conservation, for example, rather than focusing on the ecologistic concepts traditionally emphasized by environmental and conservation education. Understanding these various beliefs and attitudes toward wildlife can help identify potential interventions for encouraging positive conservation-related behavioral changes.

Among the general public in Europe and the United States, the value for human health, the intrinsic value, and the value for future generations have been listed as the top three values and functions of wildlife and nature (Van den Born *et al.* 2001). It has also been demonstrated

that among North Americans, knowledge about charismatic endangered species is highly associated with support for their conservation (e.g., Aipanjiguly *et al.* 2003). It follows, then, that these reasons in particular provide considerably effective potential in outlining perspectives through which educational and conservation-related messages can be expressed to Western zoo visitors.

Connecting Conservation Education to the Science of Conservation Ecology

Just as the literature in Chapter 2 points strongly to the need to educate visitors about the roles of zoos in wildlife conservation efforts, it is essential that such educational messages reflect the latest developments from the field of conservation ecology underlying these efforts. Conservation education should therefore disseminate knowledge from the science of conservation ecology such that individuals understand the ecological and conservation-related consequences of action (and inaction) and the essential interdependence between humans and the natural environment, and to encourage individuals to participate meaningfully (Kassas 2002) in behavior to slow, stop, or possibly even reverse trends contributing to the loss of wildlife and natural habitats.

Current normative concepts in conservation (Callicott *et al.* 1999) recognize the interdependent biological hierarchy of organisms and processes at a variety of scales. Within conservation ecology, compositionalists tend to place more emphasis on the preservation of 'natural' entities aggregated into populations and communities, while functionalists stress the importance of preserving 'normal' processes to maintain 'healthy' ecosystems. These two approaches to the science of conservation ecology should not be viewed as mutually exclusive, but rather as providing complementary vocabularies for a fuller appreciation of how to address conservation-related issues. Modern conservation ecology benefits from the synthesis of the

historic paradigms of evolutionary and ecosystem ecology (Callicott *et al.* 1999), thus underscoring the importance of a holistic perspective recognizing the essential interdependence of components and processes.

In other words, regardless of emphasis or theoretical distinctions, general ecological theory states that humans, wildlife, and natural systems are interdependent and interrelated. Accordingly, all human behavior affects wildlife and natural systems. In order to effect pro-environmental and conservation-related change among the general public, effective education should explicitly focus on this interdependence of humans and the natural environment such that individuals more fully appreciate the consequences of behavior and develop a sense of value for wildlife and nature (Stewart and Craig 2001). Such appreciation should encourage increased personal involvement in conservation strategies and contribute to the attainment of conservation-related goals. Conservation education messages should emphasize the negative consequences of behavior, both collective and individual, in order to reinforce the connection between human activity and environmental degradation, thus increasing the likelihood that such messages will become personally relevant and therefore acted upon by visitors.

CHAPTER 4

PROGRAMMATIC GUIDE FOR WILDLIFE CONSERVATION EDUCATION IN ZOOS

Analysis of the literatures on the educational context of zoos and on general environmental and conservation education reveals a set of points that, when synthesized and presented in the context of captive animal exhibits, should be specifically taken into account in the design of effective zoo-based wildlife conservation education. What follows is a synthesis of these critical points deduced from the analysis of these two important literatures. These form what I believe to be a newly synthesized and informed programmatic guide for improving conservation education in zoos to enhance broader wildlife conservation goals.

Each of the following salient points suggests how zoos can effectively educate and motivate visitors to enhance their broader wildlife conservation goals. In particular, the principles of direct experience and guided inquiry education, together with implications from the preceding literature on attitude-behavior theories and individual attitudinal typologies, present considerable potential for effective conservation education in the context of zoo exhibits and can be translated into the following guidelines for effective conservation education in zoos.

1. Zoo education should capitalize on the primary motivation underlying zoo visits and therefore utilize direct experience with animal exhibits as its foundation. In other words, wildlife conservation education in zoos should be presented in the context of animal exhibits.
2. Animal exhibits that provide visitors with direct experience with wildlife should be enriched and naturalistic in order to accurately reflect and reinforce the ecological and

conservation-related messages being conveyed. The role of environmental enrichment, used to elicit species-typical behavior and include contingencies of the natural environment, should be explained to visitors such that perceptions of included enrichment are formed with an understanding of the broader principles underlying the maintenance of wildlife in captive zoo settings.

3. Zoo education should integrate the strong affective responses provoked by direct experience with animal exhibits with cognitive knowledge in personally meaningful and personally relevant ways in order to enhance the educational impact of the experience of a zoo visit. In order to make conservation education personally meaningful, guided inquiry education should be used to help visitors interpret the educational messages being conveyed into their individual conceptual hierarchies such that the knowledge gained and attitudes formed by this experience are more readily synthesized and more likely to influence subsequent behavioral intentions and actions. Guided inquiry education can directly connect the intended conservation-related educational messages of an exhibit to the broader implications of these messages.
4. In order to make conservation education personally relevant, zoos should explicitly recognize the diversity of individual attitudinal typologies toward wildlife by including conservation education messages from a variety of perspectives, thus attempting to reach the broadest possible segment of their target audience of visitors. Recognition of the fact that individuals perceive, conceptualize, and value wildlife and environmental issues in various ways is notably relevant to the development of effective conservation education targeted toward a diverse audience, such as the total

population of zoo visitors. Consideration of various beliefs and attitudes toward wildlife can help identify potential interventions for encouraging positive conservation-related behavioral changes since personal investment in an issue strongly predicts personal involvement in the resolution of that issue. Approaches will be more successful in encouraging both cognitive gains and behavioral changes among the greatest possible number of visitors if they incorporate appeals to a variety of the attitudinal typologies, rather than restrict the scope and transmission of educational messages to only one or a few of these ways of appreciating wildlife and the environment.

5. Zoo education, presented through guided inquiry and from a variety of attitudinal perspectives, should explicitly state the various roles zoos play in wildlife conservation efforts such that the connection between *in situ* and captive efforts is apparent to visitors. In order to facilitate this connection, zoo animals should be explicitly used as symbols of their wild counterparts. Explicit demonstration of the role of zoo animals in wildlife conservation strategies is particularly important as human populations and habitats become increasingly urbanized, with a consequent disconnect between humans and wildlife in natural ecosystems. Incorporating information and messages on the current status of wildlife and the causes contributing to the need for conservation of wildlife in natural habitats into animal exhibits can help facilitate the formation of such connections between visitors and broader conservation-related implications, linking basic factual information to the conservation of wildlife represented by species on exhibit.

6. Guided educational messages from a variety of attitudinal perspectives on why wildlife is maintained in zoos and what roles these animals in particular serve with respect to broader conservation goals presents the opportunity to personally connect a broad range of individual visitors to wildlife and conservation-related issues through the encouragement of and opportunity for personal involvement. This consequence is essential if zoos hope to promote change at the scale necessary to slow, stop, and reverse negative trends contributing to the decline in wildlife and nature habitats.
7. Zoos should provide readily available and relatively easy opportunities for visitors to perform positive behavior to enhance broader wildlife conservation goals, and thus to incorporate the knowledge gained and attitudes formed into behavioral actions through personal involvement. Such opportunities to act on the knowledge gained and attitudes formed by the exhibit's animals and educational messages should be readily provided, alongside the exhibit, and easy to perform. Performance of such behavior should help reinforce the knowledge gained and attitudes formed by the experience such that future, long-term behavioral intentions and actions will be influenced, thus enhancing the broader conservation goals of the zoo and achieving more effective conservation education among the visiting public.

In sum, wildlife conservation education in zoos should focus on inspiring conservation-related knowledge gains, attitudinal changes, and behavioral actions by introducing visitors to ecological and wildlife conservation concepts through the use of direct experience with enriched, naturalistic animal exhibits and guided inquiry education aimed at a variety of interest levels and values such that the broadest possible audience of zoo visitors is reached. Wildlife conservation education in zoos should strive to address the issue of scale of perceived environmental problems

by providing visitors with direct experience and personal connection to wildlife conservation issues through enriched, naturalistic exhibits with guided, explicit messages of what issues are important and how individuals can personally become involved in conservation-related efforts. The delivery of educational messages should be done in an informed, entertaining, and personally relevant way. Specific ecological and conservation-related problems and issues should be introduced, as should opportunities for visitors to perform behavior associated with the achievement of conservation goals. As a consequence of providing readily available behavioral opportunities and personalizing the consequences of performing such behavior, the broader issues of environmental degradation and declines in wildlife can be refocused within the individual's sphere of comprehension and perceived locus of control, ultimately reinforcing and enhancing the efficacy of wildlife conservation in zoos.

CHAPTER 5

WILDLIFE CONSERVATION EDUCATION IN ZOOS USING LEMUR EXHIBITS

Based on the programmatic guide presented in Chapter 4, a model for wildlife conservation education using captive lemur exhibits is described below. This model illustrates how the application of the ecological and conservation information on lemurs can be utilized to effectively exemplify the conclusions derived from my analysis. Clearly, in order to fully actualize the proposed guidelines, zoo educators should be fully familiar with both the ecological and conservation literatures for all taxa in the exhibits utilized for conservation education. This fundamental knowledge should guide not only the design of exhibits that are conducive to the general well-being of the animal, but also direct the programmatic use of the exhibit to specifically and effectively convey important wildlife conservation messages to zoo visitors.

Each of the critical points of the programmatic guidelines is summarized below, followed by a lemur-based illustration of how these points can be actualized. Because of the highly interrelated implications of the first two guidelines discussed in Chapter 4, these points, and the applied recommendations following from them, are presented together below.

1. Zoo education should capitalize on the primary motivation underlying zoo visits and therefore utilize direct experience with animal exhibits as its foundation.
2. Animal exhibits that provide visitors with direct experience with wildlife should be enriched and naturalistic in order to accurately reflect and reinforce the ecological and conservation-related messages being conveyed. The role of environmental enrichment, used to elicit species-typical behavior and include contingencies of the

natural environment, should be explained to visitors such that perceptions of included enrichment are formed with an understanding of the broader principles underlying the maintenance of wildlife in captive zoo settings.

Lemur exhibits have become increasingly popular among zoo visitors (Coll *et al.* 2003; Webster 2000) with the consequent potential to present animals in naturalistic, enriched settings and to convey messages about the plight of lemurs and their natural habitats in Madagascar to an increasing segment of the general zoo visitor population. Enrichment for lemurs often entails changes in one of the various aspects of the animals' environment, such as the available diet items and foraging options, physical elements of the exhibit, and social groupings. Scattering food items throughout the exhibit space and providing whole foods (as opposed to processed, peeled, or cut foods) appear to increase interest in foraging and feeding behavior, and decrease feeding-time competition and aggression among lemurs (McGivern 1993). Making feeding activities more difficult to perform by hanging food items from trees similarly increases the amount of time lemurs are engaged in species-typical foraging and feeding behavior (Tomoser 1994) and also reflects more naturalistic representations of how the diet items of these species are presented in the natural habitats within the forests of Madagascar.

Lemurs are characteristically arboreal and move by clinging and leaping throughout the tree canopy. Consequently, lemur exhibits should include climbing and perching structures such that animals are able to engage in species-typical behavior above the ground. These structures (e.g., branches, ropes, mesh canopy) should vary in terms of the amount of weight they can each support before bending or giving way, in order to more accurately represent the differential strengths of natural forest branches in supporting an animal's body weight. Such variation can

promote and maintain species-typical navigation and locomotion behavior among these lemurs, which is important if these animals are intended to be released into natural habitats in the future.

Exceptions to the preceding suggestions for enrichment options should be made for exhibits displaying ring-tailed lemurs (*Lemur catta*). In contrast to other lemur species, ring-tailed lemurs are predominantly terrestrial and therefore any enrichment should be placed on the ground (rather than suspended from trees), or on sturdy structures at very low heights from the ground, to more accurately reflect the spatial niche occupied by this species in the forests of Madagascar.

With regard to social groupings and the potential for enrichment, small family groups and pair bonds seem to be widespread among lemurs, in contrast to the large social groups of many other primates. Also, lemurs do not appear to defend exclusive home ranges or display aggressive territorial behavior in natural habitats, and indeed, several species are commonly found inhabiting different layers within a given forest habitat in Madagascar (e.g., Kappeler and Ganzhorn 1993). As a consequence of these characteristics, multiple lemur groups can be exhibited and kept by a zoo within a relatively small space, as compared to other primates, without disrupting social organization or cohesion of the group. For example, Sanford's lemurs (*Eulemur fulvus sanfordi*), crowned lemurs (*Eulemur coronatus*), and ring-tailed lemurs (*Lemur catta*) could be exhibited together as a naturalistic representation of wild habitats in which these lemur species have been found to occupy the canopy, mid-layer, and forest floor, respectively, within the same area. As noted by other researchers (Webster 2000; White *et al.* 2003), exhibits with multiple species can also be particularly effective in stimulating visitor interest and education by providing a variety of animals to attract attention and by demonstrating realistic

assemblages of sympatric fauna, reinforcing the concept of interaction and interdependence among components of an ecological system.

3. Zoo education should integrate the strong affective responses provoked by direct experience with animal exhibits with cognitive knowledge in personally meaningful and personally relevant ways in order to enhance the educational impact of the experience of a zoo visit. In order to make conservation education personally meaningful, guided inquiry education should be used to help visitors interpret the educational messages being conveyed into their individual conceptual hierarchies such that the knowledge gained and attitudes formed by this experience are more readily synthesized and more likely to influence subsequent behavioral intentions and actions.

Visitors should be provided with guided cues to recognize various traits and qualities of the lemurs on exhibit. Guided cues for education can be presented through the use of exhibit elements such as informational panels, signage, banners, and docents or animal keepers to engage with visitors in interactive talks about lemurs and wildlife conservation. For example, visitors can be informed through guided cues that all ring-tailed lemurs (*Lemur catta*) have thirteen black and thirteen white bands on their tails, encouraging them to verify this information for themselves by counting the rings on an animal's tail. When this new knowledge has been confirmed through personal observation, a sense of self-satisfaction in the visitor is promoted and the knowledge becomes more meaningful to the individual visitor. Similarly, when using taped calls, or during times when the animals on exhibit are being particularly noisy, visitors can be asked to compare and distinguish between any of the twelve distinct vocalizations of the red ruffed lemur (*Varecia variegata rubra*), or to listen for the characteristic alarm call of the sifaka

(*Propithecus* spp.) in order to hear and understand for themselves where these lemurs received their common name (i.e., the alarm call sounds like 'sifaka').

Guided inquiry education can also be used to illustrate the location of lemurs' natural habitats in Madagascar through the use of a globe or map, and to then contrast the location of the animals presently on exhibit to their native ranges, thus guiding the visitor to recognize these zoo animals as representative members of wildlife found outside the zoo. Pictures of lemurs in their natural habitats can also be displayed, and then serve as cues for visitors to compare those habitats with the construction of the exhibit, encouraging an appreciation for the inclusion of certain elements, such as climbing structures (e.g., trees) for enrichment purposes, as discussed above. By actively guiding visitors to answer questions that are answerable within a reasonable time limit, confirm conclusions through personal observation, and evaluate the implications of the information being presented, guided inquiry education can make the experience with a lemur exhibit personally meaningful to individual zoo visitors, and presents the opportunity to introduce ways to make lemur conservation personally relevant.

4. In order to make conservation education personally relevant, zoos should explicitly recognize the diversity of individual attitudinal typologies toward wildlife by including conservation education messages from a variety of perspectives, thus attempting to reach the broadest possible segment of their target audience of visitors. Approaches will be more successful in encouraging both cognitive gains and behavioral changes among the greatest possible number of visitors if they incorporate appeals to a variety of the attitudinal typologies rather than restrict the scope and transmission of educational messages to only one or a few of these ways of appreciating wildlife and the environment.

Among the general public in Europe and the United States, the intrinsic value and the value for future generations have been listed among the top reasons to conserve wildlife and nature (Van den Born *et al.* 2001), emphasizing a bias toward utilitarian, humanistic, and naturalistic attitudinal typologies among this population (see Chapter 3). These values can be targeted through the use of signage or by educators stationed at the exhibit explicitly addressing the extent of lemur endangerment, the limited geographical range they occupy in the wild, and the logical conclusion that there will be no lemurs left for future generations to enjoy if conservation action is not taken soon. Additionally, the intrinsic value of the unique suite of traits possessed by lemurs makes them ideal as representative species for conservation messages among general Western zoo visitors. Lemurs are characterized by the widespread co-occurrence of several idiosyncratic traits not collectively found in other primates, including female dominance over males; lack of size differences between the sexes regardless of social system; many monogamous species; and strict breeding seasonality that appears to be correlated with day-length periods (Jolly 1986; Kappeler and Ganzhorn 1993; Richard 1985; Richard and Dewar 1991; Wright 1999). Such unusual facts are often remembered by people as 'interesting' or 'fun facts,' and emphasize the intrinsic value of these species. As such, they collectively present significant potential for inspiring interest in additional education about these animals and related wildlife conservation issues.

Conservation messages can also be targeted toward visitors predominantly identifying with a scientific attitudinal typology. For example, with few exceptions, female dominance over males characterizes all group-living lemurs studied to date in the wild. Females are consistently able to displace males from feeding sites, and in species in which mating has been observed, females exercise strong mate choice. Female feeding priority is rare among mammals, and its

presence among lemurs is still unexplained (Richard and Dewar 1991). Guided cues can direct visitors' attention to any displacement behavior of males by females performed by the animals on exhibit to illustrate this trait of female dominance. Further research on this subject is important to understanding the implications of its presence among lemurs and of its absence among other primate and mammalian taxa. Such research is possible only if lemur conservation is successful in preserving populations of sufficient size to study within ecologically intact natural systems, which is possible only if individuals take positive behavioral action on behalf of these conservation-related efforts. Guided inquiry education can then highlight the distinctiveness of female dominance among lemurs in contrast with other wildlife taxa, and direct visitors to the conclusion that future research, essential to understanding this phenomenon, is only possible if lemur conservation efforts are successful.

From the perspective of an ecologistic attitudinal typology (see Chapter 3), the interdependence between wildlife, humans, and the natural environment can be exemplified well by lemurs and the ecological roles they perform in Madagascar, where they are endemic. Madagascar is particularly interesting in terms of primate ecology and conservation in that the island has the third highest primate diversity of any country in the world (Ganzhorn *et al.* 1999; Richard and Sussman 1987). Lemurs represent over sixty percent of the total mammalian taxa and a conspicuous portion of the total animal biomass on the island. Lemurs also collectively perform a significant proportion of the ecological roles played elsewhere by animals that are notably absent from Madagascar (Wright 1992). For example, it is widely believed that the aye-aye (*Daubentonia madagascariensis*) fills the ecological niche performed by woodpeckers in other regions of the world. Lemurs are also important agents of pollination and seed dispersal, and thus are important in promoting the regeneration of forests that have been destroyed. These

interdependent relationships between the native fauna and the roles performed by lemurs as pollinators and seed dispersers are subjects of practical as well as theoretical significance, as conservation efforts will not be successful if forests are protected but the animals needed to ensure their persistence are not (Jernvall and Wright 1998). The interdependence between wildlife and natural ecosystems is especially relevant to lemurs within Madagascar, where the lack of both competing and complementary mammalian fauna implicate the significance of the roles played by lemurs in the structure and functioning of the island's forest ecosystems. Visitors should be made aware of these facts though the use of exhibit elements. Exhibits could include elements (e.g., models, pictures, or diverse and naturalistic vegetation in the exhibit itself) to represent intact forest ecosystems inhabited by lemurs and contrast them with analogous elements illustrating the lack of forest regeneration in ecosystems where lemurs are no longer found. Guided inquiry education could then connect this information on the importance of ecological interdependence, reinforced by the visual cues, with the importance of conserving these animals in order to preserve the integrity of the ecosystems they inhabit.

5. Zoo education, presented through guided inquiry and from a variety of attitudinal perspectives, should explicitly use zoo animals as symbols of their wild counterparts in order to facilitate the connection between captive animals and broader conservation-related implications for zoo visitors, thus linking basic factual information to the conservation of wildlife represented by species on exhibit.

In order to facilitate this connection, captive lemurs should be explicitly used as symbols of their wild counterparts. Information and messages on the current status of lemurs and the causes contributing to the need for lemur conservation in their natural habitats in Madagascar should be incorporated into captive lemur exhibits to actualize this symbolism.

Some taxa, including primates in general and lemurs in particular, are especially vulnerable to declines because their natural habitats are being lost entirely, converted, or shared with human populations. Anthropogenic impacts are globally significant with respect to their effects on natural resources. Tropical areas in particular are experiencing dramatic and increasingly rapid anthropogenic alterations, primarily manifest following deforestation and land clearance for agriculture to accommodate relatively high population growth rates (Aveling 1987; Pringle 2000; Putz *et al.* 2001). The extent and degree of ecological change differ between tropical areas: among the four tropical geographical regions inhabited by nonhuman primates (i.e., Africa, Asia, South America, and Madagascar), disproportionately larger ecological changes are projected for Madagascar than for other primate habitat regions, consequently affecting predicted extinction patterns in ways that are not reducible to taxonomic measures (Jernvall and Wright 1998).

Over eighty percent of Madagascar's total land area is classified as 'highly disturbed' (World Resources Institute 1994) due to human influence, with another four percent classified as moderately disturbed and fifteen percent as minimally disturbed. Together, the total land area in Madagascar classified as disturbed due to anthropogenic influence is nearly ninety-nine percent. Conversely, only 1.25 percent of the total land area in Madagascar is under total protection and only 0.63 percent under partial protection according to federal law (Groombridge 1992). As a consequence of these statistics, forty species and subspecies of lemurs are currently listed as critically endangered, endangered, or vulnerable according to the 2003 IUCN Red List of Threatened Animals (IUCN 2003). This total includes all recognized species of lemurs. All lemurs are also listed under Appendix 1 of the Convention on the International Trade in

Endangered Species (CITES). These figures indicate the serious magnitude of threat facing this wildlife taxon as a whole.

Madagascar, therefore, indisputably presents a most urgent challenge to prevent major losses of primate diversity in the world, and visitors should be made aware of the details of this challenge. Signage or updated informative talks given by educators or keepers should make clear the extent and scale of threat facing lemurs in their natural habitats by displaying such revealing statistics as those listed above.

The fact that so many primates are endangered in Madagascar may be partly a function of high rates of endemism per unit area or other ecological characters, but the primary causes must be sought in the history of settlement and development in these areas (Jernvall and Wright 1998; Marsh and Mittermeier 1987). Habitat destruction is emphasized as the primary threat to the continuing survival of the extant lemur populations in the wild (Happel *et al.* 1987; Richard and Dewar 1991), and therefore habitat protection should be a highest conservation priority. Increasing development and urbanization are the primary causes of habitat destruction and associated losses of wild lemur populations. Development pressures in Madagascar are primarily manifest as deforestation and subsequent conversion of forests to agricultural plantations. Following deforestation in Madagascar, the majority of land is used for crops, such as rice, coffee, bananas, or cassava, depending on the productivity of the soil (Benstead *et al.* 2000). Exhibits could include elements such as pictures or models to visually demonstrate these types of modifications. It might also be possible for portions of an exhibit to be blocked from the lemurs on exhibit (through the use of visually hidden barriers or aversion training to condition the animals to avoid this part of the exhibit) and modeled to represent land that has been converted into agricultural plots with uniform rows of crops or burned poles as a visual

example of the effects of deforestation. Presenting visitors with contrasting examples between enriched, naturalistic habitats with active lemurs and anthropogenically disturbed areas without animals can provoke an affective response to and make more explicit the message of habitat destruction and its effects on lemur populations.

6. Guided educational messages from a variety of attitudinal perspectives on why wildlife is maintained in zoos and what roles these animals in particular serve with respect to broader conservation goals presents the opportunity to personally connect a broad range of individual visitors to wildlife and conservation-related issues through the encouragement of and opportunity for personal involvement.

Given the extent of environmental change throughout Madagascar, the high level of endemism of its resident primate species (i.e., lemurs), and the extensive loss of native habitat for these species, *ex situ* environments are playing increasingly important roles in the preservation and conservation of lemurs. In response to the international concern for declines in lemur populations and their habitats, Madagascar was the first region for which a conservation-oriented consortium of zoos and related organizations (i.e., the Madagascar Fauna Group, MFG) was formed (Zeeve and Porton 1997).

Lemur species and captive lemur exhibits effectively illustrate many of the conservation ecology principles underlying zoo involvement in wildlife conservation strategies, as a number of lemur species are included in captive collections as part of breeding and research programs (Feistner and Price 2002). Visitors should be informed about the cooperative breeding and population management programs of which zoo animals are a part, illustrating another level of the interdependence between wildlife and humans. Lemurs are well represented by formal conservation strategies, such as the coordinated Species Survival Plans (SSPs), that organize

breeding and release programs across multiple captive institutions and in concert with *in situ* efforts in Madagascar. For example, a key project of the MFG involves the reintroduction of black and white ruffed lemurs (*Varecia variegata variegata*) to Betampona Natural Reserve, which is the last forested area within the mountain range along the eastern coast of Madagascar. Captive lemurs from the SSP population are selected for reintroduction and prepared in naturalistic settings, such as enriched zoo exhibits, for contingencies they will encounter in the natural habitat of Betampona. Visitors should be made explicitly aware of the connections between exhibited black and white ruffed lemurs and the Betampona reintroduction project, and provided with opportunities to personally follow the progress of these animals; the MFG continually updates reports on the Betampona project from the field on its website, as well as through the newsletter published online by the IUCN/SSC Re-introduction Specialist Group, and these updates can be presented to visitors through exhibit elements or by guides at the exhibit. The delivery of these messages on why wildlife is maintained in zoos, what roles these animals in particular serve with respect to broader conservation goals, and how these roles are being currently actualized presents a direct connection between the experience of a zoo visit and the implications of broader wildlife conservation efforts in which the zoo is a part. By guiding the formation of such perceptual links between zoo visitors, zoo animals, and conservation efforts, the opportunity to then incorporate personal involvement and behavioral actions is presented.

7. Zoos should provide readily available and relatively easy opportunities for visitors to perform positive behavior to enhance broader wildlife conservation goals, and thus to incorporate the knowledge gained and attitudes formed into behavioral actions through personal involvement.

In particular, visitors should be encouraged to continue to support and visit zoos, emphasizing the importance of zoos as modern conservation organizations. Along these lines, it may be appropriate to now charge zoo visitors a conservation percentage fee (Conway 2003) in addition to park entry fees in order to raise financial support for conservation-related efforts. In connection with lemur exhibits and opportunities for personal involvement, individual visitors should be given the opportunity to sign up for memberships to the zoo or related environmental and conservation organizations, volunteer their time, and donate money to directly support lemur conservation efforts (either of the zoo itself or in combination with *in situ* projects) (Hutchins 2003; Hutchins and Smith 2003). For example, collection devices could be installed as part of the exhibit for donations to go directly to the Madagascar Fauna Group (MFG) or similar organizations working toward the achievement of lemur conservation goals.

Lemur exhibits can also direct visitors to the gift shop where additional donations could be made through the purchase of related items. For example, visitors should be informed that plush toy lemurs are sold in the gift shops of zoos belonging to the MFG (e.g., San Francisco Zoo, St. Louis Zoo) and that five percent of the purchase price is donated directly to the Group. Visitors should also be presented with the opportunity to purchase organic vanilla from Madagascar, thus promoting an economic activity in Madagascar that does not require the further destruction of natural forest habitats used by lemurs.

The importance of establishing protected areas and reserves to the conservation of lemur populations in the wild should be stated to visitors (Zeeve and Porton 1997), and examples of how visitors can help promote the establishment of such should be provided. For example, many threatened and endangered lemurs inhabit areas outside the country's currently existing protected areas, reserves, and two national zoos, and the creation and expansion of protected areas can

most effectively be accomplished if the consequences of the ecological dynamics of the given areas are understood in terms of their importance to both human and lemur populations. Therefore, visitors can help encourage national and international efforts to develop protected areas within Madagascar and educate the local community about the ecology of these areas by writing letters of support and donating funds to conservation organizations (e.g., the MFG, headquartered at the San Francisco Zoo; the Lemur Conservation Foundation, headquartered at Myakka City Lemur Reserve, Florida; and the Prosimian Taxon Advisory Group (TAG) of the AZA), that work toward the achievement of these goals.

Similarly, visitors could be provided with the opportunity to sign petitions and write letters of support regarding lemur conservation issues. Pre-printed and addressed letters of support or solicitation cards requesting additional information from related organizations, such as the MFG and the Lemur Conservation Foundation, could be provided for visitors to take away from the exhibit. Such information about lemur conservation could be provided at an exhibit at a designated area (e.g., an 'information station') or by a guide or keeper, thus encouraging visitors to continue learning more about lemur conservation on their own following their introduction to these issues by zoo exhibits and education.

Visitors should also be discouraged from engaging in activities that remove animals or resources from the natural habitats of these animals. For example, visitors should be discouraged from buying or keeping exotic animals as pets, especially those perceived as charismatic and 'cute,' including lemurs, or from purchasing tropical timber products. These messages, that wildlife should be left undisturbed in their natural habitats, can be conveyed through the use of inanimate artifacts such as bones, furs, pictures, slides, or other non-animal media (Kreger and Mench 1995) in connection with the exhibit such that the importance of respecting wildlife is not

only expressed through words, but also visually reinforced by exhibits displaying animals in naturalistic habitats.

CHAPTER 6

CONCLUSION

Summary and Implications of the Present Thesis

This thesis comprises a systematic review and analysis of the literatures regarding the educational context of zoos and general environmental and conservation education, with the outcome being a programmatic guide for wildlife conservation zoo education that can be used in conjunction with captive exhibits, such as the lemur exhibits discussed in the last chapter. Having outlined guidelines for effective wildlife conservation zoo education is an important step in furthering the development of such and in promoting wildlife conservation and ecological education among zoo visitors and the general public. By following the proposed guidelines and providing explicit connections between zoo animals, zoo visitors, and conservation efforts, wildlife conservation education in zoos can help further personally meaningful and relevant learning among zoo visitors with discernible consequences in attitudes and behavior, ultimately contributing to the definition of zoos as conservation organizations and to the actualization of broader wildlife conservation goals.

The implications of this thesis also point to elements that should be included in the design of exhibits such that their educational impact is enhanced. For example, it follows from the analysis of this research that exhibits should be enriched, including contingencies found in the animals' natural habitat and providing opportunities for species-typical behavior, and that such enrichment should be made explicit to visitors. Exhibit design should therefore take into account elements that are necessary to facilitate this explication to visitors, such as visual sight lines

between the visitors' area and the enrichment in the exhibit, and the placement of any necessary signage or other features (e.g., an area for educators or keepers) used to explain the enrichment to visitors. Including the importance of and need for enrichment, this thesis also illustrates a set of salient points that should be considered in multiple aspects of captive animal exhibits, from design to display, to enhance the educational impact of exhibits and foster effective conservation education among general zoo visitors.

Implications for Future Work

While the formal presentation of the wildlife conservation education messages derived from the systematic review and exemplified by the programmatic model may vary between zoos, their impact on visitors should hopefully be consistent across institutions, ultimately resulting in increased cognitive gains and positive affective responses toward conservation-related goals and activities. Stoinski *et al.* (2001) and Swanagan (2000) have argued for the need to measure the specific outcomes of various educational approaches to evaluate the impact and efficacy of zoo education in promoting the intended cognitive and behavioral changes among zoo visitors. Accordingly, the impact of the educational approach advocated here by the proposed guidelines in promoting cognitive and behavioral changes should be actively assessed to evaluate its efficacy. Activism is an admittedly complex function of interest, knowledge, experience, concern, commitment, and opportunity. However, being more explicit about how visitors can change their behavior may encourage more conservation-related behavioral changes and ultimately contribute to achieving wildlife conservation goals (Wilson *et al.* 2003). Even though exhibits and personnel may strive to educate visitors about wildlife conservation concerns, visitors may or may not learn these principles. An evaluation of the actual lessons learned, knowledge gained, and conservation-related behavior adopted should therefore be conducted as

well. This information is critical to acquire, given that the question of whether there is a future for zoos in achieving the objectives of wildlife management and conservation is tantamount to the question of whether there is a future for wildlife (Weisberg 1999).

There is still a need for research on the impact of zoo visits on visitor conservation knowledge, awareness, affect, and behavior. There is also a need to examine the link between zoo education, conservation attitudes, and conservation-related behavior changes, with the hope of ultimately being able to describe the best methods for achieving conservation education goals. Systematic research documenting the impact of conservation messages in zoos is in its infancy, but is an important step in determining the efficacy of zoos in affecting wildlife conservation education among their visitors.

Future work (such as post-visit surveys asking questions relating to cognitive, attitudinal, and behavioral changes) can evaluate the efficacy of the guidelines proposed by this thesis in generating changes in conservation-related knowledge, attitudes, and behavior. Future work should also explore the translation of these programmatic guidelines into specific cultural contexts, and analyze their efficacy in these distinct, non-Western cultural settings. It is here that anthropologists can play a significant role. The application of the proposed programmatic guidelines to conservation education programs in non-Western zoos, and the subsequent receipt of these conservation messages by non-Western zoo visitors, may present significant suggestions for the development of effective conservation education in different cultural contexts. The future researchers and stewards of much of the world's threatened biodiversity will be the citizens of the culturally diverse countries that are home to these flora and fauna of concern. As a consequence, the development of effective and culturally appropriate conservation education programs in non-Western cultural settings will be especially important.

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