LIONS AND TIGERS AND BEARS: AN INVESTIGATION OF THE STATE OF CONSERVATION IN ZOOS

by

MEGAN MARIE CALLAHAN

B.A., Pomona College, 2010

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUREMENTS FOR THE DEGREE OF

MASTER OF ARTS

in

THE FACULTY OF GRADUATE AND POSTOCTORAL STUDIES

(Resource Management and Environmental Studies)

THE UNIVERSITY OF BRITISH COLUMBIA

(Vancouver)

October 2013

ABSTRACT

Zoos have historically been institutions focused on the recreational and entertainment value of their animal collections. However, zoos in the contemporary period have begun to embrace a conservation mindset and employ tools such as conservation projects to encourage positive impacts on species in the wild. This transition is traced from the earliest zoos to the present day and the efficacy of zoo conservation efforts is examined. There are questions regarding the zoo projects including species involved, the nature of project selection, and the stated goals. To address these questions, a species-based analysis of conservation projects at conservation-focused zoos is conducted. Initially, pressures involving zoos' operating conditions and their conservation practices are reviewed to highlight the challenges faced by zoos. Secondly, a quantitative analysis of the species involved in conservation projects is undertaken. Statistics related to the animals contained within the projects are then compared with animal threat levels as outlined by the International Union for the Conservation of Nature (IUCN) Red List. A preference for species in the following order was found: mammals, birds, reptiles, amphibians, and terrestrial invertebrates. Additional information is gathered by personal interviews with the zoos profiled. This allows for a more comprehensive discussion of pressures where business concerns and protecting wildlife must be managed simultaneously. Specific creative approaches to projects and additional strategies to further impact conservation are subsequently explored.

PREFACE

This thesis is an original, unpublished, intellectual product of the author, M. Callahan. The fieldwork reported in Chapters 2-4 was covered by ethics certificate number H12-01127 obtained from The University of British Columbia Behavioural Research Ethics Board.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

I would like to thank my supervisor Dr. Terre Satterfield for all her guidance and expertise on my thesis as well as her support throughout the entirety of the process. I would also like to thank my committee member, Dr. Kai Chan for his thoughtful and cogent insights and his encouragement and my external reviewer Dr. Milind Kandlikar for his time and assistance. Thank you very much to all of the zoo officials who graciously granted me interviews and gave such clear and thought-provoking responses, while being so available and welcoming. I am grateful to the faculty and students in the Institute for Resources, Environment, and Sustainability for all their help and encouragement. I am also grateful to all the members of The Terrestrial Research on Ecosystems and World-wide Education and Broadcast (TerreWEB) who were very supportive of all my research goals. A special thank you to the Green College community and for their thoughtful and multiple discussions on my research as well as their help in leading me down new and exciting interdisciplinary paths.

Thank you so much to my parents and Finn for all their support, help, and encouragement through all the busy days and late-nights. Your love means the world to me and I am so grateful.

Megan M. Callahan

The University of British Columbia
October 2013

CHAPTER 1: INTRODUCTION

Zoos in one form or another have been part of the human experience dating back to antiquity. Whereas such institutions have historically focused on the entertainment value of presenting their animal repositories to humans, zoos in the contemporary period are increasingly institutions for which conservation is an important part of their mission. How far this transition has progressed is certainly debated however (Jamieson 1995: 52-53 and Frost 2011: 9-13).

In order to evaluate the current status of conservation in zoos, it is helpful to examine the historical development of zoos in general and then to focus on their more recent transition to conservation-oriented institutions. This review will illuminate some of the historical standards that zoos have incorporated and with which they must contend.

1.1 HISTORY

1.1.1 Historical Menageries

Although the more modern zoo-like institution seen today was considered to have formed around the turn of the nineteenth century, displays of animal collections have existed for thousands of years. A common element to these practices was often a wealthy ruler who displayed such collections as a symbol of power, wealth, and strength (Croke 1997: 128). The more impressive and rare the captive animals were, the more prestigious the regime appeared.

The actual dates surrounding some of the earliest zoos are difficult to discern as it is challenging to find remaining structures. There is evidence that the Sumerian ruler Great King Shulgi (2094-2047 B.C.) built a zoo just outside of the city of Nippur, in the southeast of present day Iraq. However, little is known about the type of animals or style of the enclosures (Croke 1997: 129).

Many famous menageries have been traced back to ancient Egypt, a civilization noted for its reverence of animals. Indeed the several million animal mummies discovered vastly outnumber those of human mummies found (Taylor 2001). Whereas subsequent Greco-Roman cultures tended to perceive humans as superior to animals, the Egyptians held a greater link with the animal world, in some cases believing the animals to be incarnations of gods (Hancocks 2001: 7-8). Queen Hatshepsut is suspected to be one of the initial recorded collectors of animals. She created a zoo in 1490 B.C. that showcased not only local animals, but ones she had received from explorations into other

lands (Croke 1997: 129).

The first public zoo is thought to have been founded in Alexandria by Ptolemy I (c. 367- c. 283 BC) (Croke 1997: 131). Ptolemy's commander, Alexander the Great, was fascinated with different animals species and sent back samples from many of his campaigns. He was influenced in part by his tutor Aristotle, who later created *The History of Animals,* likely drawing on some of the species Alexander had procured (Hoage et al 1996: 10).

Menageries were found in other areas as well, likewise set up by rulers as an explicit or implied indicator of their power. China's King Wen of the Zhou dynasty created the "Garden of Intelligence" or a "divine park," depending on the translation (Croke 1997: 130). Many other notable historical figures across the globe including the Holy Roman Emperor Frederick II, Charlemagne, Emanuel I of Portugal, Leo X, Montezuma II, and Akabar the Great sought prestige by creating collections (Hancocks 2001: 13-15).

The impressive nature of the menageries aided in their spread across the globe. For example, the extensive zoological gardens displayed by Louis XIV, which contained 222 species at one point, impressed foreign dignitaries so much that they took the concept back to their own countries (Hoage, et al 1996: 15 and Croke 1997: 138). For many years and indeed even into the present day, those in positions of power have often gifted animals to one another as a token of friendship (Rees 2011: 34).

The oldest zoo in existence today, the Tiergarten Schönbrunn or Zoo Vienna, was constructed in 1752 by the Holy Roman Emperor Francis I for his wife Maria Theresa (Croke 1997: 138). Although there are still a handful of privately owned menageries, they are generally for personal enjoyment or for limited tourism and do not serve a conservation or research function (Croke 1997: 143).

1.1.2 Toward Modern Day Zoos

The Industrial Revolution brought about increased levels of wealth and leisure time among the elite and contributed to wider public interest in viewing captive creatures (Mazur 2001: 14). People were more willing and able to seek out new pursuits and the zoo provided an exotic escape. In the United States the vast majority of menageries at the time existed in circuses that traveled across the country and exhibited many different

types of species (Hancocks 2001: 86-87 and Beers 2006: 107-108). But by the late 1800s, stationary zoos could be readily found throughout the world. In the United States alone, eight zoos opened between 1872 and 1889 (Croke 1997: 149).

Another reason for the speed of the spread of zoos was the prestige a zoo afforded the city itself. Zoos rivaled museums and performance halls as a symbol of pride for a city. "Collecting exotic animals became analogous to collecting rare or heretofore inaccessible art" (Hoage 1996: 136). As the menageries had once been a symbol of an individual's power, zoos at that time became a symbol for a city (Mazur 2001: 17). Sometimes individual animals become an iconic face of the city and even an anthropomorphized source of civic pride (Hancocks 2001: 3).

One of the pioneers of the more modern day zoo was Carl Hagenbeck (1844-1913), a German supplier of wild animals. He greatly expanded the concept of a zoo when he opened his own collection in Hamburg in 1907 and helped zoos move into a new design period. He is credited with being the first to usher the traditional zoo into the more modern period (Rees 2011: 33). He created exhibits without bars, instead utilizing structures such as moats and hedges. He was also the first to display animals geographically, with animals from a similar region placed together instead of the more traditional taxonomic grouping structure (Croke 1997: 146). While he created exhibits more representative of the natural habitat of an animal, the visitor was still very much looking in from the outside. It wasn't until later that exhibits expanded to include a more immersion style experience (Hancocks 2001: 104).

Despite the changes that Hagenbeck inspired, the need for money solidified the entertainment aspect of zoos at this point. Such entertainment-based revenue was particularly necessary during periods surrounding the world wars and recessions when money was especially tight (Mazur 2001: 23). Animals such as elephants and camels provided visitor rides and zebras and llamas were used to pull people in carts. Such practices are extremely rare if not completely extinct today (Rees 2011: 324).

Such financial pressures continued to influence the creation of zoos. The Smithsonian's National Zoological Park was originally designed to feature a game preserve and allow for more local animals to be seen in their natural habitats. But securing funds at that time was paramount and the emphasis shifted to engaging the

public by acquiring and displaying the most popular and traditional zoo specimens (Horowitz 1996: 130-32).

1.1.3 Transition to Natural Exhibits

While Hagenbeck began the transition away from the concrete, barred exhibits, they were not yet fully naturalistic in style. Indeed when the National Zoological Park opened around this time, it was proposed that the animal houses should be reminiscent of the animal "habitats." However these "habitats" were not ones found in the natural world, but instead the human dwellings that populated the areas animals had lived (Horowitz 1996: 131).

In modern zoo vernacular, "naturalistic" refers to exhibits designed to mimic animals' habitats in the wild. Typically they do not feature a discernible separation such as visible cages, allowing the visitor to feel a part of the exhibit. While there is no exact moment that initiated the transition of zoo exhibits from the caged and moated variety to the more naturalistic and enriched settings, many current zoos and articles make mention of architect David Hancocks, a former director of Seattle's Woodland Park Zoo and that zoo's gorilla exhibit which opened under his direction in 1978. It was a revolutionary area that embraced the use of vegetation and outdoor space for the gorillas to forage and engage in natural behaviors. Such a detailed recreation of a naturalistic setting had not been utilized in zoos prior to that point. As the visitor popularity of the exhibit grew, other zoos began to visit and create similar exhibits.

The switch to more naturalistic environments is important for the conservation effort of zoos in several ways. It is worthwhile to make note of some of them during this historical review because that switch has played a significant role in the current conservation philosophy. It was a difficult transition as it was more expensive, took up greater space, and zoos worried that the decreased visibility of the animals would frustrate visitors (Davey 2005). However there are multiple advantages to this type of display.

First, breeding can be enhanced. When welfare is improved by simulating an animal's natural habitat and providing enrichment activities, animals are often more prone to engage in breeding behaviors. When sufficient foliage cover was provided in the exhibit of a snowy owl, she built a nest for the first time and a clutch of owlets was raised

and released into the wild (Hancocks 2001: 82). When mothers are able to give birth and then raise their young, they can pass on valuable natural skills and traits (Hancocks 2001: 79). This is especially important when considering breeding for reintroductions.

Secondly, visitor perceptions can be impacted by the exhibits. Positive feelings towards wildlife were recorded in visitors to zoos that displayed more naturalistic exhibits, especially those accompanied by an educational component. Those zoos with less naturalistic and more barren and caged exhibits were found to create more negative feelings towards wildlife in the minds of the visitor. These feelings included fear and indifference towards the species (Hancocks 2001: 83).

Financial benefits are seen with exhibit transitions. The new exhibits often result in more natural behaviors from the animals, cutting down on stereotyped behaviors such as pacing or bar biting. People want to see active, engaged animals, as if they are seeing the animal "in the wild." This impression is thought to occur more readily in more natural exhibits (Mazur 2001: 19).

Another financial benefit to more natural exhibits is that they often increase the life expectancy of the animals. While upfront construction and maintenance costs may be higher, there are lowered costs of animal replacement. Even more importantly, this can result in increased public goodwill. For example in the London Zoo, when the animals were kept in concrete cages, the average life span for lions, tigers, leopards, and pumas was only two years. A considerable amount of negative press was generated by this frequent turnover of the charismatic large cats (Mazur 2001: 19).

1.1.4 Changing Philosophies: How Zoos View Themselves

While the landscape of zoos has changed and continues to do so, the overall way in which zoos have seen themselves and defined their mission is also in a state of transition. Around the 1980s and to an extent even before, many zoos held the idea that they represented a type of "Noah's Ark" (Hutchins and Conway 1995). Philosophically this meant that zoos would preserve members of endangered species until such time that the world could support their re-release into the wild.

Many within the zoo community realized the impracticality of this approach, and subsequently began to focus more on the continued captive breeding of endangered species. However the difficult reality of this method was recognized when it became

apparent that no one zoo could keep enough of an endangered species to maintain a viable long-term breeding population and that transportation of breeding animals between facilities, although frequently done, was not without its own set of problems.

Captive breeding programs can be used in wildlife reintroductions, maintaining populations extinct in the wild, and can appeal to visitors and donors (Hutchins and Conway 1995: 124). However, some argue against captive breeding as it intrinsically seems to favor the "higher order" species and is only beneficial from an anthropocentric viewpoint. It is suggested that a further step in the philosophical evolution of zoos would be that the resources devoted to captive breeding may be better served for *in situ* actions such as habitat management (Varner and Monroe 1991: 27-29). Furthermore the programs may serve a more holistic approach to the surrounding ecology, politics, and environmental pressures facing endangered animals.

1.1.5 History of Conservation Within Zoos

The changes within zoo exhibits certainly impacted and were influenced by the zoo stance on conservation. But to further expand on the changing pressures zoos face and the identities they must embody, an additional examination of the history of zoo conservation is necessary.

The New York Zoological Society (NYZS) was created in 1899 and played an early and important role in the evolution of a conservation mindset for zoos. At the center of its conservation goals was the desire to "advance the study of zoology, to educate the public and to preserve the animals of North America" (Croke 1997: 152). This remained so central to the NYZS that almost one hundred years later in 1993 it would solidify and promote its viewpoint by changing its name to The Wildlife Conservation Society (Mazur 2001: 33). But the prime motivation for this focus in the early 1900s was the increasing loss of wildlife in the United States at the time. There was particular concern over the scarce numbers of buffalo, a species that had once existed in abundance (Horowitz 1996: 128 and Hancocks 2001: 91-92).

Although it was recognized early that conservation was the "right" thing to do, it was not always considered the most entertaining or exciting. This barrier was addressed in part by the fact that the NYZS enjoyed a long association with the charismatic figure Charles William Beebe. While some found his methods too flamboyant, Beebe's

popularity was a factor that helped to sway the public towards embracing the concept of conservation. He published over 20 books detailing his adventures across the globe and under the sea in support of conservation issues (Croke 1997: 155). Indeed he served to mentor and inspire many other subsequent conservation leaders including Rachel Carson and E.O. Wilson (Gould 2004: 410).

In 1965 a worldwide symposium was held to discuss the role zoos played and would play in conservation. Various stakeholders were brought together to discuss conservation definitions and strategies. A greater diversity of input was achieved with the participation of many organizations, including numerous zoos, the IUCN, the World Wildlife Fund, and animal welfare organizations among others (Jarvis 1965). This promoted future cooperation between those entities and underscored the rationality of the expanding focus of zoos on direct conservation actions and outcomes.

1.2 CURRENT CONSERVATION STATUS AND QUESTIONS

Conservation of wildlife populations is increasingly justified as the survival of more and more species becomes threatened. The fossil record suggests that 2 mammal species become extinct on average every million years, yet over 80 mammals have gone extinct in just the last 500 years (Hance 2012: 4). Currently it is estimated that around 20% of all mammals are threatened and 30% of all amphibians are threatened (IUCN 2012).

Zoos seem uniquely poised to fundamentally address many conservation components given their access to wildlife population, biological expertise, and millions of visitors per year. Indeed one of the World Association of Zoos and Aquariums' (WAZA) stated visions is "furthering species and habitat conservation and sustainability" (WAZA 2005). This transition is further evidenced by the fact that publications such as *The International Yearbook* and *Zoo Biology* focus primarily on zoos and explore conservation issues (Ryder and Feistner 1995). Zoos have the ability to garner pubic support for conservation projects by raising awareness about wildlife threats and increasing ecological education (Baur 2010). Indeed zoos are capable of reaching many people given their over 700 million annual visitors (WAZA 2013).

Zoos typically engage in an average of ten to thirty larger species-oriented

conservation projects each year. The length, scope, and nature of involvement all vary by zoo. These efforts typically involve *in situ* breeding, *ex situ* breeding, education, habitat management, or research. Zoos have had some notable successes in their conservation work with such animals as the California condor, black-footed ferret, red wolf, Arabian oryx, and Przewalski's horse. (Tudge 1991: 1 and Wagner 2005: 209).

However many zoos are limited by financial restrictions and the total amounts of funds that are devoted to conservation varies from zoo to zoo (Kleiman, Thompson, Baer 2010). Given the need for funding, there exists a tension between the more financially beneficial framework of zoos as entertainment venues and the more difficult to support model of zoos as conservation centers. While many zoos seemingly support conservation, zoo professionals are concerned about the commitments zoos have verbally made to education and conservation and the financial resources that are actually given to those programs (Mazur and Clark 2000).

Opinion varies as to whether or not zoos are succeeding in their efforts to focus on conservation (Mazur and Clark 2000, Tribe and Booth 2006, Conway 2007: 13-14). The literature that touches on zoo conservation acknowledges the struggles zoos must engage in as they weigh conservation against financial needs. It is suggested that this struggle is often detrimental to conservation efforts (Mazur and Clark 2000 and Kleiman, Thompson, and Baer 2010). A further concern is whether that financial need leads to a species bias in zoos and their conservation projects (Wemmer, Rodden, and Pickett 1997).

Conservation revolves around protecting species and ecosystems. To this end, species based research utilized in this paper will examine which species are involved in the dedicated conservation projects that zoos are undertaking. It will also provide some preliminary information on whether or not zoos are attending to the types of animals that worldwide are most in need of urgent conservation. In addition it can identify whether those populations are balanced across classes or whether a species bias exists. A species bias is the practice of preferential treatment for one group of animals. Furthermore, determining the rationale behind those choices will serve to deepen understanding of the pressures on zoos, what they are doing to combat those, and what can be done in the future.

The overreaching question driving the research is thus whether or not zoos are

succeeding in their goal of conservation. This is a complex question and so various sub-questions were developed to begin to explore this point.

- How do zoo conservation projects function superimposed on the general background of zoo operations?
- What pressures are zoos facing that contribute to the tension between conservation and entertainment?
- How are individual species faring within the conservation projects?

These are essential questions because in a world where so many species are threatened, zoos are capable of having a great impact, creating and inspiring change.

The following three chapters address these queries. Chapter 2 presents an inquiry into the pressures zoos face and most notably the tensions between conservation and basic operating conditions. It initially delves into the difficulties of defining conservation especially in a zoo setting. It furthermore utilizes interviews with zoos to look at the funding, educational, governance, and media pressures that zoos must balance with their conservation desires. It examines both the issues and current workings of zoos in order to evaluate the abilities of zoos to achieve their goals of conservation in the face of such pressures. Chapter 3 builds on the issue of zoo pressures by analyzing specifics of the conservation projects. Species involved in zoo conservation projects are compared by taxonomic grouping and are evaluated as to their need of conservation. The concept of species bias is explored here. Chapter 4 concludes the paper and touches on future studies.

CHAPTER 2: PRESSURES INHERENT WITHIN THE ZOO FRAMEWORK

2.1 INTRODUCTION

Zoos face considerable challenges as they seek to balance their varying mandates. They must function as successful businesses, responsible educators, recreational entertainers, and wildlife protectors. Such an array of roles imposes significant pressures on zoos. A variety of factors, both internal and external to a zoo's particular framework, contribute to such pressures. Here I review them to facilitate understanding of how zoos must meet their operational challenges while simultaneously striving to impact conservation. This begins to address the question of how zoo conservation projects function when they are superimposed on the general background of zoo operations.

Next, exploring the pressure of funding will help exemplify the opposing forces that dictate how zoos must appeal to the public to simultaneously support their infrastructure and their newer conservation goals. Reviewing such additional pressures as education, governance, media, and the logistics involved in conservation project selection, operation, and success will contribute further insights into the tension between conservation and entertainment.

2.2 METHODS

Zoos selected for this research were those accredited by the World Association of Zoos and Aquariums (WAZA) or its regional constituents in order to ensure they subscribed to a high level of welfare and conservation standards. Furthermore, zoos selected had to display a meaningful contribution to conservation. This was seen through their involvement and excellence in conservation leadership activities such as serving on international steering committees, participating in conservation initiatives, publishing activities, and earmarking a significant percentage of revenue for conservation purposes. In total 31 zoos were selected as some of the top conservation-focused zoos worldwide. By limiting my initial investigation to the top tier of conservation zoos, I hope to establish a benchmark for the current state of zoo conservation at premier institutions. This can be used as a starting point for indicating what remains to be accomplished

The animals involved in the conservation projects from each of these zoos were evaluated based on the International Union for the Conservation of Nature (IUCN) Red List. For further results see Chapter 3. In addition, all 31 zoos were contacted with

invitations to participate in interviews to further illuminate many of the internal and external pressures placed on zoos and to more closely examine their particular conservation projects. The interviews served to unveil further insights and address the questions regarding zoo conservation and daily operations. The personal interview style enhanced communication and allowed for behind the scenes impressions of the intricacies of zoo operations and conservation. Of the 31 zoos, ten zoos indicated their interest and availability for participating in the interviews. The semi-structured interviews ranged in length from twenty-five minutes to an hour, and were conducted in person, on the phone, or via Skype. An interview script can be found in Appendix B.

Of the ten interviewees that participated, four interviewees agreed to be mentioned by name and location, one by location only, and five spoke on the condition of anonymity. Table 2.1 indicates the interviewee number, the name of the interviewee and zoo when applicable, as well as their job titles. Confidential interviewees are referred to in the paper by their interviewee numbers, which were randomly assigned. Similarly, the job titles of the interviewees requesting confidentiality were changed. To further protect confidentiality, interviewees not referred to by name will all be referred to by "he/she" throughout the paper.

Not all of the interviewees that opted for partial or complete confidentiality gave reasons for their choices. One alluded to the fact that he/she had just begun his/her position at the current zoo and had previously worked at other zoos. His/Her opinions were thus an amalgam of different zoos. A couple of others indicated that it was due in part to the fact that they were sometimes giving their own personal opinions. There was concern that those opinions might not represent the policy of their department or the zoo as a whole. Furthermore, in some cases it was possible that the opinions of the individual might have matched with the department, but not the zoo or vice versa.

A complete discussion of methods can be found in Appendix A.

Table 2.1. Names, zoos, and job titles for interviewees (n=10)

Interview Number	Name	Zoo	Job Title
Interviewee #1	Dr. Friederike von Houwald	Zoologischer Garten Basel/Zoo Basel (Basel, Switzerland)	Curator, Involved in conservation oriented projects
Interviewee #2	Dr. Axel Moehrenschlager	Calgary Zoo (Calgary, AB Canada)	Head of the Center for Conservation Research
Interviewee #3	Confidential	Confidential	Conservation Educator
Interviewee #4	Confidential	Confidential	Conservation Director
Interviewee #5	Confidential	Detroit Zoo	Research staff member
Interviewee #6	Dr. Fred Koontz	Woodland Park Zoo (Seattle, WA USA)	Vice President of Field Conservation
Interviewee #7	Confidential	Confidential	Wildlife Director
Interviewee #8	Confidential	Confidential	Research Specialist
Interviewee #9	Dr. Rebecca Spindler	Taronga Zoo (Sydney, NSW Australia)	Research and Conservation Manager
Interviewee #10	Confidential	Confidential	Conservation Outreach Specialist

2.3 THE CONSERVATION CONUNDRUM

2.3.1 Defining Conservation

The use of the term "conservation" has been used much more readily in the latter part of zoos' history, however looking for a specific definition within that history proves to be more elusive. In the Global Biodiversity Strategy gathering of 1992, the IUCN, the United Nations Environment Programme (UNEP), and the World Resources Institute (WRI) combined to define conservation as

> The management of human use of the biosphere so that it may yield the greatest sustainable benefit to the present generation while maintaining its potential to meet the needs and aspirations of future generations (WRI, IUCN and UNEP 1992: 228)

This is a very broad definition and is not directly applicable to individual zoo

activities. In various publications such as their 1995 document, *The World Zoo and Aquarium Conservation Strategy,* WAZA has called for conservation to be a necessary and core part of zoos' mandate. On a more regional level, the AZA states that zoos are to be, "concerned about ecosystem health, take responsibility for species survival, and make substantial contributions to research, conservation, and education" (AZA Field Conservation Committee 2012: 3).

The parameters that define conservation are variable even within the WAZA community. The AZA has begun requiring zoos to submit an annual report, the Annual Report of Conservation and Science, in which zoos are directed to compile information regarding their conservation activities. The list of acceptable activities and finances for inclusion in such reports is quite broad. Money that can be included in the reports includes money spent on grants to support field conservation, conservation organizations, the cost of supplies, money spent on species recovery at the zoo such as food and housing, breeding as long as if it is for release, veterinary care for animals outside of the institution, research, training and capacity building, and education among other more specific details (AZA Field Conservation Committee 2012: 4-5). Some activities do not impact species as readily as others, yet it is difficult to distinguish between them when the zoos report such a diversity of statistics and costs.

2.3.2 Conservation Definitions Obtained from Zoo Interviews

Because of the variability of the conservation definition, one of the goals of the structured interviews was to attempt to elucidate a general definition of conservation that zoos may apply directly to their conservation projects. However, interview responses mirrored the general ambiguity of the term. Most of the zoos interviewed struggled with attempts to give a definition for conservation in a zoo setting. Interviewee 10, a Conservation Outreach Specialist, admitted, "I don't think we have a specific definition of conservation." Dr. Axel Moehrenschlager, the Head of the Center for Conservation Research at the Calgary Zoo, echoed this statement saying, "I can't actually give you a blanket definition across the zoo." Others pointed out the various potential actions that could fall under conservation such as captive management and education instead of offering an overall definition. In addition there was disagreement as to which actions actually constituted conservation.

When pressed for examples and more concrete definitions of conservation, some of the zoos interviewed referred to specific, though varied types. Dr. Fred Koontz, the Vice President of Field Conservation at the Woodland Park Zoo cited four elements: education, captive breeding programs, sustainability practices, and field conservation which includes projects with animals outside of the zoo. Though he specified he primarily looks at the field conservation aspect.

Others insisted on a more general definition. Interviewee 10 defined his/her zoo's conservation in terms of its projects and said it is how those projects "affect the status of the species in the wild," further specifying that to do so it must be hands-on, measurable, and be able to effect change in people. Interviewee 4, a Conservation Director, said conservation at his/her zoo was about trying to "preserve things in a sustainable way, whether they be species or habitat." Other general terms included "species recovery" and "to help species in the wild."

Still others considered management practices such as retaining the genetic diversity of a population, *in situ* projects, habitat restoration, and research. One other category mentioned was the use of sustainable practices at the zoo such as green roofs, or recycling programs, however this was generally considered a separate category by a majority of the zoos and indeed is listed in a separate section of the AZA definition.

Some zoo officials listed and referenced captive breeding under their definitions of conservation. Others said that even though the AZA's Species Survival Plans (SSPs) do have a potential conservation impact, they would not strictly define those as conservation projects. While those respondents asserted such plans do have conservation implications, they felt that a conservation project should involve a field component so that a direct impact to animal species in the wild can be seen.

2.3.3 Problems with Conservation Definitions

The ambiguity of the term "conservation" can lead to difficulties in monitoring its extent, usefulness, and success. Specific problems can occur in a variety of scenarios. From an analysis perspective, with the wide-ranging parameters noted above, it is difficult to quantify the numbers of species and numbers of individuals that are affected by conservation-based intervention. Secondly, it is difficult to make rational comparisons between zoos as to their efficacy of conservation efforts when projects are so varied.

Indeed some zoos consider conservation to be the strictest of fieldwork, whereas others use the term much more liberally.

In addition the ambiguity of the definition can have negative ramifications on conservation practices. For example, there exists the possibility that by using varied definitions, a particular institution can satisfy conservation quotas set by WAZA or enhance their "brand image" to the public by overestimating their conservation contributions and not making a significant difference for species in the wild. Secondly, when zoos use the term in an overly broad manner, they may actually sabotage their mission in the long-term. By labeling every exhibit as one illustrating "conservation," the term can become normalized in the public consciousness and this tends to give it less power and meaning when applied to other scenarios such as the conservation projects. Finally, whereas some of the efforts can be directly applied to impacts on the habitat to which an individual animal is native, a case can be made for the significance of indirect impact such as increased funding or human behavioral change even though these are much more difficult to quantify.

2.4 PRESSURES FACING ZOOS

The historical roots of zoo development as well as the difficulties inherent in defining the word "conservation" indicates the overriding anthropomorphic nature of zoos. In antiquity, whether a sign of power and wealth, a gift to an ally, or an homage to a loved one, displaying animals fulfilled a purely human tendency for showmanship and domination. Later, traveling menageries and early stationary zoos capitalized on the profit aspect and realized the importance of accurately assessing and meeting the expectations of the paying public. As zoos have transitioned to placing increasing emphasis on conservation, this history and public need for entertainment has been a source of tension.

While the historical transition to conservation has been one issue that zoos have had to contend with, it is by no means alone in the list of pressures that zoos must face. Zoos are complex organizations and as such must operate surrounded by a variety of competing interests. Looking at the internal and external pressures associated with conservation project specifics sheds light on the daunting task that today's zoos face as

they embrace conservation while remaining economically and operationally viable entities.

2.5 FUNDING PRESSURES

One of the largest pressures is the need for funding. Salaries must be paid and infrastructure maintained and updated. Adding conservation projects to this mix obviously increases the pressure on available financial resources. Looking at how funding is obtained generally for the zoo and specifically for conservation projects will help to deepen the understanding of his pressure and its implications for zoo conservation. Interviewee 8, a Research Specialist, spoke to the tension inherent in getting funding for the zoo as well as for conservation and what often happens, saying that some zoos are, "…trying to figure out how to get money in and making ends meet and throwing out the conservation message with what they're doing." The interviewee was alluding to the fact that some zoos are forced to focus less on the message of conservation in favor of the more financially viable entertainment aspect.

2.5.1 General Funding of Zoos

Dr. Friederike von Houwald, a Curator involved in conservation projects at the Zoologischer Garten Basel, succinctly observed when asked about finance at the zoo and with the conservation projects that, "One thing one should never forget…is [a zoo] needs to have money to run." While zoos are often conservation-focused institutions they are also businesses and need funding not only for their conservation projects, but for their daily operations as well.

Zoos are financed through a variety of different avenues and these in turn affect conservation project funding. General funding for zoos can be through national and/or local government sources, or a mixture of governmental and non-profit trusts. Some are privately funded, others have a zoological society, some are a charitable trust, and others represent a compilation of a number of these (Rees 2011: 11). Fundraising is especially important for those private zoos as they do not receive the governmental funding of the public zoos. As Interviewee 8 states, "A lot of the private zoos are definitely struggling because it's hard to make ends meet and the rising cost of insurance and all hasn't helped,

so we have to do a lot of fundraising." Fundraising is a necessity for private zoos and much of that funding comes from the zoo visitors and donors.

Many zoos are heavily dependent upon their visitors for funding. Even most of those zoos that receive governmental subsidies must contend with this fact. An Australian study found that their national zoos received less funding than such institutions as museums and national parks, accounting on average for only 18% of zoos' total income (Mazur 2001: 190).

Visitor funding is not limited to admission gate receipts. Purchases inside the zoo add to the general coffers. However, there are those within the zoo community that question the messages being sent through this approach. Interviewee 8 stated that it can be a problematic message saying, "If we tell people 'you have to be more conscious consumers and pay attention to palm oil, seafood, sustainability,' and then we sell them tons of useless stuff and bad food at the institution, to me that's a real mixed message that's not effective." Encouraging consumption of products, often non-sustainable products, seems counterintuitive to the overall messages of conservation and sustainability that zoos are more recently emphasizing. While some products do represent more preferable substitutes to generic brands, such activity may still represent a potential conflict of interest. As such it seems at times that zoos may blur some of their on-the-ground messages in order to achieve their larger goals.

It can also be confusing to the consumer as some zoo products are specifically created for conservation purposes, whereas others are questionable as to whether or not they benefit conservation activities. Also, as emphasized by Interviewee 8 above, some of the products may benefit conservation through the funds raised, but intrinsically are counter to the zoos' messages of conservation.

This reliance on public preferences and spending habits creates unique challenges for zoos. For example, since zoos function as purveyors of recreation, they must continually compete with other recreational venues by making their offerings newer and better. This leads to a cycle of spending as the new exhibits and attractions bring an influx of visitors before the novelty wears off and more money must be spent to bring in additional visitors and funds (Mazur 2001: 180).

2.5.2 Assessing Conservation Funding

Funding for conservation projects that comes from general zoo revenues must be shared with capital expenditures, salaries, supplies, and all the other day-to-day expenses that zoos must cover. Competing for resources in a climate of shortage can create friction, but can also lead to creativity. It is useful to look at current levels of funding specifically for conservation efforts and then both the challenges and successes can be addressed from the interview responses.

It is difficult to obtain exact numbers for how much is spent by zoos on conservation. The AZA has some of the more comprehensive statistics about zoo funding. AZA zoos spent around $160 million on conservation projects during 2012 (AZA 2012). It has furthermore mandated that zoos put 3% of their overall budget into conservation. As Interviewee 5, a research staff member at the Detroit Zoo puts it, "They're really trying to encourage all zoos to not *say* you're a conservation organization, but to really *be* a conservation organization."

AZA zoos are spending on average a little less then 2% of their budget on conservation (AZA Field Conservation Committee 2012: 3). WAZA's ultimate goal is 10%, but this is a difficult goal to achieve. The AZA has a list of its affiliated zoos that are contributing above average percentages of their overall funds to conservation. One of those is the Woodland Park Zoo, and according to Dr. Koontz this last year they spent around 4% on field conservation, a figure that excludes education or captive breeding. It still falls short of the 10% goal. Dr. Koontz said he hopes to get to 5% and eventually reach 10%, but it will take time.

Some other zoos gave broader numbers. Dr. von Houwald estimated the Basel Zoo gives around 200,000 Swiss Francs a year to conservation, or a little over $216,000 USD. Dr. Rebecca Spindler, the Research and Conservation Manager at the Taronga Zoo, said it contributes close to 10% of its operating budget to its conservation efforts. Interviewee 3, a Conservation Educator, said his/her zoo puts 1.5% of its general operating budget towards conservation and with additional funding from outside sources it is able to spend over a million dollars a year on conservation. Even zoos that fully support the AZA mandates and have been following a similar model for even longer are still working to expand their conservation expenditures. The interviewees in general

seemed to agree that there was still a ways to go in terms of conservation. As Interviewee 5 said, "I think that's an area that we're still striving to improve in."

Zoos have only begun to recently report, and to be required to report, their conservation spending. However, with a less than clear definition of what actually constitutes conservation, problems in comparisons can arise. Interviewee 8 pointed out there is some "creative calculating" occurring at other zoos in terms of whether or not different activities count as overall conservation. Some zoos only count direct field conservation under their conservation expenditures, whereas others count education, training, and breeding programs as well as other conservation linked programs.

The AZA does have a set of guidelines for what zoos may constitute as conservation, however it is more inclusive than what some of the zoos are already using. There are also different definitions in different regions of the globe and this can make it especially difficult to evaluate the overall conservation impact.

2.5.3 Sources of Conservation Funding

Funding for zoo conservation projects can come from a variety of different and unique sources. Often a part of the budget is underwritten for conservation projects. This may or may not be a significant portion of the overall conservation budget, depending on the zoo's financial structure. For example, Dr. Moehrenschlager of the Calgary Zoo said that the zoo receives over 80% of its conservation budget from external funding sources.

Funding Source: Visitors

Since zoo patrons contribute such a large portion of the total zoo funds, some zoos earmark a portion of their admission fees for conservation funding. The Woodland Park Zoo devotes 25 cents from every ticket towards conservation. The Oregon Zoo has a similar project with the Pacific Northwest Surcharge, where 25 cents from every admission fee goes to the Pacific Northwest Research Fund. The Zoologischer Garten Basel takes Fr.15 ($0.16 USD) per admission ticket (von Houwald).

Some zoos take special measures to emphasize to the visitor that by coming to the zoo, he/she is supporting conservation efforts. For example the Woodland Park Zoo has recently created a campaign called "See. Save." The message that is projected links the fact that when one comes to the zoo to see specific animals, one is playing a direct role in

helping to save those animals in their natural habitats just by virtue of part of the admissions fee.

This may be a useful tool for bringing more visitors to the zoo, allowing them to feel a sense of accomplishment from an activity they already enjoy. The question remains though of whether or not this promotes additional useful actions or contributions, or merely a sense of complacency as the visitor feels as though he or she is already accomplishing something.

To further engage the visitors and make them feel as though they are having a more direct impact on conservation. Dr. Koontz described The Woodland Park Zoo's program, "Quarters for Conservation." Twenty-five cents are taken out of every admission fee and are represented in a token that is given to each guest upon entry. Visitors go to a voting kiosk "where they learn about some of our major projects in the field and then they can vote" (Koontz). Thus the amount of money that goes towards each project is dictated in part by the votes of the public. This approach is clearly influenced by the type of animals profiled, as certain types of species tend to receive greater amounts of tokens. For example in the first half of 2013, snow leopards and tigers received 25% and 23% of the vote respectively, while cranes and "Pacific Northwest" wildlife, the only two non-mammals, received 7% and 10% respectively (WPZ 2013). However it is a useful way to attempt to educate the public a bit more about the type of projects in which the zoo is engaged.

Along these lines, those interviewed stressed the desire to educate people about the projects as a way to build enthusiasm and interest in the projects. Interviewee 5 stated that, "The idea is if we can change people's attitudes about wildlife and about specific species then they're more likely to support our own conservation initiatives or other organizations' conservation initiatives." The goal of changing visitor behavior and garnering more support for conservation initiatives was a frequently mentioned goal of many of the zoos.

Many of the interviewees spoke about their desire to be more involved in the promotion of the projects, communicating their personal excitement and knowledge about the ongoing studies to the public. Dr. Moehrenschlager said that while conservation is sometimes held up as the pinnacle of zoo work, it often is "the best kept secret" and

further pointed out that the conservation department has to be dedicated to promoting their accomplishments more widely instead of just communicating the scientific nature of their work.

Funding Source: Donors

Visitors are not the only way zoos receive funds for their conservation departments. A great deal of funding comes from donors, from the small-scale individual donors to larger donations from industries. Industries in particular find commercial value in associating their names with positively regarded projects. McDonald's provided over $1 million USD to help construct the McDonald's Gorilla Forest at the Taronga Zoo (Mazur 2001: 183). Such an association would obviously require vigilance on the part of zoos to attend to any potential damaging commercialization. A way of securing funds can come from such fundraising events as lectures and dinners. Dr. Spindler emphasized the benefits of these events, mentioning not only their ability to raise money for projects, but to also raise awareness about them as well as allowing the staff to get involved. Other zoos also mentioned various fundraising activities such as concerts and auctions that serve the dual purposes of promoting their conservation projects from an education standpoint as well as a fundraising viewpoint.

Grants from various organizations and agencies also provide portions of conservation funding. Government science agencies, science foundations, private family foundations, private research foundations, and provincial and federal government funding are all sources of funding for conservation projects. Some specific organizations mentioned during the interview process were the Canadian Wildlife Federation, the National Fish and Wildlife Foundation, the National Institute of Health, and the World Wildlife Fund. Interviewee 8 mentioned how his/her zoo, as a zoological institute, has been able to qualify for the funding for research projects from the Institute of Museum and Library Services. Finally, sometimes grants for conservation projects actually come from other zoos. The funding zoo may not have its own projects, but may be interested in funding something for that species or in that area.

Other Funding Sources

At not-for-profit institutions there are foundations that can fundraise from both individuals and other foundations. One zoo mentioned using interest from endowments for conservation projects. The Zoo Society at the Port Defiance Zoo is in charge of the private funds and helps to raise a large proportion of those monies. Other zoos might have specific departments focused on fundraising or networking.

Sometimes there can be unique sources of funding for conservation projects. For example, some of the fines assessed by the Oregon Fish and Wildlife Department (OFWD) for offenses such as illegal hunting or fishing are given to the Oregon Endangered Species Justice Fund. This fund supports the Oregon Zoo's Future for Wildlife Program and more specifically their endangered species conservation programs (Smith 2013 and Oregon State Police 2010: 1).

A number of zoos utilize donation bins or other money receptacles that go directly to conservation projects. Often those will be set up at exhibits of animals that tie-in directly to conservation projects being done in the field.

2.5.4 Conservation Funding vs. Zoo Funding

It is essential that both zoos and conservation projects receive funding, but what happens when those two are at odds? While many of the zoo officials interviewed spoke about the increasing support the zoos in general are providing to conservation efforts, a number of interviewees mentioned that at times the relationship between the needs of the overall zoo and the zoo conservation projects was less than harmonious.

Since conservation projects must share resources with the larger financial needs of the zoo, tensions can be created during lean times. Expenses continue but patronage may decline in periods such as recessions when the public has less disposable income. The conservation sector is often affected disproportionately when compared with other departments as it does not provide daily resources to the zoo itself. This was confirmed by Interviewee 8 who spoke about an instance at a previous zoo that he/she had worked at where the expansion of conservation projects was halted and many were ultimately cut during a financial down-turn.

In addition, many zoos prefer to keep their funding in a general fund rather than allocating a distinct amount for conservation because the flexibility of those funds is thus

enhanced. Still other zoos have a so-called emergency fund. This is usually money that is set aside in case of ecological emergencies worldwide so that the zoos can quickly respond to a critical issue. While this obviously advances the general concept of conservation and is very useful in distinct situations, a reserve fund does decrease the amount available for ongoing conservation projects.

One additional factor that should be considered is the costs for running the conservation projects. Of particular concern are the costs associated with the more "popular" animals such as mammals. Breeding, housing, and release involved in the reintroduction programs for these animals costs significantly more than for other taxonomic groups (Braverman 2013: 178). Many have argued zoos could be much more effective in the field if they focused on less "flashy" projects.

2.5.5 Funding Compared to Other Organizations

Whereas some are proud of zoos' direct conservation contributions, others believe that the zoo should serve solely as a fundraiser and fund other institutions. Organizations such as the World Wildlife Fund or the Nature Conservancy have conservation as their primary mission and as such may face different pressures than zoos. It is thus instructive to compare funding of zoo-based projects and projects that are exclusively funded by non-zoo NGOs.

As is seen in Table 2.2, The Global Environment Facility has granted roughly $147.22 million to biodiversity programs in 2010 (GEF 2011). The Royal Society for the Protection of Birds spent £85.7 million ($133 million USD) on conservation and other protection-based programs in 2011 (RSPB 2012). The WWF spent $205.84 million on conservation programs in 2012 (WWF 2012). The Nature Conservancy spent $468.84 million on "conservation activities and actions" in 2012 (The Nature Conservancy 2012). The Natural Resources Defense Council spent $16.04 million on "wildlife and wildlands" in 2011 (NRDC 2011). While it is equally difficult to judge the direct effects of all these projects, they nonetheless illustrate a large financial capacity directed towards conservation. Compared to these numbers, the AZA spent around $160 million in 2012 on conservation (AZA 2012).

Table 2.2 Conservation funds spent yearly by conservation organizations

Organization	Funding (in millions)	Year
Association of Zoos and Aquariums	$160	2012
Global Environment Facility	$147.22	2011
Natural Resources Defense Council	$16.04	2011
Nature Conservancy	$468.84	2012
Royal Society for the Protection of Birds	£85.7	2011
World Wildlife Fund	$205.84	2012

Data from AZA, GEF, NRDC, The Nature Conservancy, RSPB, and WWF

When looking at selected individual projects, zoos can at times be clearly recognized as leaders in conservation projects. In a review of funding sources for projects designed to benefit the Amur Leopard from 1996 through 2003, Christie (2007: 271) found that zoo organizations comprised 58% of all the conservation funding, while non-zoo NGOs made up 21.2% and the WWF 5.2%. Evaluating all conservation projects and benefits is very difficult. The direct impact that a project has on a species may be measured in part in relation to its incoming funding. However, it is difficult to quantify other effects on non-specified species or the environment and whether these effects are positive or negative.

There are additional factors that can make it difficult to evaluate conservation funds and impact. Zoos must measure and report their conservation funding and results. If zoos work together on a project, they both may report the project leading to double reporting of the benefits of the project. Also, each zoo has its own standards for measuring and evaluating and until those become standardized across a more global range, it is difficult to compare and compile all of the data (Christie 2007: 273).

Reintroductions represent some of the most visible and lauded of zoo conservation efforts. They are a way to bridge the gap between *ex situ* work and *in situ* projects (Braverman 2013: 64). However these may not actually represent a needed action, especially when IUCN guidelines are ignored and "surplus" animals are released more for the positive press then the conservation impact (Holst and Dickie 2007: 28). Indeed a study in 1990 conducted by the World Conservation Monitoring Centre found that zoo species both in the zoo and in reintroduction programs comprised only 1% of the total number of known species in the world (Mazur 2001: 51).

2.6 EDUCATION PRESSURES

Zoos often say that education is a prime goal and something that sets them apart from other institutions. For some zoos, education is an integral part of their mission and the primary way to achieve some of the conservation requirements placed on them by other organizations. Education is certainly one of the ways in which zoos interact most with the public.

However, one of the most ambiguous aspects of zoo conservation definitions is whether or not education falls under the purview of conservation. Dr. Moehrenschlager echoed this confusion, pointing out that the role of education remains a subject of great debate, "And certainly I think [education] has its role, it's just less tangible." Dr. Houwald, believes strongly in the importance of education in making meaningful, protective changes in the wild. She cited the idea that you must know and understand something in order to love and protect it. She noted that essential nature of education saying that while some zoos "say it's basically conservation for education, I say it's education for conservation." Interviewee 7, a Wildlife Director, echoed that sentiment, emphasizing that if people coming to the zoo are better educated, they are more likely to respect wildlife and will help support conservation initiatives.

2.6.1 Measurement and Value of Education

Education has been an unstated or stated goal of zoos for much of their history though the methods have shifted greatly. With the increasing push for conservation, many zoos are emphasizing their education programs as something that addresses those conservation goals, however many in and out of the zoo community question the overall implementation and effect of those programs.

Zoos take various approaches to education in terms of techniques, goals, emphasis, and value. Much of that variability stems from difficulty agreeing on a measurable end point as well as difficulty collecting data. Mazur (2001: 109) refers to the belief that zoo-based education should lead not only to knowledge and eventual action but also should inform skills and values. Indeed, many zoos cited the need for a behavioral change in the visiting public.

Studies vary on whether or not zoo visits and information tools present in zoos actually help encourage and inform conservation decisions. In some cases the visit can

help to increase the positive associations with particular animals and to increase educational learning about the animals and various conservation initiatives. Most studies have found that these usually occur with interactive experiences and educational shows (Swanagan 2000 and Anderson et al 2003).

Other zoos rely on less didactic efforts and instead focus more on the tone of their information. One zoo official looked not so much at what the visitor took away the first time, but whether they came back later. In this sense the emphasis is on the creation of a mood, so that the visitors are given a positive experience and want to know more when they return. As Dr. von Houwald said, "My ideal is a zoo visitor that leaves with a smile on his face…" She went on to say that creating a positive experience is like planting a seed that will eventually grow and lead to further interest from and chances for education of the visitor. Not much research exists comparing the two approaches and evaluating behavioral change in zoo visitors can be difficult.

Despite the inherent difficulties in measuring educational value, zoos maintain that they are in a unique position to offer meaningful education. While the public can engage with wildlife in a virtual way online or on screen at home or in a theater, zoo officials argue that it is not the same, citing the "authentic experience" achieved through personal visitation. Furthermore they often maintain that the response of the animal to the visitor and the visitor to seeing an animal in real time is an invaluable tool that cannot be replicated by anything other than direct action with a live animal.

2.6.2 Types of Educational Techniques

Zoos have experimented with many different types of education techniques throughout the years. Exploring some of these techniques and their relative effectiveness is useful for attempting to elucidate further zoo practices and challenges.

One of the most basic types of education that zoos have utilized is a sign near an exhibit. Signs are classic communication strategies for imparting information but are only useful if they are indeed read. As such, ways to prepare signs have been studied and have evolved. For example, visitors favor shorter rather than longer signs and too many signs in one area decrease the chance of them being read at all (Bitgood 1989: 1,7). Thus, more modern signs have larger fonts, more graphics, and colorful pictures on them. They are "designed to attract and hold visitors' attention and engage their concentration long

enough for visitors to read them and have positive reactions to the content" (Mazur 2001: 119). While some zoos maintain that education is a form of conservation, the signage is not always an educational tool that leads to further knowledge relating to conservation issues. Often the signs are a list of potentially interesting facts about the animal that give the public no concept of the threats, conservation initiatives, or ecosystems that surround that animal (Hancocks 2001: 178).

Even the zoos recognize the potential drawbacks of certain styles of communication techniques. Interviewee 3 spoke about the need for interactive communication with the visitor. His/Her conservation staff works closely with their volunteers who are stationed at the exhibits and engage in conversations with the public. Interviewee 3 said, "What I've found to be the best way to get that information out is not through signage, but through a live human being."

2.6.3 Other Programs

There were a variety of other varied and creative educational activities that zoos listed as educational tools. These included lecture series, a mobile zoo, recycling programs, online magazines, published books, and teacher workshops. Some projects designed to encourage action on local environments included building bat boxes, or planting butterfly-friendly local garden plants.

Zoos often run multi-stage programs aimed at an educational issue. One large international project that was cited by a number of zoos was the campaign against palm oil. Displays are set up outside of an exhibit emphasizing the danger of palm oil collection on the species within that exhibit. However, this particular program illustrates some of the challenges in following up on the effects of educational programs. Palm oil exists in so many different forms that awareness of its uses and therefore the ability to monitor visitor behavior is very difficult. As such, the effectiveness of the campaign has been questioned (Wilson 2010).

A further example of a creative program centers around sustainable seafood and is sponsored by Australia's Taronga Zoo. Visitors who want to be involved sign a pledge and receive weekly recipes and updates via email. The zoo itself has transitioned all its animals to a sustainable seafood diet.

However, as much as zoos may desire and strive to be educational facilities, it is

dependent to an extent on the visitors themselves. Visitors are often just there for a leisure activity and want to simply relax in a "natural setting," and thus may not fully embrace education attempts by the zoo (White and Marcellini 1986 and Mazur 2001: 115).

Programs aimed at children were frequently mentioned by interviewed zoos. The literature speaks to the nature of this effort. Although a 1999 study found that zoo visitors believed learning at zoos was an important element, they mostly saw that as a benefit to others, usually their children, instead of themselves (Morgan and Hodgkinson 1999). Many zoo programs feed into this with their efforts primarily focused on the education of children (Conway 2001: 14). Dr. Koontz noted the importance of Woodland Park Zoo's education programs for children and added that the long-range strategy of educating future generations justifies such programs being a major aspect of operation. Dr. Spindler mentioned that at Taronga there is a program focused on lessons for school children at the zoo and around 220,000 come through that program each year. Dr. Moehrenschlager stated that, "When possible I like [kids] to be exposed to our staff so that they become passionate about science and hopefully will consider going into science themselves." Programs such as these, increasing potential interest in science as well as others such as locally based projects are often designed to be more applicable to children. While it is certainly beneficial to engage in education for future generations, it represents a long-term goal and current attitudes and behaviors equally need to be addressed.

Thus, while general education goals are essentially universally lauded, the various aspects of the nature, techniques, efficacy, and emphasis make education in zoos a balancing act that requires creativity and finesse. In addition, ultimate educational effects are difficult to quantify.

2.7 GOVERNANCE PRESSURES

Standardizing zoo practices across a global range is difficult for a number of reasons, but in large part because of different regulations governing welfare, finances, and operations in zoos across different countries. There may be federal and/or local governmental regulations, regulations set by member organizations such as the various WAZA constituents, and internal regulations within the zoos themselves. These all place

additional pressures and restrictions on daily zoo actions as well as the conservation projects.

2.7.1 An Example of Zoo Governance: The United States

In the United States a zoo must adhere not only to strict AZA standards for accredited zoos, but must also be aware of local, state, and federal standards. For those zoos that subscribe to IUCN protocols, the IUCN has its own set of guidelines that specify procedures for reintroductions and for management of *ex situ* populations for conservation purposes and include strong recommendations for an educational component linking the *ex situ* populations with the *in situ* projects (Holst and Dickie 2007: 26).

On a national level in the United States, the Animal Welfare Act imposes a number of welfare standards that zoos must follow. The Animal Welfare Act of 1966 and its revisions in 1989 were designed to provide protection for animals in a variety of different situations, including animals kept within a zoo institution. However it is interesting to note that only warm-bloodied animals fall under the Act's statue for protection and governance. This clause effectively excludes all reptiles, along with some farm animals used for food and some research animals (Animal Welfare Act). As Braverman (2013: 132) points out, an essential "hierarchy of animalhood" is created within the zoo as some animals are given higher levels of protection and welfare concerns.

2.7.2 An Example of Zoo Governance: The European Union

In the EU, the Council Directive 1999/22/EC "Relating to the keeping of wild animals in zoos" was enacted by the European Union in March of 1999 and thus has a large purview as it encompasses all the zoos present in European member states (Council Directive 1999). However it is subject to local legislation in term of the speed and scope of its application (Holst and Dickie 2007: 24). In addition, it addresses obligations directed towards conservation. Article 3 requires zoos to engage in public education, adhere to specific housing criteria that meet conservation requirements, prevent animal escape, and keep records. It also states that zoos should conduct research for conservation, and/or train staff for conservation efforts, and/or pass on conservation information, and/or conduct captive breeding or reintroduction (Council Directive 1999: 94/25). The

conservation section of the article that deals the most heavily in *in situ* conservation is also the least obligatory with only one out of many different options needing to met.

2.7.3 International Governance Pressures

A barrier to which several zoos referred was the political climate surrounding the area in which a zoo is conducting a conservation project. Many endangered species are found in areas of political instability. A destabilized or an unrecognized government within a country can create not only constantly shifting regulations to which the projects must adapt but can engender a physically dangerous work environment.

In addition, even in relatively stable countries, the politics of the area may not be supportive of the projects. Dr. von Houwald gave the example of rhinos and ivory poaching, stating that in some places when a poacher is caught and sent to jail, he would likely pay a small bail and be released within a day. Such legislative structure obviously does not provide much reinforcement for conservation.

It should also be noted that the realities of the situation in the area often supersede conservation efforts and legislative enforcement. Interviewee 5 gave the example of the bushmeat trade saying, "It's all well and easy to start some sort of program that will prevent people from killing apes and eating them, but the reality of it of course is that people need something to eat. So it's usually not as simple as simple law enforcement." Local politics and enforcement, due to a variety of circumstances, often create or do not address problems for conservation projects.

The interviews provided some information about zoos' efforts to deal with such difficulties and will be discussed later. At this point, suffice it to say that to mitigate some of these issues, zoos pointed to ties they developed with communities in the areas. These often made the transitions easier and some of the political pressures eased as the projects became more locally inclusive instead of consisting of foreign entities working independently.

Simple bureaucratic issues can also have major impacts on zoos. While zoos are located in one specific locale, their work often stretches across a much wider range. Dealing with varying governance structures of different cultures can be difficult. Interviewee 10 mentioned a project in which the zoo was moving an injured animal across a national border for treatment purposes but because it was an endangered species,

the logistics involved many different bureaucratic levels.

Another issue to consider is the different cultural norms that apply to different locales. People in one area or from one cultural background may be more or less willing to emphasize a particular conservation program than others, or may find some projects more acceptable or more reprehensible (Hancocks 2001: 180-81). This would in turn inform different priorities in different zoos. Related to this are stylistic differences in management that even in an increasingly globalized world can affect cooperation between different areas.

Interviewee 10 noted that goals and time scales are also embraced differently by various cultures. He/She specifically listed the difference between a country that was very forceful and ready to move quickly and one that was not that direct and worked at a slower pace, saying "You have to have the work in their world, at their pace, under their guidelines."

Governance that affects zoos can in turn be affected by various external factors. For example, a disease outbreak can limit the transport and transfer of certain animals and taxonomic groups between different locations (Holst and Dickie 2007: 28). This bureaucratic process can inhibit work, even though the legislation and restrictions represent isolated occurrences over which the zoo has no control.

2.7.4 Internal Governance Pressures

In addition there are legislative issues within zoos themselves. Not only are there as many organizational structures as there are zoos, there are different bureaucratic decision-making priorities expressed by different departments like welfare, funding, marketing, and conservation among others (Mazur 2001: 165). Such variability is highlighted in the next section.

2.8 COORDINATION OF CONSERVATION PROJECTS

Hutchins and Conway (1995: 125-126) list a number of factors that are commonly found in effective conservation projects. These include a dynamic leader, an *ex situ* and *in situ* link, positive interactions with local governments, local people, and other organizations, the capacity for direct zoo involvement especially on site, training,

education, a scientific basis and effective marketing. The length of this list speaks to the pressures involved. Many of these elements were found in the zoo projects selected and indeed were highlighted in the interview process.

In each of the interviews, the zoo personnel were asked how they selected their conservation projects. While the overall goal of assisting animal species in the wild was consistent across all of the zoos, the methods and decision processes varied greatly.

2.8.1 Conservation Project Selection Criteria

Some zoos have very specific criteria for selecting projects. For example, Interviewee 3 mentioned his/her zoo has a number of different components that must be in place before a project can be evaluated for inclusion. The projects must have a direct field application, they must include an educational component, and they must have a "community involvement," and potentially lead to behavioral change.

Other zoos are less specific in their stated criteria, preferring the flexibility that accompanies broader parameters. For example, Dr. Moehrenschlager stated that the Calgary Zoo focuses on the general categories of reintroduction and the "science of community based conservation," with 80% of their projects in their former category and 20% in the latter. He further noted that it was important to find a niche, one that "would be sufficiently large to be significant, but sufficiently small to eventually be an authority in." Such a niche would represent an area that zoos may be able to fill much easier than other institutions. For example, sample sizes are often quite small when looking at endangered species and creating controls becomes difficult. As he pointed out, this can "scare many professors at universities because in the worst case it doesn't make it very publishable." He was not critical of university studies and indeed supported collaboration. Rather his point was that zoos are well suited for that type of work as the pressures placed on zoos are not the same as those found in a traditional academic setting. Many zoos do publish papers about their work, but there are a number of other factors that zoos focus on when conducting their projects.

Still other zoos, like the Taronga Zoo, have actually developed a formula for selection. Dr. Spindler spoke about the selection of their 10-15 projects each year. The process begins with a review by at least 10 of 20 potential reviewers. Those reviewers assess 12 different criteria including conservation benefit, the size and scope of the

project, the urgency of the project, and the length of time for the effects to take place and to last. After adding the scores for all the criteria, the reviewers then multiply by the probability of success, which is an experience and logic-based component as to whether or not the project will achieve its stated goals. Next, it is divided by the overall dollars requested for the project. So in essence, the equation becomes total conservation benefit, as determined by the reviewers, to total dollars spent. Though it is difficult to give a monetary value to something as complex as an ecosystem, it is a way to create a standardization amongst diverse projects and to determine which to select.

And sometimes it is the intangibles that can lead to the selection of a project. Dr. Koontz said for projects to be successful they often involved an endangered species, an inspirational leader on site, and the respect of the local population, "and that together makes such a compelling story." While there are often stringent guidelines for the selection of projects, it can be those stories, and what the zoo has that leads to a successful project.

2.8.2 Other Selection Influences

Other criteria can be considered when zoos are selecting conservation projects. Many of the AZA affiliated zoos profess an interest in "packaged" conservation projects, ones that utilize one or more flagship species and emphasize a local component (Christie 2007: 262). A flagship species is one that is used as the face of the conservation projects. That species is usually one that is well-known and desirable to the general public. The flagship species then becomes a pre-made marketing tool for the overall conservation project. The local component involved in such "packages" allows the zoos to be more selective for their area and the visiting public.

The types of conservation projects are also affected by time and global events, especially in the nature of fluctuations in the designation of different species. Braverman (2013: 56) gives the example of the polar bear, which used to be a commonly displayed animal in zoos when it carried endangered status. But when its population expanded after a ban on hunting, zoos no longer kept up with breeding programs and allowed the exhibits to gradually shut down. The polar bear has subsequently become the face for global warming and zoos are once again seeking to exhibit them, so the process of populating the zoos to start breeding programs and to promote conservation projects has

to in essence start all over again.

2.8.3 Who Chooses the Projects

Just as the project criteria, or how the projects are selected, varies from zoo to zoo, so too does the "who" vary, with different zoos having different groups or individuals selecting the projects. Some zoos have specific centers and departments dedicated to conservation and these divisions primarily handle the decisions. Other zoos have groups of curators and administrators that form a committee to evaluate the potential conservation projects. Either way, the process is an amalgamation of different individuals compiling information regarding the various animal types and capabilities of the zoo and zoo staff.

Those interviewed pointed out that having committed and diligent personnel is crucial in guiding project selection criteria. Indeed sometimes it is an individual instead of an organization that makes the greatest change, and it is up to organizations such as zoos to support those individuals. For example, golden lion tamarins have been a success story for zoos by increasing numbers from the brink of extinction and repopulating areas. But it was one individual, Dr. Devra Kleiman whose initial work and drive at the National Zoo led to the project working so well on a global level (Hancocks 2001: 157).

Interviewees noted that projects of importance to staff members often go further in the selection process than those projects which have no internal backing. Interviewee 4 emphasized the value of this approach and noted that his/her zoo's projects were, "…selected by each curator, veterinarian, researcher [who] got to pick something they were most passionate about, then they were vetted to see if they were doable." Dr. Spindler noted such personal dedication wasn't as defining a feature for the selection process at Taronga, but did factor in, serving as a potential "tie-breaker" between two projects if there was only space for one. This can be a beneficial system as it emphasizes passions that are already found within the zoo grounds and may perhaps increase the effort focused on the projects. However it is entirely dependent on the species preferences of the staff members and may not fully evaluate which species are the ones most in need of conservation.

However not all decisions are made internally. Interviewee 8 indicated that when his/her zoo was looking for local projects it looks at what tops the lists for the Fish and

Wildlife Service, the Nature Conservancy and the Audubon Society. Interviewee 8 stated the zoo did so because, "We don't necessarily want to go out on a limb by ourselves. But we want to see ourselves as local conservation facilitators as well as help boost the effort." Groups such as these are focused on conservation, but inherently have their own sets of pressures and may also focus on more societally desirable animals instead of a balanced range of animals in need of conservation (Metrick and Weitzman 1996: 14-15).

2.8.4 Project Partnerships

Most of the zoos interviewed spoke about the importance of partnerships to their conservation work. Interviewee 5 illustrated this best, saying, "None of these programs we really do on our own, they're all partnerships." Finding a local research group or a local population interested in the project is an important element for zoos. Not only is it logistically easier to deal with those that are familiar with and dedicated to an area's terrain and culture, the classic zoo projects of breeding and reintroductions may not address the issues that led to a dwindling animal population in the first place. Interviewee 10 states that "Conservation is not just protecting the species in the wild and putting the species back, but it's trying to work with governments, other people, companies." While governments and companies are often useful for funding and logistics, other people can prove extremely valuable on a more local level.

Involving the local population thus enhances the mission of saving individual animals by helping humans find more sustainable ways to use the resources around them. Dr. Koontz noted how the projects were about helping endangered species as well as, "helping a region be more sustainable and the people that live there to live in more sustainable ways." One example is The Thailand Hornbill Project, which is supported by a number of zoos including the Woodland Park Zoo. It involves employing locals to watch over hornbill nests and conduct research. In the past, the local villagers used to collect the hornbill eggs and sell them for money, but through the conservation project the locals are instead caring for the nests, as well as learning and raising awareness about the plight of the hornbills (WPZ 2012).

Finding a local research group, or a local population interested in the project is often an important element for zoos. It becomes even more necessary when examining international projects, as then zoos must work outside their own governmental confines

and thus increased coordination becomes essential. Dr. Koontz once again sums up this increasing emphasis on the human aspect of the projects saying, "More and more our projects are not only defined or strategized based on the animal or landscape, but based on the situation with the human context around the project."

2.8.5 Assessing Project Success

While zoos appear sincere in their desires to make a tangible difference for species in the wild, they must report goals achieved to backers, regulators, and ultimately to zoo visitors. Different backers may want different results, as Interviewee 5 said, "If people have mixed agendas then they have natural built-in conflicts about where the funds should be spent." The pressures involved in defining what parameters constitute success and then communicating them in a standard way are significant. Measuring these successes proves difficult to do in a compatible framework. There exist conservation project databases for many of the WAZA constituents, however these are generated by the zoos with no consolidated rubric for inclusion and as such some zoos may be more or less selective about what constitutes a conservation project and what is spent on that project (Mace et al 2007: 323).

Mace et al (2007: 324-325) created a method and equation for measuring conservation success within projects that attempted to allocate, "…scores to each of the measures of Importance, Volume, and Effect…" (339). While it provided a way to measure projects across a comparable scheme, it has its own drawbacks and as such is unlikely to be used readily by zoos.

Another study was completed in 2010 that looked at WAZA branded projects. WAZA brands some conservation projects that it finds help impact global *in situ* conservation (WAZA). The study found that the 113 projects selected by WAZA are indeed making an impact on conservation, though they could make a much larger impact with greater resources (Gusset and Dick 2010).

In addition to the lack of standardization, zoos must often contend with unique situations that limit their degree of success. For example, while many conservation projects take years and generations of species to be fully realized, donors and visitors expect zoos to show results within a short amount of time. This can impact how zoos measure success and what projects zoos chose, specifically whether or not they can be

completed in the short-term. Without a widely agreed upon standard success measures, zoos are left to individualize their definition of success, several of which were discussed in the interviews.

2.8.6 Specific Measures of Success

A commonly cited measure in the interviews consisted of a project resulting in a viable population, that is, enough naturally reproducing animals to make an established population that can survive on its own. Dr. Koontz took it a step further, saying it was not just a measure of endangered species population viability, but the quality or quantity of the habitat as representative of a necessary factor for the improvement of the animal population.

Another commonly stated goal was the advancement of the project to a point where zoo support was no longer necessary and where the local human population assumes full control. Though it should be noted this may represent more of an interim success in that the animal population is still somewhat reliant on human intervention, albeit local rather than foreign.

The overall designation of a species can be another indicator of a project's relative success. If an animal is downgraded from threatened to vulnerable as a result of a conservation project, that clearly represents improvement.

For research-based conservation a way of viewing success can be the data change, the addition of new information to established data. Dr. Moehrenschlager suggested that looking at both the number and types of journal articles published about conservation activities would be a helpful indicator.

The success of some projects can be described numerically. For example, if a project targets poaching issues, convictions for poaching or number of animals poached compared to previous years could be tallied.

On the other hand, some success parameters listed by interviewees are extremely difficult to quantify and stand in stark contrast to ones in which numbers are useful. Successful research, training, and educational activities are often accomplished even in a setting where other goals are not achieved. Even the failures can be useful. Dr. Spindler spoke about a project they were funding that failed to meet half of its goals. The zoo worked with the project and tried to evaluate what failed to work and whether it was the

project model or execution of the project in order to hopefully prevent failures such as that in the future.

As zoos have many different ways of measuring successes it makes it very difficult to standardize them across a worldwide range and fully quantify the benefits of each as compared to one another. However, the successes can be tangible with some critically endangered species improving their survival odds. In addition, the relationship between stakeholders and the knowledge gained in approaching these relationships can only lead to strengthening the possibility of future successes.

2.9 MEDIA PRESSURES

While legislation and regulations represent types of zoo pressures that are generally more fixed in nature, and project logistics are specific to individual zoos, the public pressures remain varying in their type and degree. The collective media represents a particularly powerful pressure with which modern day institutions must contend. Zoos have experienced the "double-edged sword" nature of media coverage. Whereas favorable images of successful projects lead to positive public perception, controversial stories can paint the zoos in a negative light and damage their public image. This is obviously harmful for an institution that relies heavily on public support and funding. Another potential problem is when too much attention is given to one species or one successful breeding project for a very charismatic species, as it can divert awareness away from other species and the larger issues facing the ecosystem as a whole (Mazur 2001: 125).

During the interviews, several zoos referred to the fact that the media had become increasingly supportive of stories about field projects. While stories about babies used to be the predominant focus of various media outlets, now that focus has started to shift and frequently includes the impacts and benefits zoos are having on conservation issues in the wild. Zoos are certainly encouraging this change and trying to feed into the transition by reaching a balance between the stories revolving around "cute babies" and those involving conservation ramifications. Interviewee 10 stated his/her zoo may use the babies to bring visitors through the gates, but that they "…use the animals as a vehicle for messaging about the plight of the species in the wild and what the [visitor] can do to help."

The zoo tries to impart the message that the babies are ambassadors for the projects the zoo is conducting in the wild.

2.10 CONCLUSION

It is clear from the preceding sections that there exists a multitude of pressures that zoos must face. Such pressures are rooted in the historical development of zoos and are amplified by ongoing transitions associated with financial concerns, internal organizational structures, and a variety of external components. In addition, the variability of defining and standardizing conservation issues makes discussing the pressures all the more challenging.

One potential consequence arising as a result of such tensions is the practice of species bias within conservation projects. This is discussed separately in an upcoming chapter. But other, more general remarks can be directed toward the effects that such pressures have on zoos and how zoos have met the challenges presented. The zoos should be acknowledged for their devotion and dedication to conservation. However, due to the pressures previously discussed, this does not always translate to the practical application and success of that conservation.

The largest barrier and thus the most formidable pressure cited by interviewees with respect to the conservation projects was the need for resources, in short, adequate money. Zoos must receive enough funding to initiate, maintain, and complete their conservation projects, as well as meeting the coexisting financial pressures involved in day-to-day operations. Focusing on fundraising and entertainment requires much attention and energy and impacts the ability of an organization to devote major efforts to conservation related goals. However, funding is a necessity and zoos must continue to work on balancing their funding needs as well as their entertainment and conservation values.

Even if the funding is available, time works against zoos. Conservation takes a long time, especially as zoos need to develop specialized resources, relationships, and manpower. Many of the projects exhibit effects on a much longer scale, but that creates problems for those who want to see results immediately, including backers, regulating organizations, and the general public. Conflicting agendas within zoos themselves and

between external stakeholders occur and these must be articulated and sorted over time.

Education has been both a stated and unstated goal of zoos for much of their history, even though there has been considerable shifting in the methods employed. With the increasing push for conservation, many zoos are emphasizing their education programs as something that addresses those conservation goals. However many in and out of the zoo community question the overall implementation and effect of those programs. Educational efforts are hampered by the difficulty in assessing their effectiveness with rigorous studies. Ultimately, however, zoos are positioned such that there is great potential for an educational impact given the sheer numbers of individuals that visit. Indeed this could well be a tool for enhancing a zoo's conservation ability and should be considered as such.

Zoos must contend with a maze of governance issues, ranging from the bureaucracy of the individual institution to national rules to international conditions. For example, navigating the politics of certain countries requires flexibility. While zoos have certainly found ways to work around and within these governance systems, creating a more standardized format that could cover zoo conservation projects across all locales would help to address this issue.

The logistics of setting up, running, and evaluating the success of conservation projects are quite varied within different institutions. This fact contributes to difficulty in drawing comparisons and also sets up other challenges. For example, ways of choosing projects may favor the inclusion of certain projects over others. Although such preference may occur because of a particular local need or the availability of specific expertise or interest at a site, this approach may trump an animal's overall conservation need.

Dr. Dale Jamieson articulated a rather pessimistic summary that could be applied to the pressures reviewed,

> In my opinion there will be increasing tension between what zoos do to gain public support (entertain) and what they must do in order to justify themselves (preserve species)…This conflict already prevents zoos from being as good as they can be, and it will become more pronounced in the future (Jamieson 1995: 63)

However, interviews and subsequent analysis point to numerous bright spots that may currently mitigate such an outlook and hint at an even more promising future.

First of all, zoos have played pivotal roles in conservation successes. For example, many of the zoos profiled in this report have been involved in boosting the populations of the Black-footed Ferret and the Western Pond Turtle from incredibly low numbers in the wild to population numbers that can approach viability. The pluses and minuses of breeding programs and species survival plans can be debated but the fact remains that in these examples, the individual species have been retrieved from the brink of extinction in specific locales in large part by zoo efforts.

Zoos as a whole seem to compare relatively favorably with other conservation organizations in terms of overall funds spent on conservation efforts. Indeed, in funding for certain projects like the Amur leopard conservation efforts, zoos lead the way. Despite the variability that zoos show in reporting and classifying conservation projects, this can be considered an indicator of commitment at the very least.

There is evidence that conservation is assuming new levels of support with the public across the board. Media outlets have noted increasing interest in conservation stories, indicating progress from the classic feature stories that concentrated solely on charming baby mammals. Conservation donations are up as membership in conservation organizations rise (Dalton 2005). Such a shift would tend to decrease the pressures created by the competition between recreation and conservation.

Zoos have shown considerable creativity in their educational and outreach programs. Engaging the public in their conservation projects with unique programs to secure funding and stimulate interest has resulted in the involvement of diverse groups and partnerships. Strategies that rely on creative ways to incorporate favored “flagship species” and utilizing their popularity to sell the conservation project as a whole extends benefits beyond the scope of just that featured species.

There has been increased cultural understanding on the part of zoos and efforts are ongoing to incorporate the wishes, the livelihood, and the priorities of human populations adjacent to areas of conservation need. More cooperation has been beneficial to all involved and has resulted in more successful projects.

Clearly there are some positives that zoos are creating and utilizing in their missions of conservation, despite the pressures they face. However, it should be remembered that the zoos highlighted in this report were chosen for their notable

achievements in conservation endeavors. They are, in effect, the "cream of the crop" and all facilities worldwide do not necessarily share the same experiences. Interviewees diplomatically alluded to this situation when they brought up the need for consistency in the conservation messages that zoos broadcast. Interviewee 8 mentioned activities he/she had witnessed in other zoos such as walking animals on leashes or providing non-sustainable foods and other products in gift shops as actions that are not always consistent with the zoo's conservation focus and run instead towards the side of entertainment. Despite this, the same interviewee noted that some activities and messages can be done in a way that focuses on conservation principles rather than "taking the easy way out" and focusing on funding and entertainment. This message is and can be followed through in many of the zoos today and indeed is embraced by most of the zoos in this investigation. The pressures faced constitute a challenge, but have not deterred all significant conservation efforts. The future challenge lies in continued analysis and maximization of such efforts.

CHAPTER 3: ANALYSIS OF ZOO CONSERVATION PROJECTS

3.1 INTRODUCTION

Pressures have been discussed that lead to considerable tension between conservation objectives and zoo operating conditions. A fundamental question that then follows is whether or not such tensions impact the conservation mission of zoos. It is clear that public pressure involving the nature of zoos is directly associated with many such pressures, most notably species preference and resultant funding. Thus, examining the conservation projects and whether or not there exists a species bias in that area should help to shed light on this issue. Species bias refers to the preferential treatment of certain species or taxonomic groups, in this case with regards to the urgency of their conservation needs. Species chosen for conservation projects were compared to the International Union for Conservation of Nature (IUCN) Red List, an internationally recognized instrument designed to inform the urgency of conservation need.

It should be noted that examining potential species bias in terms of the IUCN Red List comparison is just one step in developing the overall picture of conservation in zoos, though a necessary step nonetheless. Other factors can be used to evaluate conservation efforts, such as which species garner the greatest amount of funding. These factors will discussed later in the chapter. As well, while "bias" may have negative connotations not intended here, it does however capture the possible pressures zoos face when articulating and realizing some conservation goals.

This chapter will explore the results of the IUCN Red List comparison. First the literature that discusses the concept of species preference as it exists in a general zoo setting will be reviewed. This will then be expanded to investigate how such preferences may affect conservation projects within zoos. Study results focusing on potential species biases within the projects will be analyzed. More nuanced information from zoo interviews, including deeper analysis and mitigating factors, shed additional light on the results of the study.

3.2 LITERATURE REVIEW

3.2.1 Visitor Preference

While the literature is limited in terms of preference in relation to zoo conservation projects, there is considerable information on what characteristics are

preferred by general zoo patrons. In 1979, Stephen Kellert's paper, 'Zoological Parks in American Society,' examined zoo visitors' knowledge and preferences. He found that, "73 percent say they dislike rattlesnakes, 52 percent vultures and only 4 percent elephants" (Jamieson 1985: 109). In 2000, the San Diego Zoo asked visitors about which animals they had come to see. Of the top ten results, eight of them were mammals and the remaining two were the general categories of "reptiles" and "all animals" (McGraw and Weaver 2001). A more recent study at a UK zoo found that visitor interest in zoo exhibits could be determined by a number of criteria. Taxon groups represented the largest determining factor and mammals incited the greatest visitor interest. An additional criterion was body size, with larger animals generally being preferred (Moss and Esson 2010).

Frynta et al (2010) noted that zoo collections generally adhere more to pleasing physical characteristics than IUCN designation or taxonomic uniqueness. Such physical characteristics may include body size, age, and activity level.

Numerous other studies reiterate the fact that body size for many species is positively correlated with visitor interest (Balmford, Mace, and Leader-Williams 1996, Marešová and Frynta 2008, and Frynta et al 2010). While the majority of animals in the wild are very small in stature, zoos err towards the side of the larger, more visible species, presenting a skewed version of wild populations (Hancocks 2001: 165-66). Indeed "ninety-five percent of all creatures on earth are smaller than a chicken's egg" (Hancocks 1995: 34) and exhibiting larger species certainly impacts not only what the public sees at a zoo but how the public perceives the natural world.

Another study emphasized that age was an important element in visitor preference. If an infant animal was present in an exhibit, the time that visitors spent at the exhibit was increased. This same group also found that animal activity level was correlated with visitor preference (Bitgood, Patterson, and Benefield 1998).

Hancocks mentions a veritable "just-right" exhibit that incorporates many of the above characteristics, Disney's Animal Kingdom Oasis Exhibit. He points out that it is "populated only by animals that are pretty, cute…perhaps weird but definitely non-threatening" (2001: 221).

The naming process, utilized by many zoos, is an interesting phenomenon and can be an illustration of potential bias. Naming creates a stronger link between the viewer and the animal. Failing to name an animal "can mean distancing ourselves…and disregarding their likeness to ourselves, which makes it easier to justify harmful treatment through reference to the difference between 'them' and 'us'" (Borkfelt 2011: 123). Typically mammals, larger animals and those of particular marketing interest to the public are given names, frequently through an interactive voting method. However, the smaller animals such as invertebrates and amphibians are often left out (Braverman 2013: 99). Of course this could be a factor of their shorter lifespans and greater population numbers, but clearly it is impacted by and in turn impacts their public popularity.

3.2.2 Species Diversity in Zoos

Animals have been divided into various groupings: kingdoms, classes, orders and so forth. Zoos purport a dedication to diversity, to having all of these different categories. But in reality their collections often stray more to the "exotic" to attract visitors and include the requisite lions, tigers, bears and other such charismatic megafauna.

Indeed through this process of display, zoos influence one another as to what species are seen within the zoo. As the public becomes used to seeing specific animals within a zoo, they come to expect those species at every zoo (Hancocks 1995: 33). Zoos must then subsequently fit a preconceived notion of what is in a zoo and that continues to grow with each new zoo ascribing to that model. This circle of the visitor being influenced by the zoo and the zoo by the visitor continues. Indeed, Hancocks (1995: 33) gives the example that if you ask a person to name different animal species, he will only list about one to two dozen. In addition the vast majority of those will be the charismatic megafauna that are present in most zoos such as the larger cats, primates, and African savannah animals. With the focus on the more exotic animals, zoos stress the threats facing those species. While these are important, local threats to local species are often ignored. This is unfortunate as visitors may not be adequately apprised of the value of local changes that they can make in their daily lives (Hancocks 1995: 36).

As noted, there is little data that looks specifically at bias issues affecting zoo conservation projects, but it is worth looking at some of the available literature that touches on species bias in general conservation projects. A study from 1996 examining

the US Endangered Species spending found that the top ten species, which accounted for half of the total monies spent, were comprised entirely of birds and large mammals. The funding was based more on a set of visual or "charismatic" determinants instead of those actually in the greatest need. In addition the "degree to which they are considered to be higher forms of life" was heavily influential (Metrick and Weitzman 1996: 3). Other aspects of general preferential treatment were seen in one study that noted more attractive species received greater monetary support from the public (Gunnthorsdottir 2001). Body size was reiterated as a factor when a 1998 study showed that increasing the length of an animal by 10% resulted in an 8.6% increase in funding for US Endangered Species funding (Metrick and Weitzmann 1998).

Those that have looked at the role of species preference in zoos have studied either only WAZA projects (Gusset and Dick 2010), reintroduction projects (Seddon, Soorae and Launay 2006), or individual zoos or locales. The following results provide an examination that stretches across many different zoos worldwide and presents a new viewpoint by focusing on the more conservation-focused zoos.

3.3 METHODS

The individual species involved in conservation projects of each of the 31 zoos selected for this paper were compiled and evaluated with the aim of establishing whether or not zoos were focused on the animals most in need of conservation and whether or not a species bias existed. The species were identified through a combination of zoo websites, annual reports, and direct interviews. Thus, these species may not represent the entirety of the zoo conservation projects, but are fully representative of the projects that are available and announced to the general public.

In order to address the variability of zoo reporting, a list of project criteria was specified and in order for projects to be included in this study they had to meet at least two of the project criteria. The criteria included education, research, breeding, habitat management, and increasing populations in the wild.

To further examine how the species were faring within the conservation project, each species and class was evaluated as to its conservation need. The IUCN Red List was used as an independent source. It is a global compilation of animals that evaluates species'

status in the wild and assigns each a designation in relation to its overall level of threat. For this research, the threat level of each species was then extrapolated to serve as a measure for the need for conservation for each species and class. The IUCN designations are: Not Evaluated (NE), Data Deficient (DD), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CR), Extinct in the Wild (EW), and Extinct (EX). Vulnerable, Endangered, and Critically Endangered are referred to as "threatened" species. This can be seen in Figure 3.1.

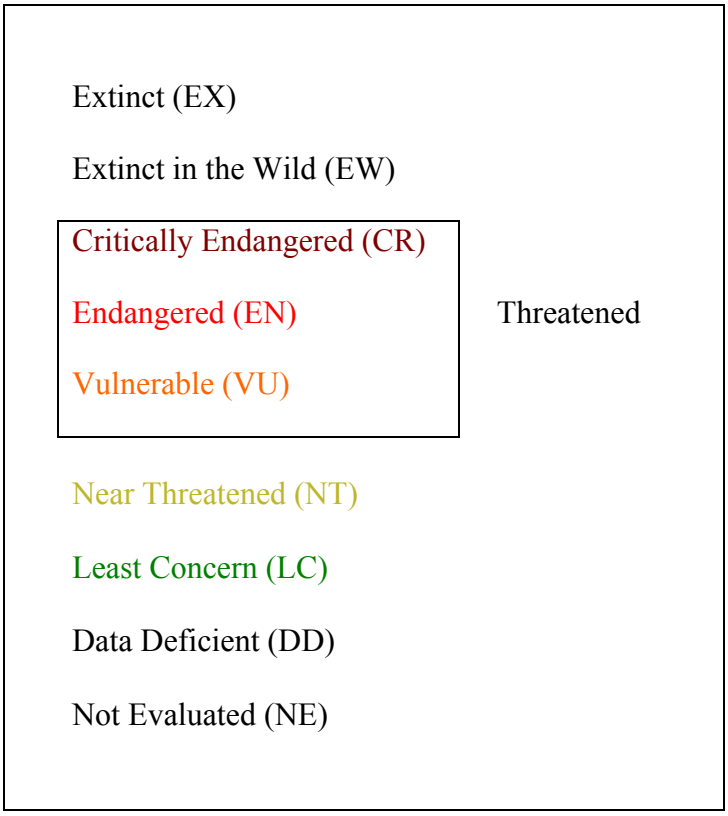

Figure 3.1. IUCN Red List Categories adapted from IUCN Red List. Threatened species are indicated in box in figure: Critically Endangered (CR), Endangered (EN), and Vulnerable (VU).

For each species determined by the previously stated criteria, I cited the IUCN designation. In addition, classes were compared to one another and to the overall data from the IUCN Red List. Five general groups of animals were used in the analysis utilized by this paper. These include amphibians, birds, mammals, reptiles, and terrestrial invertebrates. Terrestrial invertebrates are all the specific invertebrate orders that are found primarily on land. Those that are found exclusively in the water were not included.

In this paper taxonomic groups and taxa refer specifically to the animal classes noted above.

A complete discussion of the methods involved can be found in Appendix A.

3.4 RESULTS

Conservation projects meeting the methodology criteria discussed were tallied and then the species involved in each were determined. Table 3.1 indicates the numbers arranged by taxonomic group or animal class. The complete list of individual species and number of projects can be found in Appendix C.

Table 3.1. Number of species in zoo conservation projects in each class

Taxonomic Group	Number of Species	Number of Species not including DD and NE[1]
Amphibians	24	24
Birds	62	60
Mammals	127	125
Reptiles	48	44
Terrestrial Invertebrates	6	3

[1]*Data Deficient (DD) and Not Evaluated (NE) categories are descriptive terms applied by the IUCN and refer to the fact that a threat level has not been made for that species.*

Some taxon groups had a much higher sample size such as mammals (127), whereas others had a very small sample size such as Terrestrial Invertebrates (6). The total sample size for species was 267 and the total number of projects was 461. Excluding Data Deficient (DD) and Not Evaluated (NE) projects revises the totals to 256 for species and 451 for projects. As the Data Deficient and Not Evaluated categories do not have a level of threat assigned by the IUCN Red List, it is important to separate them in the IUCN comparison analysis, but they should still be noted. To better evaluate the species data, the percentages of the species involved in conservation projects were compared by class (Figure 3.1).

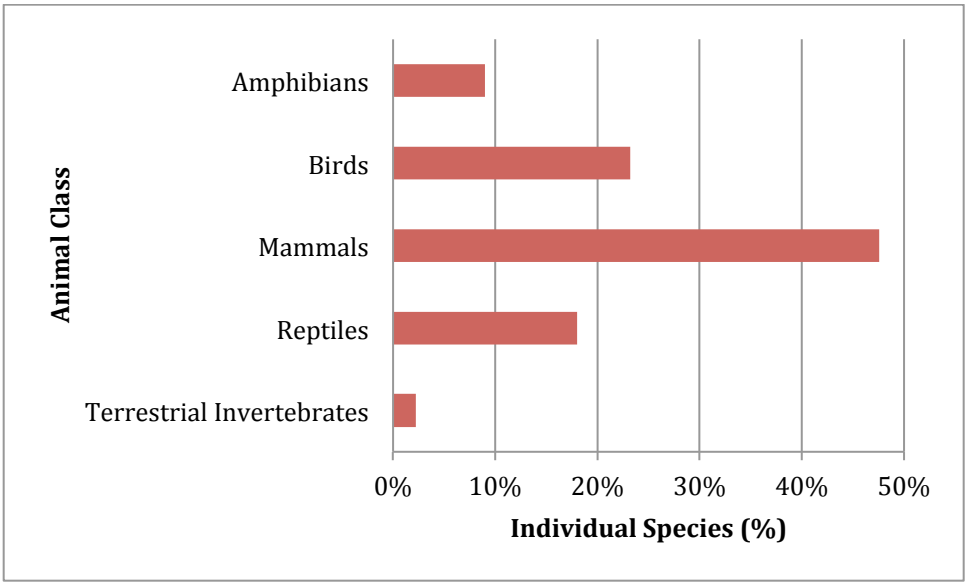

Figure 3.2. Percentage of individual species in zoo projects distributed by animal class.

Looking at the percentages reveals that mammals (47.57%) represented a higher percentage of the total number of species involved in conservation projects than other taxonomic groups (Figure 3.2). The remaining percentages decreased in the following order: birds (23.22%), reptiles (17.89%), amphibians (8.99%), and finally terrestrial invertebrates (2.25%). This emphasis on mammals is often found in zoos (Hancocks 2001: 173 and McGraw and Weaver 2001) and the subsequent hierarchy of species seems to follow the perceived "higher forms of life" preference format (Metrick and Weitzman 1996: 3) with terrestrial invertebrates on the bottom. In addition to the number of individual species, the number of conservation projects per class was examined (Table 3.2 and Figure 3.3). The number of species and the number of conservation projects differ, as an individual species can be the focus of a number of conservation projects.

Table 3.2. Number of conservation projects in each class

Taxonomic group	Number of projects	Number of projects not including DD and NE
Amphibians	28	28
Birds	85	83
Mammals	278	276
Reptiles	63	59
Terrestrial Invertebrates	7	3

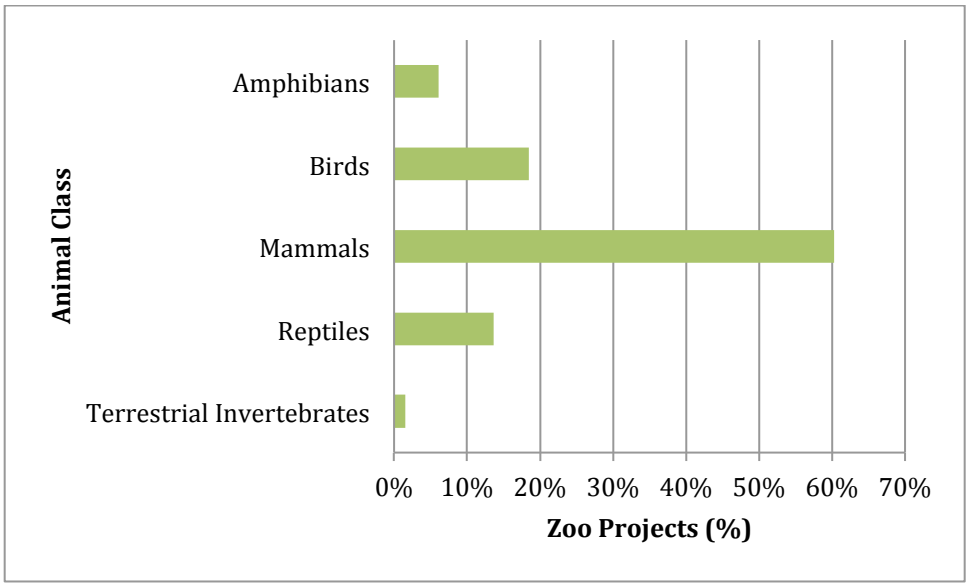

Figure 3.3. Percentage of zoo projects distributed by animal class.

As indicated in Table 3.2 and Figure 3.2, the number of zoo conservation projects involving these species follows a similar pattern with a high number of the projects focused on mammals (278), making up 60.30% of zoo conservation projects. The remaining taxonomic groups decrease in the same order, order: birds (85, 18.44%), reptiles (63, 13.67%), amphibians (28, 6.07%), and terrestrial invertebrates (7, 1.52%).

The following figures (Figure 3.4-3.6) incorporate IUCN data. As noted in methodology, the IUCN Red List provides a respected and global indicator of conservation need and serves in this study as an indicator of whether or not an animal is "in need of conservation." There are limitations to this method and they are discussed in the qualifications section of this chapter.

However this method does provide an overview of the zoo conservation projects and how many species are designated as threatened by the IUCN in each taxonomic group. Each taxonomic group was examined for whether or not it was focusing primarily on those species considered most threatened. By IUCN designation the threatened category is those Critically Endangered (CR), Endangered (EN) and Vulnerable (VU). Again, the Data Deficient (DD) and Not Evaluated (NE) categories were removed from the final results.

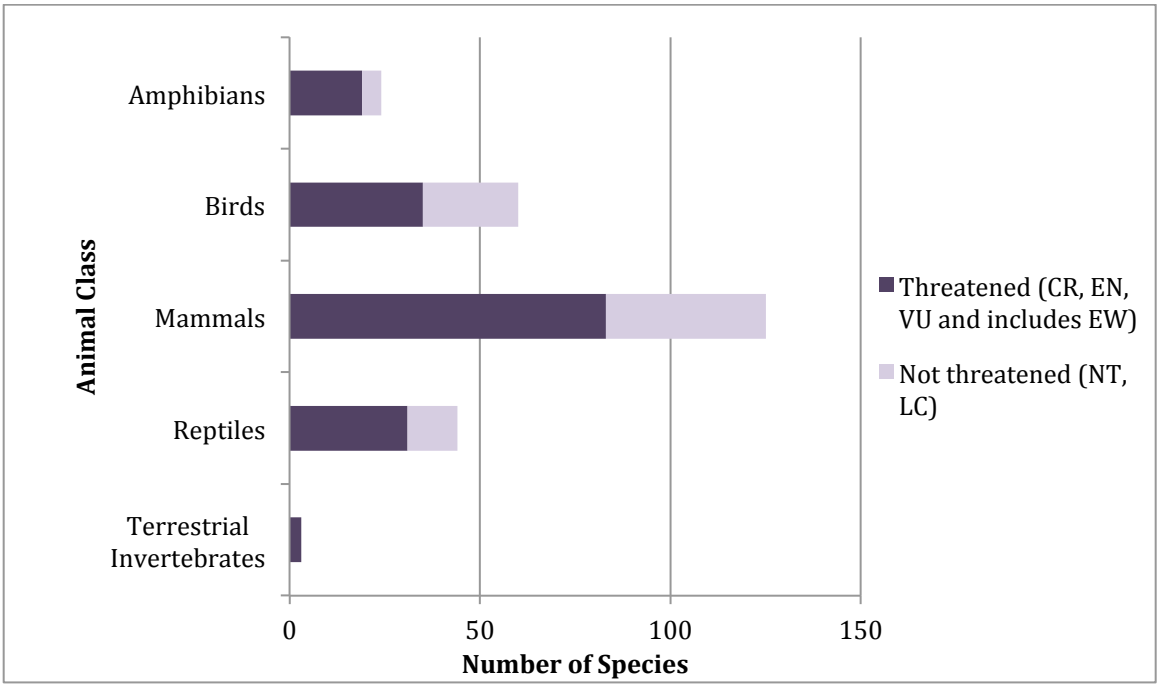

Figure 3.4. Numbers of threatened (Critically Endangered, Endangered, Vulnerable, and including Extinct in the Wild) and Not Threatened (Near Threatened and Least Concern) species in zoo conservation projects as determined by the IUCN Red List.

Figure 3.4 illustrates how many zoo projects are focused on globally threatened and non-threatened species in each class. As seen in the figure, all of the taxon groupings indicate that more projects focus on threatened than non-threatened species. Indeed 66.80% of all zoo conservation projects were comprised of species deemed globally threatened by the IUCN. The class with the highest number of non-threatened species was mammals (42 not threatened species, 83 threatened species). Birds were next (25 not threatened, 35 threatened), followed by reptiles (13 not threatened, 31 threatened), then amphibians (5 not threatened, 19 threatened), and finally terrestrial invertebrates (0 not threatened, 3 threatened).

The overall numbers of individuals in the mammal class are higher. To this end, looking at the percentages of the number of threatened species compared to the total number of species is useful. The lowest is in fact birds (59.32%), followed by mammals (66.40%), reptiles (73.81%), amphibians (79.17%) and finally terrestrial invertebrates (100%).

While many of the "not threatened" species may be threatened on a local level, it is interesting to note that mammals and birds are the two taxonomic groups that contain

the highest number of non-threatened species. While those two groups have the most number of projects, it may in part be due to the zoos' desire to have projects focused on these types of species and thus it is more common to take mammals and birds not found on the IUCN list.

The IUCN Red List has data on how many species in each taxonomic group are threatened. Each taxonomic group on the IUCN Red List was evaluated and the overall number of threatened species was compared to the other groups in order to see the percentages threatened of each taxonomic group (Figure 3.5).

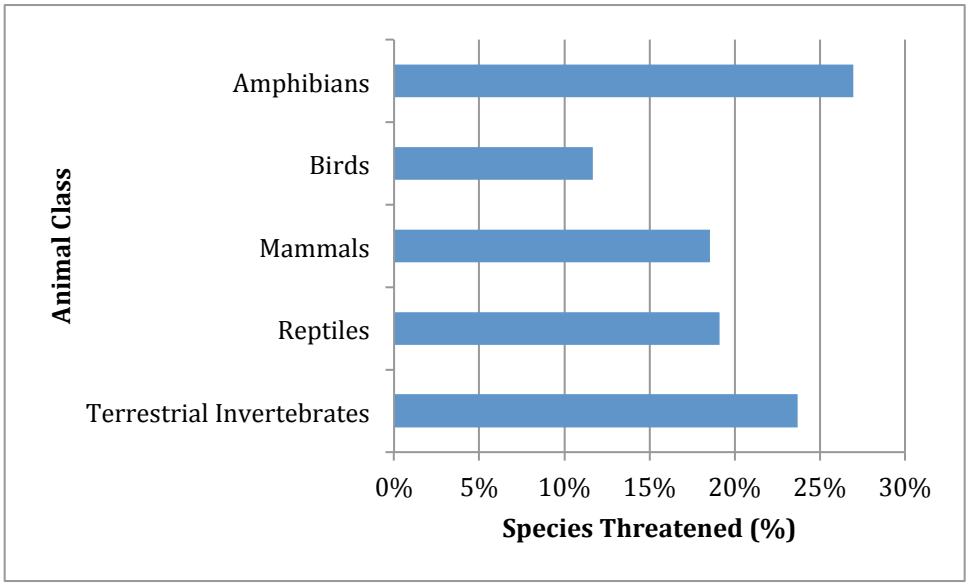

Figure 3.5. Percent of species in each taxon that is threatened with extinction according to IUCN Red List (does not include DD, NE, and Extinct). Data adapted from IUCN Red List.

Amphibians have the highest percentage of species threatened (26.95%) compared to the other groups. They are followed by terrestrial invertebrates (23.70%), reptiles (19.10%), mammals (18.56%), and finally birds (11.68%). These results were then used to evaluate the zoo conservation projects.

The sample sizes of zoo projects are significantly smaller then the IUCN Red List. This makes comparing direct numbers difficult. However comparing percentages of species, projects, and the IUCN distribution allows for some clearer results. The species compiled from the zoo conservation projects were compared to the IUCN Red List (Figure 3.6).

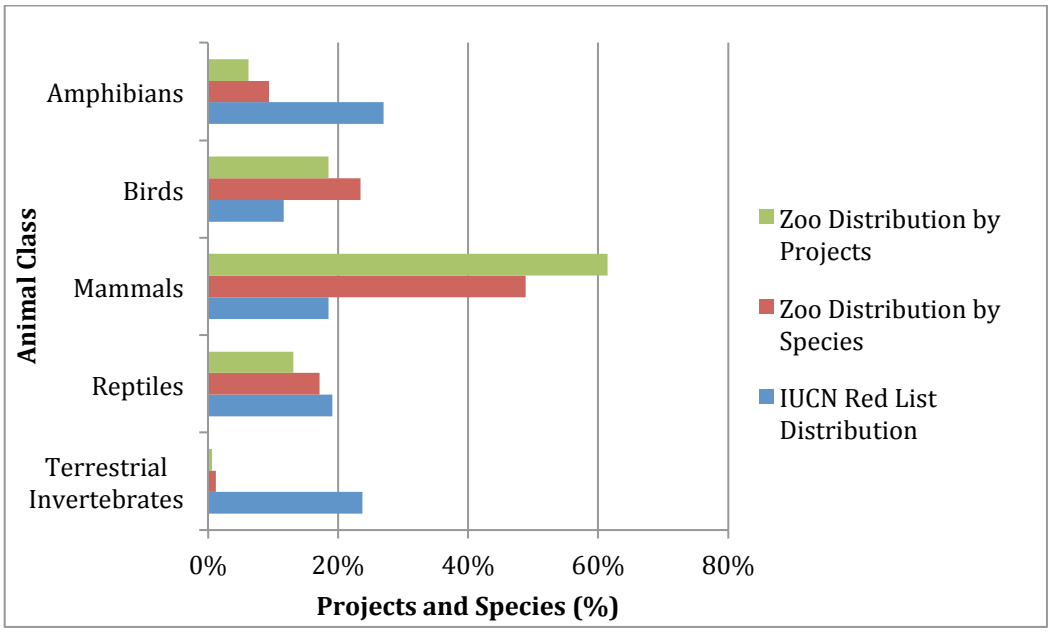

Figure 3.6. The percentages of species in each class threatened with extinction (based on the IUCN Red List), compared with the percent focus of zoo distribution efforts, specifically by species and by zoo conservation projects (not including DD, NE, EX).

The IUCN distribution is much more uniform compared to the zoo distributions of species and projects, which show greater numbers of mammals and birds and fewer numbers of amphibians and invertebrates. These results indicate that the zoos are focusing on mammals and birds to a greater extent than terrestrial invertebrates, reptiles, and amphibians. This is the case despite the fact that amphibians represent the taxonomic group with the largest amount of threatened species.

In Figure 3.5, the IUCN Red List distribution (blue bar) is compared within classes, as opposed to overall numbers of animals. Zoos cannot directly impact every species, rather only the projects and species specific to any one zoo. Thus the blue bar cannot be directly compared to the green and red bars and the data each represent. However, this figure remains instructive as a comparative relative weighting of the prominence afforded mammals.

If, and again using the IUCN Red List distribution, the classes are compared to the total number of animals threatened, as opposed to the total number of animals in the particular class (as shown in Figures 3.5 and 3.6), the results change slightly. The total number of animals threatened in each class was divided by the number of threatened

species overall. The most threatened remains amphibians (28.36%). Once again, terrestrial invertebrates are next with (23.82%), however they are followed by birds (19.27%), then mammals (16.71%), and finally reptiles (11.84%). The percentage of reptiles is likely affected by the fact that reptiles have the fewest species given the designation; "threatened."

Further analysis was completed within the individual classes in order to determine which orders primarily comprised the conservation projects. The first class examined was mammals (Figure 3.7).

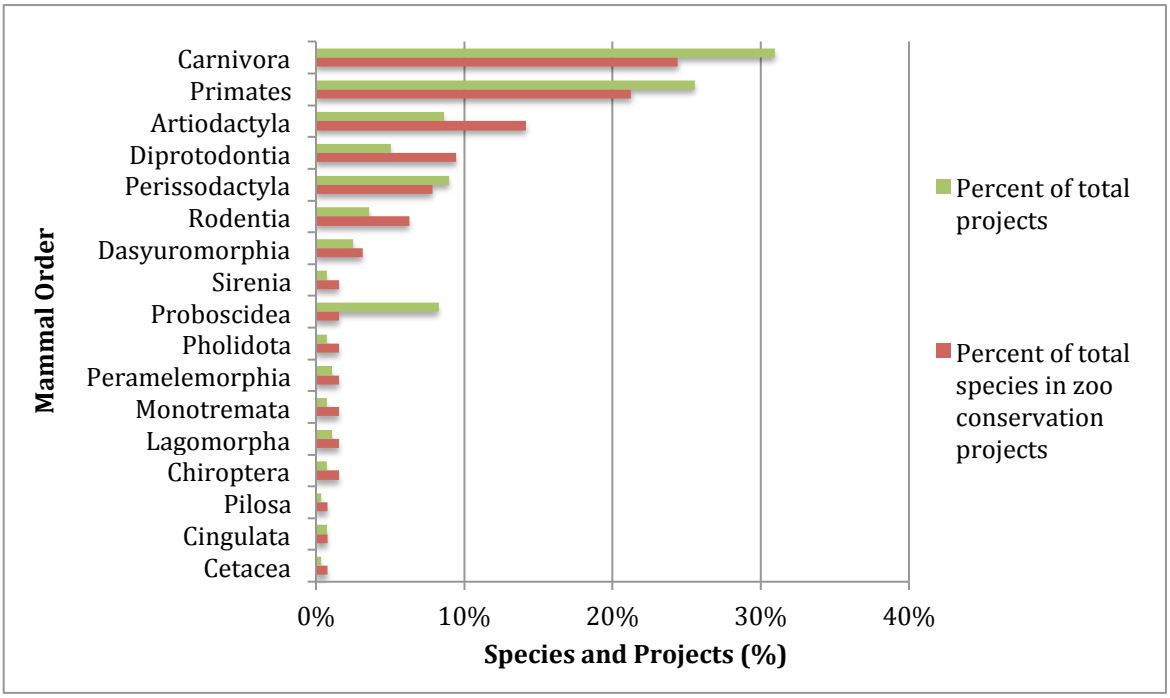

Figure 3.7. Percentage of zoo conservation effort focused on various mammal orders, by number of species targeted and by number of projects. Listed in decreasing order of percent of total species in zoo conservation projects.

It can be seen that Carnivora, more commonly referred to as carnivores (24.41% of total species conserved and 30.94% of total number of projects), and Primates (21.26% of total species conserved and 25.54% of total number of projects) made up the largest percentage of the mammal class for both the projects and species. The high percentage of carnivores and primates is consistent with Gusset and Dick (2010), who examined specifically WAZA supported *in situ* conservation projects and evaluated their effectiveness. Although an earlier study (Seddon, Soorae and Launay 2006) found that

carnivores and Artiodactyla (even-toed ungulates) represented the highest two percentages they were looking specifically at reintroduction projects.

One other note is the Proboscidea order had a low percentage of total species as only two species were represented, African elephants and Asian elephants. However the percent of total projects was much higher as there are 22 total zoo projects focusing on that order.

The bird class was then evaluated to determine which orders were primarily represented in zoo conservation projects (Figure 3.8).

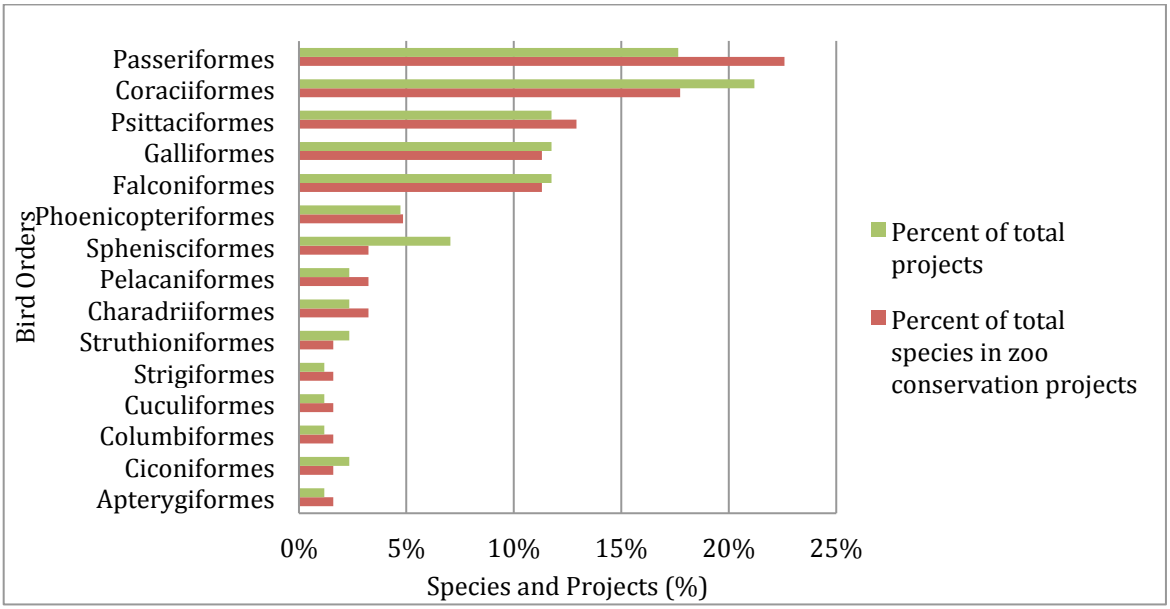

Figure 3.8. Percentage of species and projects for bird orders.

The most represented order was Passeriformes (22.58% and 17.65%). This order contains so-called "perching birds," includes songbirds, and comprises the majority of birds. Given their high numbers and visibility it is not surprising they have the highest percent of total species involved in projects and the second highest percentage of total projects. The order with the second highest percent of total species and highest percent is Coraciiformes (17.74% and 21.18%) and they include kookaburras, kingfishers, and other species which are generally described as colorful and exotic (Graham). Next are Psittaciformes (12.90% and 11.76%), which includes parrots, cockatoos, and lorikeets. Then Galliformes (11.29% and 11.76%) which include turkeys, chickens, and pheasants and Falconiformes (11.29% and 11.76%), which are the diurnal birds of prey.

There are only three orders of amphibians, Anura, Caudata, and Caecilian. Of those, two are represented in the conservation projects examined, Anura and Caudata. Three projects are centered around animals from the order Caudata, commonly salamanders, whereas the remaining 21 species and 25 projects are for species from the Anura order, or frogs.

3.5 SPECIES BIAS

The literature indicates that there are clear preferences by zoo visitors for certain species with certain characteristics. The data suggest that a similar preference for certain classes and orders of animals is seen in conservation projects. Further review of information obtained through interviews adds to this picture.

One of the factors involved in selecting conservation projects is seeing what animals are already in residence within a zoo facility. Dr. Fred Koontz, the Vice President of Field Conservation at Woodland Park Zoo said that field projects truly start at the zoo itself and a first step at Woodland Park is often to look at what animals are already present. The staff then tries to find projects for those in which they think it is possible to make a difference.

Not all of the zoo officials interviewed indicated that the presence of the animals at the zoo was a defining criterion for deciding on conservation projects. However even those that did not readily consider this factor at the onset of choosing projects admitted they may use it as a tiebreaker when deciding between multiple projects to engage in or fund. Interviewees went on to note there are valid reasons for this approach. Interviewee 3, a Conservation Educator, said that by engaging in conservation projects where a proxy animal can be viewed in the zoo, a clearer story emerges for the visitor. Education about threats and solutions are then made more tangible.

As previously noted, zoo collections are in large part assembled to entice visitors and make them want to come to the zoo. Since projects are frequently begun by reviewing animals within an established collection, it is clear that such choices are being made within an already pre-selected group. That is, the species bias that is already present in zoo collections can be carried over to conservation project selection by giving preference to existing animals at the zoo. Animals commonly held in zoo collections are,

"ones that have been held in captivity historically, or are easy to breed or easy to source from the wild, not the ones that are most conservation dependent" (West and Dickie 2007: 8). It should be noted that a number of the zoos specified that their existing collections do contain a large proportion of threatened species. However this does not necessarily entail an equal distribution of threatened species across classes or indeed ones chosen for conservation projects.

Species bias as a concept was brought up in most of the interviews. The majority of the zoos readily indicated a general knowledge of the public preferences towards more traditionally appealing species such as mammals. Dr. Friederike von Houwald of the Zoologischer Garten Basel pointed out that though it was "sad," it was usually "much easier to run a campaign when you have a cute, cuddly, lovely [animal]." Interviewee 3 listed great apes, elephants, cats, tigers, and cheetahs as species that the public seemed greatly interested in and moved by. Interviewee 7, a Wildlife Director, discussed the broader term of "charismatic mega-vertebrates," and how it was much easier to find those willing to fund these larger, more appealing animals. While all interviewees would likely agree with the belief that all animals are charismatic species, as vocalized by Interviewee 4, a Conservation Director, the interviews clearly indicated knowledge of the biases and visitor preferences that are inherent within many zoo frameworks.

When discussing whether the species bias entered into the decisions about conservation projects, only two interviewees stated that it did not impact their process. The remaining eight of the interviewees indicated that their zoos ascribed in some way to the preferences in order to captivate public attention and funds. However many of those stated that only the animals announced to the public were impacted, while their overall conservation missions remained across all taxonomic groups. In addition it should be noted that even if the zoos chose one class more readily over another, the interviewees made it clear that all the animals chosen were picked because they represented a species facing some level of threat, even if not specified by the IUCN Red List, in a location where the zoos might be able to make a positive difference.

3.6 QUALIFICATIONS

Some of the above discussion is subject to qualifications that need to be elucidated for full and precise understanding.

3.6.1 IUCN Red List

The IUCN Red List provides one of the few globally recognized formats for determining the relative threatened level of different species and as such was selected as a tool to evaluate conservation projects in this study. However, there are issues with that instrument that should be realized.

One such issue is that the IUCN Red List is not universally used by zoos to evaluate their conservation projects. While many of the zoos interviewed did use the IUCN Red List in evaluating some or all of their projects, others supplemented that list with more localized information. Out of the ten interviewed zoos, eight reported on what sources they used to determine the level of threat for potential conservation projects. Five zoos stated that they used the IUCN Red List. One zoo denied using it at all and two others noted that a variety of other lists were used. Of the zoos that employed the Red List, three pointed to the additional use of such other inventories as state, provincial, or federal endangered species lists as well as regional collection plans.

This multitude of lists is important for the zoos as some species are not listed on the Red List or there is insufficient data to give them a designated level of threat. For example, the Oregon Silverspot Butterfly (*Speyeria zerene hippolyta)* is in the Not Evaluated category on the IUCN Red List. However, it is only found in Oregon and California and is classified as Threatened by the United States Endangered Species Act (FWS 2013). Thus, expanding the list of designations gives a more precise picture for this animal.

In addition, the IUCN Red List is a global ranking system and as such looks at a species across the whole world in order to determine a designation for that species. Thus a species may be deemed of Least Concern by the IUCN Red List because it has a sufficient population worldwide, while in a particular region it may be critically endangered. For example, the Bearded Vulture (*Gypaetus barbatus*) has a satisfactory world population and is listed as Least Concern by the IUCN Red List. However its population is very sporadic with high numbers in some areas, and very low numbers in

other areas like Egypt. It has seen a great decline in Europe and only through reintroductions have the populations begun to recover (Ferguson-Lees and Christie 2001, Margalida et al 2008, and Ogada et al 2011).

While these qualifications are noteworthy, I do not believe they overly detract from the final results. The preliminary research involving which conservation projects are chosen by zoos and the ratio of the various taxonomic groups are not impacted by the Red List and the List is used as a construct for comparison purposes. In addition, expanding the inclusion criteria beyond the Red List occurred in a minority of the cases, like the above noted vulture and butterfly and are indicated in the graphic data.

3.6.2 Aquariums

As this study is focused solely on zoos it does not take into account conservation projects run by aquariums. While some zoos do have projects focused on aquatic animals, those were not counted in the results with the exception of marine mammals with a terrestrial component such as walruses. However many aquariums are involved in terrestrial conservation projects. Thus it is possible that some of the ratios of taxonomic groups may be different if conservation projects from aquariums were also included. It should be noted though that a study that looked at the threatened level of reintroduction projects and included fish echoed the findings of this survey in that mammals and birds are over-represented in conservation projects (Seddon, Soorae, Launay 2006).

3.7 FLAGSHIP SPECIES

An aspect of this study that emerged as the interviews progressed is that much of the data is based on publicly available material. While this was done in an effort to elucidate what is in essence “sold” to the public, it is not always representative of the entirety of the conservation projects. This became clear during a number of the interviews and proves an interesting insight into the conservation projects and their marketing as well as raising questions about the relative benefits and negatives regarding what is communicated to the general public, a topic that will be further expanded in the discussion.

Many of the zoos interviewed stated they would use a more charismatic species as

the front of their conservation program, a so-called "flagship" species. While the species used would certainly be one in need of conservation, it would serve an additional role of engaging the public and thus be a more effective front for raising funds not only for itself, but for other less "publically desirable" species.

Dr. Friederike von Houwald, a Curator involved in conservation-oriented projects at the Zoologischer Garten Basel, said that zoos often use these more attractive species to garner the attention of the visitor and thus more effectively bring in funds which can then be subsequently used for the less endearing species. Interviewee 7 indicated that several invertebrates and frogs are benefited by the zoo's chimp and gorilla projects located in the same locale.

Dr. Koontz expanded on this concept by noting that the Woodland Park Zoo often chooses larger animals not only because of their public appeal, but also because of their large ranges. That is, if a project is focused on the tiger or the elephant, part of that project may involve either managing or protecting the entirety of that species' habitat. The habitat of tigers and elephants can be quite extensive and many other smaller species are benefited by such attention. Dr. Koontz referred to the example of the tiger and its rich surrounding ecosystem by eloquently saying, "If you save the tiger, you save the forest."

Thus the conservation projects compiled in the previous results may not be fully representative of all the animals aided through the projects. Instead it is representative of the animals that the zoos base their projects upon and advertise to the general public. The fact remains that some animals are aided indirectly through such actions as habitat management projects. Numbers are more difficult to identify in this intangible situation, but it clearly represents a conservation benefit, albeit one not as easily quantified.

While the animals chosen as a front for the projects' flagship species are often the more charismatic megafauna, zoos often do try to engage those animals upon whom a majority of an ecosystem may be dependent, a so-called "keystone species." This is much easier for areas where animals such as elephants are the keystone species, however it is much more difficult where a species such as an ant may be the keystone species.

3.8 CONCLUSION

A species bias is clearly noted in this investigation. It is suggested by the literature, quantified by the study data, and discussed by zoo conservation personnel. The preferential order includes mammals first, followed by birds, reptiles, amphibians, and terrestrial invertebrates.

However it seems equally apparent that the zoos are dedicated to promoting and achieving conservation and are utilizing various methods to achieve this goal. A large percentage of zoo projects are focused on globally threatened species, with additional projects focused on more locally threatened ones. Zoos often try to exploit biases in creative ways to benefit some of the less preferred species. Showcasing flagship species for projects takes advantage of such animals' large range and complex ecosystems and is used to garner public support and thus enhance funding.

However this brings up a number of questions in regards to whether or not this is the best way for zoos to conduct these projects. While the projects themselves may be tailored to a larger number of species this is often not made clear in the publicized information. This survey was based primarily on zoo information made available to the general public and as such it remains unclear whether the bias exists solely within the published material or whether the projects themselves are also much more specified then the zoos might prefer.

This study and others indicate that there is a strong focus on some species, generally the charismatic megafauna, but by feeding into this preference are zoos to some extent continuing to promote it in exchange for funding? On the one hand the public needs to be engaged for both funding support and for the more long-term education goals. On the other hand though, if people are only recognizing the species-based approach of the zoo, it could hinder future conservation projects. Is this a reasonable exchange or could more be accomplished by focusing on the reality of ecosystems in all their complexity and trying to educate the public about this? In terms of engaging the public, this becomes a difficult line for zoos to tread. Understanding the complexities and interrelationships that characterize ecosystems could spur more meaningful human action.

Zoos may argue they are addressing these issues on their own, taking the financial support from the public and putting it towards habitats and species that are not adequately

recognized and promoted. However might it be more effective and certainly more forthright if the public knows about these actions as well? One argument could certainly be that zoos wouldn't get as much funding with a more generalized approach. A counter argument could be this is a short-term plan that does not look to long-term results and the need for cementing awareness for all species across a global range.

CHAPTER 4: DISCUSSION

Zoos have been a part of the human experience for thousands of years, employing varying formats, methods, and missions throughout that long history. What began with man's fascination with other species has been alternately exalted, explored, and exploited. This evolution continues to the present as zoos transition from one form to another.

The focus of this investigation has revolved around the transition of zoos from entertainment and recreational venues to full partners in meaningful conservation efforts. The answer to the central question, "Are zoos succeeding in and living up to their conservation pledges and goals?" is found to be complex but remains vitally important to a natural world that is increasingly at risk. While some would purport, either through their words or actions, that an effective conservation orientation has been embraced, others indicate that it is still a transition that is very much in progress, a careful balancing act that must be understood and supported.

This transition is difficult because of the myriad of pressures that are placed on zoos and the number of issues and tensions to which such pressures lead. Both internal and external forces ranging from public pressure, to governance, to funding, to the logistics of the conservation projects themselves, make it difficult for the zoos to reconcile the basic conditions needed for daily operations with those needed for conservation.

Species bias, the preferential treatment of certain species, is known to exist not only in the public mindset, but in the makeup and emphases of zoo collections. This has been explored in the literature in a number of studies. What has not been as widely and similarly investigated is whether or not such a bias exists within the conservation projects in which zoos engage. This investigation suggests that a similar process of taxonomic preference indeed occurs in conservation projects associated with zoos. This adds additional strength to the knowledge base about this issue. Pinpointing this finding allows further expansion on both the pressures that predispose to it and its ramification on animal protection. Challenges can be met and solutions explored only when facts are as complete as possible.

Although this study did document species bias, the data also indicated that over two thirds of the conservation projects reviewed did indeed focus on species considered

threatened on a worldwide scale. Some other species were considered threatened on a more local level even if the IUCN designation was not as definitive.

This study also featured interviews with zoo personnel and fulfilled the hope that more nuanced information could be obtained through personal discussions. The interviews suggested that, for the most part, zoos recognized species bias and were aware of the funding and promotional benefits that accompanied the inclusion of publicly popular species. Such a finding allowed exploration into how zoos have dealt with this issue and as such, potentially opens up avenues for additional creativity. For example, the fact that zoos recognized the marketing power of certain species did not equate with blind allegiance to the old business adage that one must always, "give the customer what he wants." It became clear that less popular species can be benefited even when showcasing the larger popular mammals. The stories and images of these "flagship species" are emphasized and promoted by zoos, but the reality is that wider ranging effects can be seen. Thus, the advantage of this technique is that a variety of animals receive conservation assistance while the preferential funding triggered by charismatic animals is maintained.

Uncovering this technique is of value because conservation strategies can be further understood and amplified. For example, on a deeper level, the concept and importance of ecosystems is underscored with this technique. There is great value in emphasizing the interrelationships, dependencies, and complexities of ecosystems. Biologist Robert Vrijenhoek shared his ideas on this subject saying,

> The public focuses its emotional and economic attention on saving a few charismatic species (e.g., whales, pandas, rhinos, condors) while generally failing to understand the tattered threads that form the connections in the web of life (2005: 74)

Additional and full disclosure of the nature of the flagship species concept should be an integral part of zoos' message, rather than being relegated to a ruse that trades popularity for funding. Even though flagship species may be in need of conservation, they currently can be used as facades. An alternative approach may be admission that such flagship species are actually representations of more complex work that occurs within each project. This approach would emphasize the visualization of the world as a series of related relationships rather than a series of separate individuals.

The valuable contributions that zoos can make to educational efforts were touched on in this investigation. Zoos can reach a wide number of people and it may be informative to focus this considerable educational potential on the broader ecosystem concept rather than on individual species information. Humans are often the perpetrators of many different threats to the natural world and so it seems that increasing knowledge about that world and what can be and is already being done could help create more active participants in conservation efforts. Zoos cannot directly impact every species. But by spreading the message of their work with some species in the framework of a complex ecosystem, increased tolerance and care for all species could be enhanced.

In addition, future investigations could and should focus more fully on evaluations of the efficacy and impact of the educational component of zoos. Zoos have made education an important aspect of their overall identity, but the outcomes and potential benefits of those educational components need to be measured and expressed more clearly and accurately. For zoos to promote education as such an integral part of their daily work as well as their conservation commitment, that education must be further evaluated to determine whether or not it is as essential a part of conservation as zoos report.

Much has been said about the zoos' responsibility to their patrons, but little has been said about the zoos' responsibility to the animals. It was clear throughout the interview process that zoo conservation officials within this study are motivated, sincere professionals with a strong drive to positively impact conservation work. When asked about the future of conservation projects, a definite majority wanted to expand their efforts by including additional species or achieving greater depth and focus within existing projects. Such a dedication to all animals needs to be communicated to the larger public. Animals within the zoos and those in the wild involved in projects are not merely objects of curiosity that can help humans pass an afternoon of leisure but are engaged in the same survival threats that impact all.

The zoos in the study focused on 267 species, a large number, but one that pales in comparison to the millions of species worldwide, and the large proportion of those that are threatened. The 31 zoos in this study were selected on the strength of their conservation efforts, so it is likely that other zoos will exhibit smaller numbers or less

successful projects. Zoos are not capable of saving all species as the Noah's Ark analogy once suggested, but they are capable of a great deal, whether it is hands-on projects, raising funds, or inspiring and educating the world. An eloquent vision for the future of zoos is voiced by David Hancocks,

> The ultimate goal is that zoos become energetic, passionate, and skillful protectors and advocators of all things in Nature. The new zoos must engage themselves directly in new ventures and become active champions of wildlife conservation and environmental survival and breed empathy and tolerance as much as they breed emus and tigers. (2001: 251-52)

Making this vision a reality requires continued work and study. Zoos face considerable pressures but have considerable potential and as such can be significant conservation contributors.

One issue this study highlighted was the need for increased standardization and clarity across zoo conservation fronts, as comparing and indeed defining conservation was difficult. This might include more standard reporting of conservation activities and increased consistent monitoring of which animals are currently focused on in conservation projects. It would help to streamline the process as well as ensuring adequate species diversity within the projects.

Zoos have had positive impacts on wildlife conservation. Increased education as to the diversity of the natural world and how these are echoed in the conservation projects could be effective as a long-term strategy for public engagement.

4.1 STUDY STRENGTHS AND LIMITATIONS

There are limitations to the study that if attended to could increase its value and effectiveness. First and foremost, the numbers within the study are small and subsequent analyses could increase the number of zoos evaluated. This would then boost the corresponding numbers of projects and species evaluated and could lead to more nuanced information from additional interviews. Secondly, a lack of standardization within a variety of reviewed factors existed throughout the study. Although this was noted and attempts to standardize discussion within study criteria were made, more consistency in such areas as conservation descriptions, activities, and goals would simplify and strengthen the narrative. Thirdly, the use of flagship species was considered a creative

approach to a dilemma of conservation. Intuitively this seems correct, but if subsequent investigations could corroborate this by looking specifically at the fate of the ancillary species that are presumably benefited by association, this consideration could be more definitive. Lastly, in studies involving person-to-person interviews the communication style of the interview may lead to under or over representation of the issue.

The interviews also represent a strength of the study however as they provide information not always readily obtained through other sources. During a conversation, clarification and follow-up can be pursued and is immediate, helping to dispel communication inadequacies. Another strength revolves around the fact that this study attends to some gaps in the literature and looks at global participation by individual zoos. Such worldwide inclusion allows for important discussions about issues such as cultural differences. Finally, considerable background information was researched and included in the narrative sections. This approach contributed to creating a fuller picture of the complex pressures that zoos face.

4.2 FUTURE STUDIES

Future studies in a variety of different areas could help to further understand and expand issues present in zoo conservation as well as contribute to solutions. One of the most difficult types of study, but one of the ones most suited to understanding the impact of zoos, is evaluating how zoos are affecting their visitors. It is challenging to examine the impact that zoos alone can have on multiple individuals. One of the most common tools used for attempting to quantify this is the visitor survey. While this does give some indication and has been informative, it is limited in time and scope and does not give much data on future actions and how those can have a measurable impact on conservation. Especially valuable within the category of zoos' effects on visitors would be further assessments of educational efficacy, focusing on techniques, methods, and message. A comparative study that would look specifically at ecosystem education versus the current standard of individual animal education could be particularly beneficial.

Aquariums were not included in this study even though a variety of different zoos are directly or indirectly affiliated with aquaria. A similar evaluation of such institutions and their zoo associations would be valuable, especially in light of significant oceanic

threats and the subsequent need for aquatic conservation.

Standardization issues could certainly benefit from further attention. As noted in the previous sections, standardization of all aspects of conservation would improve subsequent analyses of conservation impact. With this groundwork in place, the different interpretations of the essence of conservation could be emphasized and evaluated compared to one another. These might include hands-on participation, assisting other zoos or partners with funding, education, or on site-research.

As noted in the previous section, a study looking at the extent and success of projects involving flagship species would be useful. Looking specifically at animals that receive "fall-out" benefit from their association with the designated animal serving as the project's front could help focus on what benefits are bestowed and how far reaching they are. Relative success could then be interpreted more easily and actions could be adjusted accordingly.

REFERENCES

African Association of Zoos and Aquaria (PAAZAB). *About Us*. Retrieved June 15 2013 from www.zoosafrica.com/about.html

Alcorn, J.B. (1993). Indigenous peoples and conservation. *Conservation Biology*, 7(2), 424-426. doi: 10.1046/j.1523-1739.1993.07020424.x

Allen, K. (1995). Ethical parameters for marketing and public relations. In: Norton, B.G., Hutchins, M., Stevens, E.F., and Maple, T.L. (eds.) *Ethics on the Ark: Zoos, Animal Welfare, and Wildlife Conservation*, pp. 289-296. Smithsonian Institution. Washington, DC. Print.

Anderson, U.S., Kelling, A.S., Pressley-Keough, R., Bloomsmith M.A., Maple, T.L. (2003). Enhancing the zoo visitors' experience by public animal training and oral interpretation at an otter exhibit. *Environment and Behavior*, 35(6), 826-841. doi: 10.1177/0013916503254746

Animal Welfare Act (AWA), 7 USC §§ 2131-2159 (2010).

Araki, H., Cooper, B., and Blouin, M.S. (2007). Genetic effects of captive breeding cause a rapid, cumulative fitness decline in the wild. *Science*. 318(5847): 100-103. doi: 10.1126/science.1145621

Association of Zoos and Aquariums (AZA). (2009). *Conservation*. Retrieved May 14, 2013 from http://www.aza.org/conservation

Association of Zoos and Aquariums (AZA). (2012). *Zoo and aquarium statistics*. Retrieved 14 May 2013 from http://www.aza.org/zoo-aquarium-statistics

AZA Field Conservation Committee (2012). *Toolkit for increasing AZA-accredited zoo and aquarium contributions to field conservation* Retrieved 2 July 2013 from http://www.aza.org/uploadedFiles/Conservation/Toolkit%20for%20Increasing%20Field%20Conservation%20Contributions%202012_Final.pdf

AZA Field Conservation Committee. (2013). *Defining field conservation for the AZA community.* Retrieved 11 July 2013 from http://www.aza.org/uploadedFiles/Conservation/TheDefinitionofConservation_FCC2012.pdf

Balmford, A. (2000). Separating fact from artifact in analyses of zoo visitor preferences. *Conservation Biology,* 14(4), 1193-1195. doi: 10.1046/j.1523-1739.2000.99078.x

Balmford, A., Mace, G. M., and Leader-Williams N. (1996). Designing the ark: setting priorities for captive breeding. *Conservation Biology*, 10(3), 719-727. doi: 10.1046/j.1523-1739.1996.10030719.x

Beers, D.L. (2006). *For the Prevention of Cruelty: The History and Legacy of Animal Rights Activism in the United States.* Swallow Press, Ohio. Print.

Bitgood, S. (1989). Deadly sins revisited: A review of the exhibit label literature. *Visitor Behavior*, 4(3), 4-11. Retrieved 23 March 2013 from http://archive.informalscience.org/researches/VSA-a0a2e7-a_5730.pdf

Bitgood, S., Patterson, D., and Benefield, A. (1988). Exhibit design and visitor behavior: empirical relationships. *Environment and Behavior*, 20(4), 474-491. doi: 10.1177/0013916588204006

Borkfelt, S. (2011). What's in a name?—Consequences of naming non-human animals. *Animals*, 1(1), 116-124. doi: 10.3390/ani1010116

Braverman, I. (2013). *Zooland: The Institution of Captivity*. Stanford University Press, Stanford. Print

British and Irish Association of Zoos and Aquariums (BIAZA) (2013). *Home-Biaza*. Retrieved 15 June 2013 from www.biaza.org.uk

Canada's Accredited Zoos and Aquariums (CAZA). (2013). *CAZA Home*. Retrieved 15 Jun 2013 from www.caza.ca

Christie, S. (2007). Zoo-based fundraising for in situ wildlife conservation. In: Zimmerman, A., Hatchwell, M., Dickie, L., and West, C. (eds.) *Zoos in the 21st Century: Catalysts for Conservation*, pp. 257-274. Cambridge University Press. Cambridge, UK. Print.

Coe, J.C. (1989). The Genesis of Habitat Immersion in Gorilla Exhibits, Woodland Park Zoological Garden and Zoo Atlanta, 1978-88, (unpublished). Retrieved 6 June 2013 from http://www.joncoedesign.com/pub/PDFs/GeneisHabitatGorilla1989.pdf

Conway, W. (2007). Entering the 21st century. In: Zimmerman, A., Hatchwell, M., Dickie, L., and West, C. (eds.) *Zoos in the 21st Century: Catalysts for Conservation*, pp. 12-21. Cambridge University Press. Cambridge, UK. Print.

Council Directive (EC) 1999/22/EC of *29 March 1999 relating to the keeping of wild animals in zoos.* [1999] OJ L94/24.

Croke, V. (1997). *The Modern Ark: The Story of Zoos: Past, Present & Future*. Scribner, New York. Print.

Dalton, R.J. (2005). The greening of the globe? Cross-national levels of environmental group membership. *Environmental Politics*, 14(4), 441-459. doi: 10.1080/09644010500175783

Davey, G. (2005). Relationships between exhibit naturalism, animal visibility and visitor interest in a Chinese Zoo. *Applied Animal Behavior Science*. 96(1): 93-102. doi: 10.1016/j.applanim.2005.04.018

European Association of Zoos and Aquaria (EAZA). (2012). *EAZA Members.* Retrieved 15 June 2013 from www.eaza.net/mempership/Pages/Members.aspx

Ferguson-Lees, J. and Christie D.A. (2001). *Raptors of the World*. Illus. Franklin, K., Mead, D., and Burton, P. Houghton Mifflin, New York.

Frost, W. (2011) (Ed). *Zoos and Tourism: Conservation, Education, Entertainment?* Channel View Publications, Bristol. Print.

Frynta, D., Lišková, S., Bültmann, S., and Burda, H. (2010). Being attractive brings advantages: the case of parrot species in captivity. *PLoS ONE,* 5(9). doi: 10.1371/journal.pone.0012568

Friends of Nairobi National Park (2013). Boma Predator Deterrent by Turere LED lights. Retrieved 7 May 2013 from http://fonnap.wordpress.com/frontpage

Global Environment Facility (GEF). (2010). *GEF annual report 2010*. Retrieved 14 May 2013 from http://www.thegef.org/gef/sites/thegef.org/files/publication/WBAnnualReportText.revised.pdf

Gould, C. G. (2004). *The Remarkable Life of William Beebe: Explorer and Naturalist.* Island Press, Washington D.C

Graham, K. *Coraciiformes Taxon Advisory Group: Association of Zoos and Aquariums.* Retrieved 30 July 2013 from www.coraciiformestag.com

Gunnthorsdottir, A. (2001). Physical attractiveness of an animal species as a decision factor for its preservation. *Anthrozoos*, 14(4), 204-215. doi: 10.2752/089279301786999355

Gusset, M. and Dick, G. (2010). 'Building a future for wildlife'? Evaluating the contribution of the world zoo and aquarium community to *in situ* conservation. *International Zoo Yearbook*, 44(1), 183-191. doi: 10.1111/j.1748-1090.2009.00101.x

Hance, J. L. (2012). *Life is Good: Conservation in an Age of Mass Extinction*. Mongabay.com. Print.

Hancocks, D. (1995). Lions and tigers and bears, oh no! In: Norton, B.G., Hutchins, M., Stevens, E.F., and Maple, T.L. (eds.) *Ethics on the Ark: Zoos, Animal Welfare, and Wildlife Conservation*, pp. 31-37. Smithsonian Institution. Washington, DC. Print.

Hancocks, D. (2001). *A Different Nature: The Paradoxical World of Zoos and Their Uncertain Future.* University of California Press, Berkeley. Print.

Holst B. and Dickie L.A. (2007). How do national and international regulations and policies influence the role of zoos and aquariums in conservation. In: Zimmerman, A., Hatchwell, M., Dickie, L., and West, C. (eds.) *Zoos in the 21st Century: Catalysts for Conservation*, pp. 22-33. Cambridge University Press. Cambridge, UK. Print.

Hoage, R.J. (1996). Epilogue. In: Hoage, R.J. and Deiss, W.A. (eds.) *New Worlds, New Animals: From Menagerie to Zoological Park in the Nineteenth Century*, pp. 136-140. The Johns Hopkins University Press, Baltimore, MD. Print.

Hoage, R.J., Roskell, A., and Mansour, J. (1996). Menageries and zoos to 1900. In: Hoage, R.J. and Deiss, W.A. (eds.) *New Worlds, New Animals: From Menagerie to Zoological Park in the Nineteenth Century*, pp. 8-17. The Johns Hopkins University Press, Baltimore, MD. Print.

Horowitz, H.L. (1996). The National Zoological Park. In: Hoage, R.J. and Deiss, W.A. (eds.) *New Worlds, New Animals: From Menagerie to Zoological Park in the Nineteenth Century*, pp. 126-135. The Johns Hopkins University Press, Baltimore, MD. Print.

Hutchins, M. and Conway, W.G. (1995). Beyond Noah's Ark: the evolving role of modern zoological parks and aquariums in field conservation. *International Zoo Yearbook*, 34(1), 117-130. doi: 10.1111/j.1748-1090.1995.tb00669.x

International Union for the Conservation of Nature (IUCN). (2013a). *Home*. Retrieved 3 May 2013 from http://www.iucn.org

International Union for the Conservation of Nature (IUCN) (2013b). *The IUCN Red List of Threatened Species*. Retrieved 5 May 2013 from http://www.iucnredlist.org

Jamieson, D. (1985). Against zoos. In Singer, P. (ed.) *Defense of Animals*. Pp. 108-117. Ed. Basil Blackwell: New York.

Jamieson, D. (1995). Zoos revisited. In: Norton, B.G., Hutchins, M., Stevens, E.F., and Maple, T.L. (eds.) *Ethics on the Ark: Zoos, Animal Welfare, and Wildlife Conservation*, pp. 52-66. Smithsonian Institution. Washington, DC. Print.

Jarvis, C. (1965). Zoos and conservation symposium. *International Zoo Yearbook*, 5(1), 97-100. doi: 10.1111/j.1748-1090.1965.tb01585.x

Johnson, K. (2010, September 27). Raising frogs for freedom, prison project opens doors. *The New York Times*. Retrieved 21 June 2013 from http://www.nytimes.com/2012/09/28/us/raising-frogs-for-freedom-prison-project-opens-doors.html?_r=0

Kellert, S. R. and Dunlap, J. (1989). *Informal Learning at the Zoo: A Study of Attitude and Knowledge Impacts*. Zoological Society of Philadelphia, Philadelphia, PA. Print.

Leader-Williams, N. and Dublin, H.T. (2000). Charismatic megafauna as 'flagship species. In A. Entwistle and N. Dunstone. (eds.) *Priorities for the Conservation of Mammalian Diversity: Has the Panda Had its Day?,* pp. 53-84. Cambridge University Press: Cambridge, UK. Print.

Mace G.M., Balmford, A., Leader-Williams, N., Manica, A., Walter, O., West, C., Zimmerman, A. (2007). Measuring conservation success: assessing zoos' contribution. In: Zimmerman, A., Hatchwell, M., Dickie, L., and West, C. (eds.) *Zoos in the 21st Century: Catalysts for Conservation*, pp. 322-342. Cambridge University Press. Cambridge, UK. Print.

Marešová, J. and Frynta, D. (2008). Noah's Ark is full of common species attractive to humans: the case of boid snakes in zoos. *Ecological Economics,* 64(3), 554-558. doi: 10.1016/j.ecolecon.2007.03.012.

Margalida, A., Heredia, R., Razin, M., and Hernández, M. (2008). Sources of variation in mortality of the Bearded Vulture *Gypaetus barbatus* in Europe. *Bird Conservation International*, 18(1), 1-10. doi: 10.1017/S0959270908000026

Mazur, N.A. (2001). *After the Ark? Environmental Policy Making and the Zoo.* Melbourne University Press, Victoria. Print.

McGraw, A. and Weaver S. (2001). Developing the new "heart" of the San Diego Zoo. *Visitor Studies Today*, 4(1), 4-7. Retrieved 23 June 2013 from http://archive.informalscience.org/researches/VSA-a0a6t4-a_5730.pdf

Metrick, A. and Weitzman, M. L. (1996). Patterns and behavior in endangered species preservation. *Land Economics,* 72, 1-16. Retrieved 27 June 2013 from http://www.jstor.org/stable/3147153

Metrick, A. and Weitzman, M. L. (1998). Conflicts and choices in biodiversity preservation. *Journal of Economic Perspectives*, 12(3), 21-34. Retrieved 27 June 2013 from http://scholar.harvard.edu/weitzman/files/conflicts_choices.pdf

Morgan, J.M. and Hodgkinson, M. (1999). Motivation and social orientation of visitors attending a contemporary zoological park. *Environment and Behavior*, 31(2), 227-239. doi: 10.1177/00139169921972074

Moss, A. and Esson, M. (2010). Visitor interest in zoo animals and the implications for collection planning and zoo education programmes. *Zoo Biology*, 29(6), 715-731. doi: 10.1002/zoo.20316

National Resources Defense Council (NRDC). (2011). *NRDC financial report*. Retrieved 14 May 2013 from http://www.nrdc.org/about/annual/nrdc_annual_report2011.pdf

Nechay, G. (1996). Editorial. *Naturopa*. 82(3).

Ogada, D. L., Keesing, F., Virani, M. Z. (2011). Dropping dead: causes and consequences of vulture population declines worldwide. *Annals of the New York Academy of Sciences*, 1249, 57-71. doi: 10.1111/j.1749-6632.2011.06293.x

Oregon State Police Fish and Wildlife Division (FWD). (2010). *Two men sentenced following investigation into unlawful taking of flat abalone.* The Field Review. Retrieved 31 Jun 2013 from http://www.oregon.gov/osp/FW/docs/newsletter/january2010.pdf

Penning, M., Reid, G. McG., Koldewey, H., Dick, G., Andrews, B., Arai, K., Garratt, P., Gendron, S., Lange, J., Tanner, K., Tonge, S., Van den Sande, P., Warmolts, D. and Gibson, C. (Eds) (2009). *Turning the Tide: A Global Aquarium Strategy for Conservation and Sustainability*. World Association of Zoos and Aquariums (WAZA), Bern, Switzerland. Retrieved 2 July 2013 from http://www.waza.org/files/webcontent/1.public_site/5.conservation/conservation_strategies/turning_the_tide/Aquarium%20strategy%20EN.pdf

Reed, D. H., O'Grady, J.J., Brook, B. W., Ballou, J. D., Frankham, R. (2003). Estimates of minimum viable population sizes for vertebrates and factors influencing those estimates. *Biological Conservation*, 113(1), 23-34. doi: 10.1016/S0006-3207(02)00346-4

Rees, P.A. (2005). Will the EC Zoos Directive increase the conservation value of zoo research? *Oryx*, 39(2), 128-131. doi: 10.1017/S0030605305000335

Rees, P.A. (2011). *An Introduction to Zoo Biology and Management*. Wiley-Blackwell, Oxford. Print.

Royal Society for the Protection of Birds (RSPB). (2012). *Annual review: saving nature for future fenerations RSPB's year 2011-12.* Retrieved 14 May 2013 from http://www.rspb.org.uk/Images/The_RSPBs_year_2011-12_tcm9-325474.pdf

Seddon, P.J., Soorae, P.S., and Launay, F. (2006). Taxonomic bias in reintroduction projects. *Animal Conservation*, 8(1), 51-58. doi: 10.1017/S1367943004001799

Shaffer, M.L. (1981). Minimum population sizes for species conservation. *BioScience*, 31(2), 131-134. doi: 10.2307/1308256

Smith, R. (2013). *Oregon Zoo*. The Oregon Encyclopedia-Oregon History and Culture. Retrieved 13 June 2013 from http://www.oregonencyclopedia.org/entry/view/oregon_zoo

Snyder, N. F.R., Derrickson, S. R., Beissinger, S. R., Wiley, J. W., Smith, T. B., Toone, W. D. and Miller, B. (1996). Limitations of captive breeding in endangered species recovery. *Conservation Biology*, 10(2), 338–348. doi: 10.1046/j.1523-1739.1996.10020338.x

Stott, R.J. (1981). The historical origins of the zoological park in American thought. *Environmental Review*, 5(2), 52-65. doi: 10.2307/3984250

Swanagan, J. S. (2000). Factors influencing zoo visitors' conservation attitudes and behavior. *The Journal of Environmental Education*, 31(4), 26-31. doi: 10.1080/00958960009598648

Taylor, J.H. (2001). *Death and the Afterlife in Ancient Egypt*. The British Museum Company Ltd., Chicago. Print.

The Nature Conservancy. (2012). *The Nature Conservancy 2012 annual report*. Retrieved 14 May 2013 from http://www.nature.org/media/annualreport/annualreport2012_global.pdf

Tudge, C. (1991). *Last Animals at the Zoo*. Hutchinson Radius, London. Print.

U.S. Fish and Wildlife Service (FWS). (2013). *Species profile-Oregon Silverspot butterfly*. Retrieved 4 August 2013 from http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=I01A

Varner, G.E. and Monroe, M.C. (1991). Ethical perspectives on captive breeding: Is it for the birds? *Endangered Species Update*, 8(1), 27-29.

Vrijenhoek, R. (1995). Natural processes, individuals, and units of conservation. In: Norton, B.G., Hutchins, M., Stevens, E.F., and Maple, T.L. (eds.) *Ethics on the Ark: Zoos, Animal Welfare, and Wildlife Conservation*, pp. 74-92. Smithsonian Institution. Washington, DC. Print.

Wagner, F. (1995). The should or should not of captive breeding In: Norton, B.G., Hutchins, M., Stevens, E.F., and Maple, T.L. (eds.) *Ethics on the Ark: Zoos, Animal Welfare, and Wildlife Conservation*, pp. 209-214. Smithsonian Institution. Washington, DC. Print.

West, C. and Dickie L.A. (2007). Introduction: Is there a conservation role for zoos in a natural world under fire? In: Zimmerman, A., Hatchwell, M., Dickie, L., and West, C. (eds.) *Zoos in the 21st Century: Catalysts for Conservation*, pp. 1-11. Cambridge University Press. Cambridge, UK. Print.

White, J. and Marcellini, D. (1986). HERPlab: A family learning centre at the National Zoological Park. *International Zoo Yearbook*. 24/25: 340-343. doi: 10.1111/j.1748-1090.1985.tb02565.x

Wickins-Drazilova, D. (2006). Zoo animal welfare. *Journal of Agricultural and Environmental Ethics*, 19(1), 27-36. doi: 10.1007/s10806-005-4380-2

Wilson, T. (2010). Exposed: the inaccurate and inappropriate campaign by Zoos Victoria. *Institute of Public Affairs*. 1-16. Retrieved 27 September from http://www.ipa.org.au/library/publication/1278034984_document_100704_-_paper_-_melbourne_zoo_and_political_campaigns.pdf

Woodland Park Zoo (WPZ). (2012). Hornbill Family Nest Adoption Program. Retrieved 7 May 2013 from http://www.zoo.org/page.aspx?pid=1967#.UYl8sqWiek

Woodland Park Zoo (WPZ). (2013). Quarters for Conservation. Retrieved 30 September 2013 from http://www.zoo.org/page.aspx?pid=1993#.Uknz2RZOzCZ

World Association of Zoos and Aquariums (WAZA). (2005). *Building a future for wildlife–the World Zoo and Aquarium conservation strategy*. Retrieved 11 July 2013 from http://www.waza.org/files/webcontent/1.public_site/5.conservation/conservation_strategies/building_a_future_for_wildlife/wzacs-en.pdf

World Association of Zoos and Aquariums (WAZA). (2013). *WAZA Home*. Retrieved June 2 from www.waza.org

World Resources Institute (WRI), World Conservation Union (IUCN), and United Nations Environment Programme (UNEP). (1992). *Global Biodiversity Strategy: Guidelines for Action to Save, Study, and Use Earth´s Biotic Wealth Sustainably and Equitably*. Washington, DC pp. 1-245. Retrieved 11 July 2013 from http://www.wri.org/publication/global-biodiversity-strategy

World Wildlife Fund (WWF). (2012). *WWF annual report 2012*. Retrieved May 14, 2013 from worldwildlife.org/annualreport

Zimmermann, A. & Wilkinson, R. (2007). The conservation mission in the wild: Zoos as conservation NGOs? In: Zimmerman, A., Hatchwell, M., Dickie, L., and West, C. (eds.) *Zoos in the 21st Century: Catalysts for Conservation*, pp. 303-321. Cambridge University Press. Cambridge, UK. Print.

Zoo Aquarium Association (ZAA). *Who We Are*. Retrieved 15 June 2013 from www.zooaquarium.org.au/index.php/who-we-are

APPENDIX A: METHODOLOGY

A.1 ZOO SELECTION PROCESS

There are around 1,550 accredited zoos in the world (WAZA). Individual conservation projects were analyzed from a subset of this large group and were drawn from only accredited zoos. The subset was focused on zoos that have a significant conservation impact as defined by their WAZA association and meaningful contribution to conservation activities as outlined below. Since there exists no standardized list of the best conservation zoos, several methods were employed to determine which zoos should be included in the analysis.

Primarily, the only zoos that were accredited and considered here were ones that are certified by the World Association of Zoos and Aquariums (WAZA) or its various regional and national constituents. For the zoos selected these consisted of The African Association of Zoos and Aquaria (PAAZAB), South East Asian Zoos Association (SEAZA), Zoo and Aquarium Association (ZAA), European Association of Zoos and Aquariums (EAZA), British and Irish Association of Zoos and Aquariums (BIAZA), the Association of Zoos and Aquariums (AZA), and Canadian Association of Zoos and Aquariums (CAZA). See Table 2.1 for a more in depth explanation of the WAZA constituents. This was to ensure that the zoos selected adhered to the welfare and conservation standards set forth by WAZA.

Table A.1. Accredited Zoos--WAZA association members, locations, and number of members as of 2012

Association Member	Area Located	Number of Zoos and Aquaria members
Association of Zoos and Aquariums (AZA)	USA, Canada, Mexico, Argentina, Bahamas, Bermuda, Hong Kong	222
British & Irish Association of Zoos and Aquariums (BIAZA)	Britain and Ireland	Over 100
Canadian Association of Zoological Parks & Aquariums (CAZA)	Canada	28
European Association of Zoos & Aquaria (EAZA)	41 Countries in Europe	345
African Association of Zoos & Aquaria (PAAZAB)	12 Countries in Africa	70
Zoo and Aquarium Association Australasia (ZAA)	Australia, New Zealand, Fiji	85

Data adapted from AZA, BIAZA, CAZA, EAZA, PAAZAB, and ZAA

WAZA members were then reviewed with attention to conservation leadership activities. Parameters examined that suggested excellence in such activities included serving on international steering committees, participating in conservation initiatives, publishing activities, and earmarking a significant percentage of revenue for conservation purposes. While the list is by no means exhaustive it serves to represent some of the most forward-thinking and conservation dedicated zoos. In total 31 zoos were examined.

A.2 LIST OF ZOOS SELECTED

Zoos who met the previous criteria were included in their study and their locations can be found in Table 2.2.

Table A.2. Zoos included in study and their locations (n=31)

Zoo	Location
Adelaide Zoo	Adelaide, SA Australia
Australia Zoo	Beerwah, QLD Australia
Barcelona Zoo	Barcelona, Spain
Bronx Zoo	Bronx, NY United States
Calgary Zoo	Calgary, AB Canada
Chester Zoo	Chester, United Kingdom
Columbus Zoo and Aquarium	Powell, OH United States
Denver Zoo	Denver, CO United States
Disney Animal Kingdom	Lake Buena Vista, FL United States
Dublin Zoo	Dublin, Ireland
Houston Zoo	Houston, TX United States
Indianapolis Zoo	Indianapolis, IN United States
Johannesburg Zoo	Johannesburg, South Africa
Lincoln Park Zoo	Chicago, IL United States
Melbourne Zoo	Parkville, VIC Australia
National Zoological Gardens of South Africa	Pretoria, South Africa
Oregon Zoo	Portland, OR United States
Perth Zoo	South Perth, WA Australia
Phoenix Zoo	Phoenix, AZ United States
Port Defiance Zoo and Aquarium	Tacoma, WA United States
Saint Louis Zoo	Saint Louis, MO United States
San Antonio Zoo	San Antonio, TX United States
San Diego Zoo	San Diego, CA United States
Singapore Zoo	Singapore, Singapore
Smithsonian National Zoological Park	Washington DC, United States
Taronga Zoo	Sydney, NSW Australia
Tiergarten Schönbrunn/Zoo Vienna	Vienna, Austria
Toronto Zoo	Toronto, ON Canada
Woodland Park Zoo	Seattle, WA United States
Zoo Atlanta	Atlanta, GA United States
Zoologischer Garten Basel/Zoo Basel	Basel, Switzerland

A.3 CULTURAL DISCUSSION WITH REGARD TO SELECTED LOCATION

It should be noted that the majority of the zoo locales are within those countries commonly perceived as having "western" sensibilities. There are a number of reasons as to why this occurred.

Alcorn (1993: 425) notes that only European based languages contain the term

"conservation." While other nations may have similar concepts, they do not identify a similar separate term. It should be thus noted that the data is bound by these terms, but should still be considered valid when evaluating conservation issues in zoos.

The role of zoos as potential conservation institutions was established most notably by zoos in Europe and North America, with Australasian zoos additionally influencing policy decisions (Mazur 2001: 43).

There is a higher focus of AZA member institutions on conservation-based publications (Rees 2011: 341). To this end, AZA institutions may thus have a higher visibility in terms of their conservation output. Additionally this could represent the fact that they are doing more conservation work, and should thus also be considered. Both of these explanations may help to explain some of the discrepancies in zoos selected for the survey.

A.4 COMPILATION OF ZOO CONSERVATION PROJECTS

In order to establish how individual species were faring within the conservation projects, an additional list of conservation projects was compiled from the list of zoos. A species-based investigation was undertaken to understand the specific nature of conservation projects in regards to individual animals and classes. The species were identified through a combination of zoo websites, annual reports, and direct interviews. Thus, these species may not represent the entirety of the zoo conservation projects, but are fully representative of the projects that are available and announced to the general public.

Zoos vary greatly in their reporting of conservation projects. In order to address this variability, a list of project criteria was specified. The criteria served to evaluate zoo conservation projects for inclusion in this study and included education, research, breeding, habitat management, and increasing populations in the wild. A project had to meet at least two of the project criteria to be included in this study.

Education comprises either on-site zoo education or education at the location of the conservation project. In either locale the education component must have a high likelihood of aiding in the conservation of an animal species. For example, a sign on a zoo exhibit will likely not have a distinct and measurable impact on species conservation.

However, a program educating a local population on identifying and avoiding hornbill nests would likely have an impact on the hornbill species.

Research often takes place *in situ* and involves the discovery of additional information about a species that can add to the knowledge base and can aid in the species conservation.

Breeding can happen *in situ* or *ex situ*. It can either refer to breeding for reintroduction purposes or breeding for zoo stocks. When conservation projects involving breeding those animals kept within zoos, those animals must be part of an endangered species breeding plan such as the Species Survival Plans (SSPs) run by the AZA or the European Species Programs (ESPs) run by the EAZA. In terms of the reintroduction process, this term is used to refer generally to threatened species being bred in captivity and released into habitats in the wild. This also serves to include restocking and reinforcement (Nechay 1996 as cited in Rees 2011: 349). This term thus applies to the release of animals in locales where they are currently extinct, or where they are used to help bolster previously existing populations.

Breeding is a contentious issue as to its impact on wildlife conservation (Varner and Monroe 1991, Snyder et al 1996, and Araki et al 2007). Care was taken to attempt and ensure the conservation projects utilizing breeding were set up in a way to make a difference for species in the wild, though it is difficult to measure. In addition the projects had to include at least one additional criterion.

Habitat Management occurs *in situ* and makes an area more livable for a species. This often includes increasing the size of an animal's available habitat or altering the existing area through management of flora and other fauna in the region.

Increasing populations in the wild is a broader category that includes four sub-categories not touched upon in the previous sections. First, increasing protection for the species, which in turn can aid in increasing animal numbers. Protection could take the form of creating patrols in areas with high poaching, disarming traps, or paying locals to watch over particular animal habitats.

Second, decreasing animal-human conflict can lead to greater animal numbers. This may include using non-lethal means to deter predatory animals from human settlements.

Third, “headstarting” can increase the number of animals that reach full maturity. It refers to the removal of young animals from the wild when they are still vulnerable to many threats, often invasive predatory species. The animals are raised in captivity until they are large enough to more easily withstand many of the threats, then are released back into the wild.

Finally zoos can also be wildlife rehabilitators, removing injured animals from the wild and releasing them once they are capable of surviving again on their own. In some cases the animal is incapable of surviving in the wild, for example birds who have injured their wings in such a fashion that they are unable to fly again. In those cases, zoos sometimes breed the animal and release its offspring into the wild, another form of reintroduction.

A.5 ADDITIONAL NOTES ON PROJECT SELECTION

It should be noted that some zoos are actively engaged in conservation projects and others serve to fund projects without direct participation. For the purpose of this research, it was determined that zoo-funded projects would also be included as long as they met the predetermined project criteria. In some cases, zoos funded or worked on a project started and run by another zoo on the list. In cases where those could be determined, the project was only counted once.

Another consideration is that some zoos are part of larger organizations that encompass other zoos, aquariums or wildlife parks. In cases such as those, care was taken to attempt to determine which species were specifically focused on by the zoo included in the study. When such distinctions could not be made, the conservation projects conducted by that organization as a whole were included.

A.6 IUCN RED LIST COMPARISON

To further examine how the species were faring within the conservation project, each species and class was evaluated as to its conservation need. The International Union for Conservation of Nature (IUCN) Red List was used as an independent source. It is a global compilation of species that evaluates their status in the wild and assigns each a designation in relation to its overall level of threat. For this research, the threat level of

each species was then extrapolated to serve as a measure for the need for conservation for each species and class. The IUCN designations are: Not Evaluated (NE), Data Deficient (DD), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CR), Extinct in the Wild (EW), Extinct (EX). Vulnerable, Endangered, and Critically Endangered are referred to as "threatened" species.

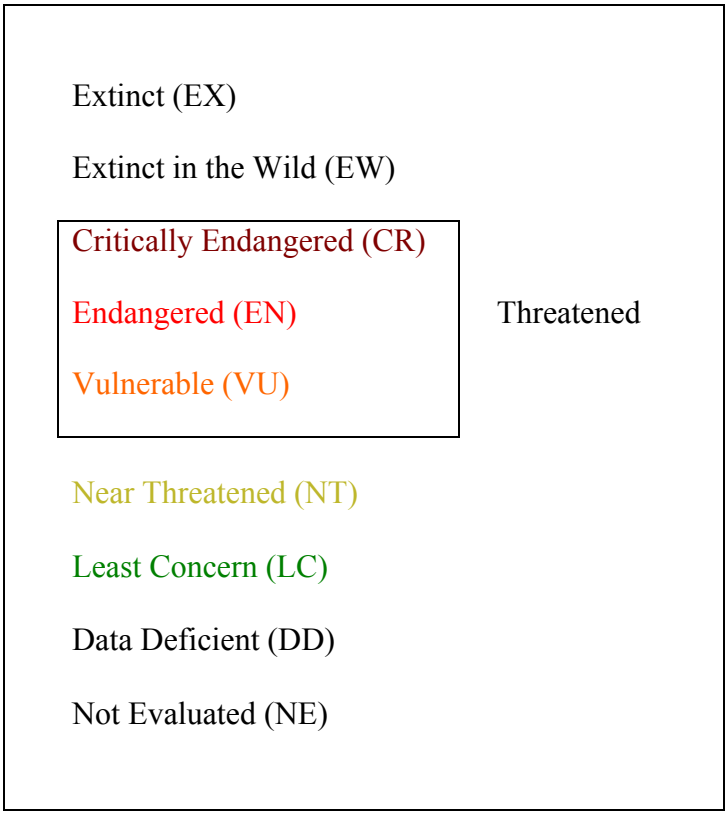

Figure A.1. IUCN Red List Categories adapted from IUCN Red List. Threatened species are indicated in box in figure: Critically Endangered (CR), Endangered (EN), and Vulnerable (VU).

For each species determined by the previously stated criteria I cited the IUCN designation. In addition, classes were compared to one another and to the overall data from the IUCN Red List. Five general groups of animals were used in the analysis utilized by this paper. These include amphibians, birds, mammals, reptiles, and terrestrial invertebrates. Terrestrial invertebrates are all the specific invertebrate orders that are found primarily on land. Those that are found exclusively in the water were not included. In this paper taxonomic groups and taxa refer specifically to the animal classes noted above.

A.7 INTERVIEWS

In order to unveil further insights and address the questions regarding zoo conservation and daily operations, the data on the species selected for projects was supplemented by personal interviews with ten of the 31 zoos selected for inclusion in the study. After initially contacting all of the zoos with invitations to participate, interest and availability were indicated by conservation personnel at ten of the zoos. Interviews were conducted in person, on the phone, or via Skype. The semi-structured interviews ranged in length from twenty-five minutes to an hour. Interview scripts can be found in Appendix B. The questions followed general categories of conservation project selection and examples, conservation actions, public participation, project goals, and funding. Degrees of confidentiality were offered to participants.

Of the ten interviewees that participated, four interviewees agreed to be mentioned by name and location, one by location only, and five spoke on the condition of anonymity. Table 2.2 indicates the interviewee number, the name of the interviewee and their zoo when applicable, as well as their job titles. Confidential interviewees are referred to in the paper by their interviewee numbers, which were randomly assigned. Similarly, the job titles of the interviewees requesting confidentiality were changed. To further protect confidentiality, interviewees not referred to by name will all be referred to by "he/she" throughout the paper.

Table A.3. Names, zoos, and job titles for interviewees (n=10)

Interview Number	Name	Zoo	Job Title
Interviewee #1	Dr. Friederike von Houwald	Zoologischer Garten Basel/Zoo Basel (Basel, Switzerland)	Curator, Involved in conservation oriented projects
Interviewee #2	Dr. Axel Moehrenschlager	Calgary Zoo (Calgary, AB Canada)	Head of the Center for Conservation Research
Interviewee #3	Confidential	Confidential	Conservation Educator
Interviewee #4	Confidential	Confidential	Conservation Director
Interviewee #5	Confidential	Detroit Zoo	Research staff member
Interviewee #6	Dr. Fred Koontz	Woodland Park Zoo (Seattle, WA USA)	Vice President of Field Conservation
Interviewee #7	Confidential	Confidential	Wildlife Director
Interviewee #8	Confidential	Confidential	Research Specialist
Interviewee #9	Dr. Rebecca Spindler	Taronga Zoo (Sydney, NSW Australia)	Research and Conservation Manager
Interviewee #10	Confidential	Confidential	Conservation Outreach Specialist

APPENDIX B: CONSERVATION DEPARTMENT INTERVIEW SCRIPT

Introduction:
I am interested in exploring the emerging roles of zoos as conservation centers and the specific conservation projects in which zoos engage.

What is your role in the zoo?

I'd like to talk about the zoo's conservation projects and the audiences you seek to reach. Could you tell me first about your conservation projects?

1. Project
1.1. Could you give me an example of a specific project?
1.2. Can you tell me (more) about the day-to-day work involved in this project?

2. Conservation
2.1. How would you define conservation?
2.2. What are some of the specific conservation practices that this zoo employs?
    2.2.1. Are there any other ways in which the zoo is engaging in conservation?
2.3. Do you consider education as part of conservation? If so, how do you employ education in your conservation projects?
2.4. Do the conservation projects involve captive breeding?
2.5. What about habitat restoration?
2.6. Do the conservation projects involve research?

3. Project Selection
3.1. Can you tell me (more) about some of the criteria used to select the conservation projects?
    3.1.1. How do you select certain projects or targets for your conservation efforts?
3.2. Do you use the IUCN Red List, Endangered Species List, or other similar resources when deciding upon conservation projects?
3.3. Who selects the projects?
3.4. Does location affect the selection of the project?
    3.4.1. Are projects selected because they are local? Global?
3.5. Are there certain species characteristics that make them more likely to be chosen?
3.6. Is there an ideal species for these projects? If so, why is it an ideal species?

4. Public
4.1. Can you describe your primary audiences or your 'public'?
4.2. Are there local, visiting, and/or more remote public you seek to reach?
4.3. How are these different publics involved or not involved in the conservation projects? (Further clarification if requested: Perhaps in such ways as volunteering for or funding).

5. Goals
5.1. Can you tell me (more) about some of the goals of the conservation projects?
5.2. How do you measure the completion of these goals?
5.3. What are some of your more successful projects?
    5.3.1. Why are they successful?
    5.3.2. How does this project affect species survival?

6. Funding
6.1. What are some general funding sources for the zoo?
6.2. Can you tell me (more) about how these conservation projects are funded?
6.3. Do these projects receive enough funding?
6.4. How much of the zoo's budget is dedicated to conservation?
6.5. Can you tell me (more) about how these projects are advertised and marketed?

7. Opinion
7.1. How would you like the public to be involved in the conservation projects?
7.2. What are some of the barriers to these conservation projects?
7.3. If possible, what would you change about the conservation projects?

8. Other
8.1. Is there anything else you would like to share?

Note: I will frequently provide necessary pauses after questions as well as additional prompts as needed to provide chances for additional answers. The wording will be along the lines of "is there anything else that comes to mind or that you would like to add?"

APPENDIX C: LIST OF COMMON AND SCIENTIFIC NAME OF SPECIES IN ZOO CONSERVATION PROJECTS, AND NUMBER OF PROJECTS

Common Animal Name	Scientific Name	Number of Zoo projects
Addax	Addax nasomaculatus	1
African Elephant	Loxodonta africana	8
African Wild Dog	Lycaon pictus	8
Alala	Corvus hawaiiensis	1
Alpine She-oak Skink	Cyclodomorphus praealtus	1
American Burying Beetle	Nicrophorus americanus	1
American Pika	Ochotona princeps	1
Amur Leopard	Panthera pardus ssp. orientalis	1
Andean Bear	Tremarctos ornatus	2
Andean Flamingo	Phoenicoparrus andinus	1
Anegada Iguana	Cyclura pinguis	1
Angolan Colobus Monkey	Colobus angolensis ssp. palliatus	1
Angolan Talapoin	Miopithecus talapoin	1
Argali Sheep	Ovis ammon	1
Armenian viper	Montivipera raddei	1
Asian (Malayan) Pangolin	Manis javanica	1
Asian Elephant	Elephas maximus	15
Asiatic Black Bear	Ursus thibetanus	1
Atlantic Hawksbill Sea Turtle (Hawksbill Turtle)	Eretmochelys imbricata	2
Attwater's Prairie Chicken	Tympanuchus cupido attwateri	2
Australian Pelican	Pelecanus conspicillatus	1
Australian Sea-lion	Neophoca cinerea	1
Axolotl	Ambystoma mexicanum	1
Bald Eagle	Haliaeetus leucocephalus	1
Bali Mynah	Leucopsar rothschildi	1
Banded Leaf Monkey	Presbytis femoralis	1
Batagur River Terrapin	Batagur baska	1
Baw Baw Frog	Philoria frosti	1
Bearded Vulture	Gypaetus barbatus	1
Black and White Ruffed Lemur	Varecia variegata	1
Black Footed Ferret	Mustela nigripes	5
Black Howler Monkey	Alouatta pigra	1

Black Lion Tamarin	Leontopithecus chrysopygus	2
Black Rhinoceros	Diceros bicornis	7
Black-Eared Miner	Manorina melanotis	1
Black-Eyed Tree Frog (Morelet's Treefrog)	Agalychnis moreletii	1
Black-Flanked Rock Wallaby	Petrogale lateralis	1
Black-Tailed Prairie Dog	Cynomys ludovicianus	2
Blandchard's Cricket Frog (Northern Cricket Frog)	Acris crepitans	1
Blue-Crowned Laughingthrush	Garrulax courtoisi	1
Blue-Throated Macaw	Ara glaucogularis	1
Bolivian Squirrel Monkey	Saimiri boliviensis	1
Bonobo	Pan paniscus	1
Bornean Orangutan	Pongo pygmaeus	7
Bornean Slow Loris	Nycticebus menagensis	1
Bornean Tarsier	Tarsius bancanus ssp. borneanus	1
Bottlenose Dolphin	Tursiops truncatus	1
Brush-Tailed Rock Wallaby	Petrogale penicillata	2
Burmese Python	Python bivittatus	1
Burmese Roofed Turtle	Batagur trivittata	1
Burmese Star Tortoise	Geochelone platynota	1
Burrowing Owl	Athene cunicularia	1
Bushy-Crested Hornbill	Anorrhinus galeritus	1
California Condor	Gymnogyps californianus	4
California Least Tern	Sterna antillarum	1
Canopy Goanna	Varanus keithhornei	1
Cao-vit Crested Gibbon	Nomascus nasutus	1
Cape Vulture	Gyps coprotheres	1
Cheetah	Acinonyx jubatus	12
Chilean Flamingo	Phoenicopterus chilensis	2
Chimpanzee	Pan troglodytes	12
Chiricahua Leopard Frog	Lithobates chiricahuensis	1
Chuditch	Dasyurus geoffroii	1
Cinereous Vulture	Aegypius monachus	1
Clouded Leopard	Neofelis nebulosa	3
Common or Plains Zebra or Grant's Zebra	Equus quagga	2
Cotton-Top Tamarin	Saguinus oedipus	1
Darwin's Frog	Rhinoderma darwinii	1
Delacour's Langur	Trachypithecus delacouri	1

Desert Tortoise	Gopherus agassizii	1
Diamondback Terrapin	Malaclemys terrapin	1
Dorcas Gazelle	Gazella dorcas	1
East Texas (American) Black Bear	Ursus americanus	1
Eastern Barred Bandicoot	Perameles gunnii	2
Eastern Indigo Snake	Drymarchon couperi	1
Eastern Plains Garter Snake	Thamnophis radix	1
Echo Parakeet	Psittacula eques	1
Egyptian Tortoise	Testudo kleinmanni	1
Eld's Deer	Rucervus eldii	1
Ethiopian Wolf	Canis simensis	1
European Pond Turtle	Emys orbicularis	1
Fennec Fox	Vulpes zerda	1
Ferruginous Hawk	Buteo regalis	1
Fijian Crested Iguana	Brachylophus vitiensis	2
Fishing Cat	Prionailurus viverrinus	1
Fowler's Toad	Anaxyrus fowleri	1
Galapagos Giant Tortoise	Chelonoidis nigra	1
Geoffroy's Rousette Fruit Bat	Rousettus amplexicaudatus	1
Giant Anteater	Myrmecophaga tridactyla	1
Giant Armadillo	Priodontes maximus	2
Giant Panda	Ailuropoda melanoleuca	8
Golden Eagle	Aquila chrysaetos	1
Golden Lancehead	Bothropoides insularis	1
Golden Lion Tamarin	Leontopithecus rosalia	7
Golden Mantella Frog	Mantella aurantiaca	2
Grand Cayman Blue Iguana	Cyclura lewisi	1
Grauer's Gorilla	Gorilla beringei ssp. graueri	1
Great Hornbill	Buceros bicornis	3
Greater Bilby	Macrotis lagotis	1
Green Sea Turtle	Chelonia mydas	2
Green-Eyed Frog	Lithobates vibicarius	1
Grevy's Zebra	Equus grevyi	4
Grey Wolf	Canis lupus	1
Grizzley Bear	Ursus arctos	1
Guatemalan Beaded Lizard	Heloderma horridum	1
Guthega Skink	Liopholis guthega	1
Hazel Dormouse	Muscardinus avellanarius	1
Helmeted Honeyeater	Lichenostomus melanops cassidix	1

Helmeted Hornbill	Rhinoplax vigil	1
Hippopotamus	Hippopotamus amphibius	1
Hirola	Beatragus hunteri	1
Horned Guan/Pavon	Oreophasis derbianus	1
Houston Toad	Anaxyrus houstonensis	1
Humboldt Penguin	Spheniscus humboldti	5
Indian Rhinoceros	Rhinoceros unicornis	1
Jaguar	Panthera onca	2
Jamaican Iguana	Cyclura collei	3
James' Flamingo	Phoenicoparrus jamesi	1
Javan Gibbon	Hylobates moloch	2
Javan Green Magpie	Cissa thalassina	1
Kemp's Ridley Sea Turtle	Lepidochelys kempii	1
Key Largo Woodrat	Neotoma floridana	1
King Cobra	Ophiophagus hannah	1
Koala	Phascolarctos cinereus	2
Komodo Dragon	Varanus komodoensis	4
Kori Bustard	Ardeotis kori	1
Lake Titicaca Frog (Titicaca Water Frog)	Telmatobius culeus	1
Leadbeater's Possum	Gymnobelideus leadbeateri	1
Leatherback Sea Turtle	Dermochelys coriacea	2
Leopard (African)	Panthera pardus	1
Lesser Grey Shrike	Lanius minor	1
Lion	Panthera leo	3
Loggerhead Sea Turtle	Caretta caretta	2
Lord Howe Island Stick Insect	Dryococelus australis	1
Lowland Tapir	Tapirus terrestris	1
Malayan Pangolin	Manis javanica	1
Malayan Tapir	Tapirus indicus	2
Malayan Tiger	Panthera tigris ssp. jacksoni	2
Maleo	Macrocephalon maleo	1
Mandrill	Mandrillus sphinx	1
Maned Wolf	Chrysocyon brachyurus	1
Mangrove Cuckoo	Coccyzus minor	1
Mary River Turtle	Elusor macrurus	1
Massasauga Rattlesnake	Sistrurus catenatus	2
Matschie's tree kangaroo	Dendrolagus matschiei	1
Mauritius Fody	Foudia rubra	1
Mauritius Olive White-Eye	Zosterops chloronothus	1

Mona Iguana	Cyclura stejnegeri	1
Mountain Bluebird	Sialia currucoides	1
Mountain Chicken	Leptodactylus fallax	1
Mountain Gorilla	Gorilla beringei	5
Mountain Nyala	Tragelaphus buxtoni	1
Mountain Pygmy Possum	Burramys parvus	1
Mountain Yellow-legged Frog	Rana muscosa	1
Narrow-Headed Gartersnake	Thamnophis rufipunctatus	1
New Holland Mouse	Pseudomys novaehollandiae	1
North Island Brown Kiwi	Apteryx mantelli	1
Northern Corroboree Frog	Pseudophryne pengilleyi	1
Northern Leopard Frog	Lithobates pipiens	1
Northern White Rhinoceros	Ceratotherium simum	2
Numbat	Myrmecobius fasciatus	1
Okapi	Okapia johnstoni	3
Olive Ridley Sea Turtle	Lepidochelys olivacea	1
Orange-Bellied Frog	Geocrinia vitellina	1
Orange-Bellied Parrot	Neophema chrysogaster	2
Oregon Silverspot Butterfly	Speyeria zerene hippolyta	2
Oregon Spotted Frog	Rana pretiosa	4
Oribi	Ourebia ourebi	1
Oriental Pied Hornbill	Anthracoceros albirostris	1
Ozark Hellbender	Cryptobranchus alleganiensis bishopi	1
Pacific Pocket Mouse	Perognathus longimembris pacificus	1
Page Springsnail	Pyrgulopsis morrisoni	1
Palila	Loxioides bailleui	1
Panamanian Golden Frog	Atelopus zeteki	1
Philippine Cockatoo	Cacatua haematuropygia	1
Phillippine Crocodile	Crocodylus mindorensis	2
Phillippine Tarsier	Tarsius syrichta	1
Pink Pigeon	Nesoenas mayeri	1
Platypus	Ornithorhynchus anatinus	1
Ploughshare Tortoise	Astrochelys yniphora	1
Polar Bear	Ursus maritimus	6
Proboscis Monkey	Nasalis larvatus	1
Przewalski's Horse	Equus ferus ssp. przewalskii	2
Puaiohi	Myadestes palmeri	1
Puerto Rican Crested Toad	Peltophryne lemur	1

Puerto Rican Parrot	Amazona vittata	1
Puma	Puma concolor	1
Pygmy Hippopotamus	Choeropsis liberiensis	2
Pygmy Rabbit	Brachylagus idahoensis	2
Red Grouse	Lagopus lagopus	1
Red Kangaroo	Macropus rufus	1
Red Panda	Ailurus fulgens	3
Red Wolf	Canis rufus	1
Red-Fronted Macaw	Ara rubrogenys	1
Red-Necked Ostrich	Struthio camelus camelus	2
Red-Tailed Black-Cockatoo	Calyptorhynchus banksii	2
Regent Honeyeater	Xanthomyza phrygia	2
Rhinoceros Hornbill	Buceros rhinoceros	3
Ricord's Iguana	Cyclura ricordii	2
Ring-Tailed Lemur	Lemur catta	2
Roan Antelope	Hippotragus equinus	1
Roatan Spiny-Tailed Iguana	Ctenosaura oedirhina	1
Rock Hopper Penguin	Eudyptes chrysocome	1
Rodrigues (Flying Fox) Fruit Bat	Pteropus rodricensis	1
Rothschild's Giraffe	Giraffa camelopardalis ssp. rothschildi	2
Rufous-Necked Hornbill	Aceros nipalensis	1
Rusty Monitor	Varanus semiremex	1
Saltwater Crocodile	Crocodylus porosus	1
San Clemente Loggerhead Shrike	Lanius ludovicianus mearnsi	1
Sand Lizard	Lacerta agilis	1
Scimitar-Horned Oryx	Oryx dammah	3
Shark Bay Mouse	Pseudomys fieldi	1
Short-beaked echidna	Tachyglosus aculeatus	1
Siamese Crocodile	Crocodylus siamensis	1
Siberian (Amur) Tiger	Panthera tigris ssp. altaica	2
Sloth Bear	Melursus ursinus	1
Smoky Mouse	Pseudomys fumeus	1
Smooth Green Snake	Liochlorophis vernalis	1
Smooth Newt	Lissotriton vulgaris	1
Snow Leopard	Panthera uncia	5
Somali Wild Ass (Subspecies of African Wild Ass)	Equus africanus	2
Southern Corroboree Frog	Pseudophryne corroboree	1
Southern Dibbler	Parantechinus apicalis	1

Southern Ground Hornbill	Bucorvus leadbeateri	1
Southern Hairy-Nosed Wombat	Lasiorhinus latifrons	1
Southern White Rhinoceros	Ceratotherium simum ssp. simum	2
Speke's Gazelle	Gazella spekei	1
Sumatran Orangutan	Pongo abelii	10
Sumatran Tiger	Panthera tigris ssp. sumatrae	5
Sun Bear	Helarctos malayanus	4
Swift Fox	Vulpes velox	1
Tammar Wallaby	Macropus eugenii	1
Tarictic Hornbill	Penelopides panini	2
Tasmanian Devil	Sarcophilus harrisii	4
Taylor's (Whulge) Checkerspot Butterfly	Euphydrayas editha taylori	1
Tenkile (Scottis) Tree Kangaroo	Dendrolagus scottae	1
Texas Horned Lizard	Phrynosoma cornutum	1
Thick-billed Parrot	Rhynchopsitta pachyrhyncha	1
Three Forks Springsnail	Pyrgulopsis trivialis	1
Tonkin Snub-Nosed Monkey	Rhinopithecus avunculus	2
Tsessebe	Damaliscus lunatus	1
Vancouver Island marmot	Marmota vancouverensis	2
Visayan Warty Pig	Sus cebifrons	1
Visayan Writhed-Billed	Aceros waldeni	1
Waldrapp Ibis	Ceronticus eremita	2
Walrus	Odobenus rosmarus	1
Wattled Crane	Bugeranus carunculatus	1
Weimang (Golden-mantled) Tree Kangaroo	Dendrolagus pulcherrimus	1
West African Manatee	Trichechus senegalensis	1
West Indian Manatee	Trichechus manatus	1
Western African Dwarf Crocodile	Osteolaemus tetraspis	1
Western Lowland Gorilla	Gorilla gorilla ssp. gorilla	4
Western Pond Turtle	Actinemys marmorata	2
Western Snowy Plover	Charadrius alexandrinus	1
Western Swamp Tortoise	Pseudemydura umbrina	1
White-Bellied Frog	Geocrinia alba	1
White-bellied Heron	Ardea insignis	1
White-Crowned Hornbill	Aceros comatus	2
White-Naped/White-Crowned Mangabey	Cercocebus atys	2
Whooping Crane	Grus americana	3

Wild Bactrian Camel	Camelus ferus	1
Wildebeest	Connochaetes taurinus	1
Woma Python	Aspidites ramsayi	2
Wreathed Hornbill	Aceros undulatus	2
Wyoming Toad	Anaxyrus baxteri	1
Yakka Skink	Egernia rugosa	1
Yellow-Footed Rock Wallaby	Petrogale xanthopus	1