



MSU Graduate Theses

Spring 2016

The Effectiveness Of Visits To Dickerson Park Zoo On Guests' Conservation Mindedness And Behavior

Sarah K. Foster

As with any intellectual project, the content and views expressed in this thesis may be considered objectionable by some readers. However, this student-scholar's work has been judged to have academic value by the student's thesis committee members trained in the discipline. The content and views expressed in this thesis are those of the student-scholar and are not endorsed by Missouri State University, its Graduate College, or its employees.

Follow this and additional works at: <https://bearworks.missouristate.edu/theses>

 Part of the [Biology Commons](#)

Recommended Citation

Foster, Sarah K., "The Effectiveness Of Visits To Dickerson Park Zoo On Guests' Conservation Mindedness And Behavior" (2016). *MSU Graduate Theses*. 7.
<https://bearworks.missouristate.edu/theses/7>

This article or document was made available through BearWorks, the institutional repository of Missouri State University. The work contained in it may be protected by copyright and require permission of the copyright holder for reuse or redistribution.

For more information, please contact BearWorks@library.missouristate.edu.

**THE EFFECTIVENESS OF VISITS TO DICKERSON PARK ZOO ON GUESTS'
CONSERVATION MINDEDNESS AND BEHAVIOR**

A Masters Thesis

Presented to

The Graduate College of

Missouri State University

In Partial Fulfillment

Of the Requirements for the Degree

Master of Science, Biology

By

Sarah Katherine Foster

May 2016

Copyright 2016 by Sarah K. Foster

THE EFFECTIVENESS OF VISITS TO DICKERSON PARK ZOO ON GUESTS' CONSERVATION MINDEDNESS AND BEHAVIOR

Biology

Missouri State University, May 2016

Master of Science

Sarah K. Foster

ABSTRACT

Today, there are more than 10,000 zoos worldwide that provide the public with opportunities to observe and learn about endangered and threatened species from ecosystems all over the world. Through direct and emotional interactions with wildlife at zoos, more than 600 million guests a year have a chance to evolve from spectators to participants of conservation. A mixed-method survey strategy took place at Dickerson Park Zoo in Springfield Missouri about the Species Survival Plan to understand guest's conservation mindedness and behavior changes after a visit. Initial surveys were given in the zoo and the follow-up surveys were given online a month later. Multiple questions showed similar percentages of conservation mindedness and behavior change between presentation and control days and if guests were Friends of the Zoo Members or not. Recycling, turning off lights, unplugging electronics, using florescent light bulbs and not watering lawns or using herbicides or pesticides showed the highest conservation mindedness of all respondents. These responses have been shown to save homes and families money and are the easiest to accomplish. Zoos need to continue to strive to affect behavioral changes towards conservation of their guests to ensure our earth's future.

KEYWORDS: conservation, conservation mindedness, behavior change, dickerson park zoo, species survival plan

This abstract is approved as to form and content

Dr. Janice Greene
Chairperson, Advisory Committee
Missouri State University

**THE EFFECTIVENESS OF VISITS TO DICKERSON PARK ZOO ON GUESTS'
CONSERVATION MINDEDNESS AND BEHAVIOR**

By

Sarah K. Foster

A Masters Thesis
Submitted to the Graduate College
Of Missouri State University
In Partial Fulfillment of the Requirements
For the Degree of Master of Science, Biology

May 2016

Approved:

Dr. Janice Greene

Dr. Alicia Mathis

Dr. Brian Greene

Dr. Julie Masterson, Dean, Graduate College

ACKNOWLEDGEMENTS

I thank the following people for their support during the course of my graduate studies. Thank you to Daniel Boone, Kari Spivey, Kristen Kohlhepp, Erin Buchanan and docents for assisting me in presenting the Species Survival Plan to the guests of Dickerson Park Zoo and obtaining surveys. A thanks Pam Price and the Dickerson Park Zoo staff for allowing me to conduct my research. A thanks Dr. Alicia Mathis, and Dr. Brian Greene for their guidance and encouragement during this process. I give a huge thank you to Dr. Janice Greene. Thank you for being there throughout this entire process from the first meeting to getting me through until the very end. Your encouragement has given me the tools I needed to complete this project!

I dedicate this work to my parents, Mark and Christell Foster. Thank you for showing me unconditional love and support through every decision I have ever made. Thank you for being my chauffeur to rehearsals, basketball, softball, track, voice and piano practices; for bringing my dinner to rehearsals even after a long day at work; for standing on the sidelines pushing me to do my very best. I would not be the person I am today if it weren't for your love and encouragement! I know your hope is that after this accomplishment I can find a "Big Girl Job" and pursue my passion for conservation!

TABLE OF CONTENTS

Introduction.....	1
Environmental Education and Interpretation	2
Conservation Education in Zoos	3
Conservation Mindedness and Responsible Environmental Behavior	4
Species Survival Plan	6
Research Questions	7
Methods.....	11
Human Research IRB Approval	11
Study Population.....	11
Experimental Design.....	11
Instruments	13
Data Analysis	14
Results	16
Demographic Results	16
Initial Survey.....	16
Follow-Up Survey – Conservation Mindedness Growth.....	18
Quick Response Code Usage	18
Presentation Knowledge Responses	18
Discussion	24
Future Research	28
References	29
Appendices	31
Appendix A. Human Research IRB Approval Email	31
Appendix B. Species Survival Plan Presentation Information	32
Appendix C. Initial Survey Instrument.....	34
Appendix D. Follow-Up Survey Instrument	37
Appendix E. Example SSP Presentation Knowledge Responses	39
Appendix F. Quick Response Code Pages.....	41

LIST OF TABLES

Table 1. Frequency and percentages of all demographic characteristics of respondents ..	20
Table 2. Mean Conservation Mindedness of Initial Survey Responses.....	21
Table 3. Mean comparison of behavior change	22
Table 4. Quick Response Code Usage	22
Table 5. Characteristics and responses on initial survey to SSP presentations	23

LIST OF FIGURES

Figure 1. Learning Model for an Interpretive Program (Knapp 2007)	9
Figure 2. Evolution of zoos to conservation center (Zimmerman 2007)	9
Figure 3. Environmental Interpretation Behavior Change Model (Knapp 2007)	10
Figure 4. Five forces that influence inspiration for conservation (Zimmerman 2007)	10
Figure 5. Species Survival Presentations and guest's taking initial survey	15

INTRODUCTION

Zoological gardens were first established in London in 1826 (Ballantyne, Packer, Hughes, and Dierking 2007). This first generation zoo held exhibits that included unknown wild exotic species housed in cages. The main goal of this zoo was solely for species identification and classification. In order for scientific research to continue, researchers started to charge an entrance fee for visitors to admire these amazing new species, starting the phenomenon zoos have become today. The focus of these early zoos was to allow visitors to enjoy a day of recreation and education along with scientific research. With zoos becoming bigger attractions for visitors, second generation exhibits evolved. Zoos started to include more natural appearance to the design of enclosures that mirrored features that were naturally found in species' habitats (Ballantyne et al. 2007).

Many zoological institutions, aquariums, and other wildlife associations serve as places where family and friends can go to spend time with one another. People gather to enjoy a nice day watching lions roar and basking in the sun or gather around the giraffe deck to feed the long-necked wonders. This leisurely environment can inspire a mindset toward learning even if guests are unaware. Originally, zoos were founded on the public's general curiosity of exotic species such as lions, tigers and bears. Today, there are more than 10,000 zoos worldwide, and more than 600 million guests visit these zoos every year (Balmford, Williams, Mace, and Manica 2007; Ballantyne and Packer 2011). Zoos and aquariums provide the public with opportunities to observe and learn about species from ecosystems all over the world. Through direct emotional and cognitive

experiences that can result from interactions with wildlife at zoos, guests may evolve from spectators to participants in conservation.

Environmental education and interpretation are defined and their increasing importance in zoos is described. Conservation education in zoos and the overall goal of conservation in zoos are explained, followed by how zoos can affect conservation mindedness and responsible environmental behavior (REB) in their guests. The Species Survival Plan (SSP) that is used in modern zoos today is explained and how it is involved in the research. The review is then concluded with the questions at hand surrounding why zoos and other conservation-related sites are important in today's society.

Environmental Education and Interpretation

Environmental education and interpretation are closely related and share a terminal goal: "to produce individuals that can make responsible environmental decisions" (Knapp 2007). Although the two fields share an ultimate goal, the inherent nature of both fields creates two distinct contrasts. Environmental education is associated with formal institutions that require students to participate in educational experiences, whereas interpretation occurs in informal settings with participants that are voluntary, and is considered short-term. With time being a constraint for interpretation, how much does a participant of an interpretive program remember?

Endel Tulving (Knapp 2007), a Canadian neuroscientist, developed a long-term memory theory based on the notion that there are two primary memory systems: remembering and knowing. Remembering is being able to recall experiences and information from particular events and is often referred to as episodic memory. This type

of memory involves participants remembering images, feelings and other context-specific details. Knowing is a person's conceptual knowledge of the world. This is when participants remember knowledge or facts without the need for recollective cues, also known as semantic memory. In Tulving's model, three variables can aid in episodic memory and can increase the odds of "capturing" semantic memory (Fig. 1). These three variables better allow participants to be involved and to remember the interpretive program. The interpretive event taking place offers experiences with the corresponding variables to enhance episodic memories and semantic memories.

Conservation Education In Zoos

Between the 1960's and 1970's conservation institutions realized they needed to shift their focus from recreation to conservation due to the public's increased awareness of nature and environmental and conservation issues (Ballantyne et al. 2007; Marino, Malamud, Nobis, Broglio, and Lilienfeld 2010). Today, modern zoological institutions have moved toward the idea of developing pro-conservation attitudes, knowledge and behaviors with their guests (Ballantyne and Packer 2005). In order to achieve these attitudes and behaviors, conservation education has become the number one priority in modern zoological parks (Zimmerman 2007). The aim of conservation education is to develop lifelong knowledge and skills for conservation. It was designed to increase awareness and behaviors of visitors and the public towards responsible use of natural resources, and to promote the public's awareness of "conservation of biodiversity by providing information about species and their natural habitats" (Patrick, Matthews, Ayers, Tunnicliffe 2007). Moving away from the menagerie setting to placing animals in

a more naturalistic simulation of their natural environment teaches guests more about the animals and their conservation (Fig. 2).

In 1980, the Association of Zoos and Aquariums (AZA) declared conservation a top priority (Zimmerman 2007). Since this time, zoo administrators have become more aware of the importance of ensuring the survival of threatened and endangered species (Zimmerman 2007). New enclosures in zoos now contain wide-open areas, more water features and even sound recordings that mimic wilderness environments. More natural environments give the visitors insight and information about the animals and their conservation issues. Third-generation exhibits also allow visitors to have more of an “up-close” and personal interaction with the animals (Ballantyne et al. 2007). Animals in their natural enclosures can be used as teaching aids that allow zoos to show information about the diversity of the biological world. They also serve as “ambassadors” for their species’ ecology and conservation status (Rabb and Saunders 2005). Zoos offer these exhibits as viewing sites for a better understanding of human relationships with the non-human world. If the public is aware of these animals and their habitats, they can participate in the conservation and protection efforts needed for the animals’ survival. These experiences at zoos could have a tremendous capacity to educate and inspire guests about the conservation issues of the natural world (Powell and Bullock 2014).

Conservation Mindedness and Responsible Environmental Behavior

David and Bullock (2014) define conservation mindedness as wildlife issues becoming more meaningful to guests and promoting intention to support conservation organizations or change certain daily activities. Both responsible environmental behavior

(REB) and locus of control contribute to the conservation mindedness changes that could occur for guests of any wildlife conservation area. After zoo guests become more aware of conservation issues, they may develop more positive attitudes that can lead to supporting conservation efforts and hopefully, adopting responsible behavior (Kruse and Card 2007).

In order for conservation mindedness and REB to occur, goals for program development in environmental interpretation must be developed. Knapp (2007) discussed three levels of goals that allow participants of environmental interpretation to achieve behavioral change (Fig. 3). Level I: Entry-Level Goals have four different components. The first seeks to provide participants with sufficient site information to allow him/her to be knowledgeable about the site where the interpretation program occurs. Understanding of a site provides the visitor with an experience that promotes understanding and comprehension. Awareness of the site provides visitors with enough knowledge to understand resource management policies and goals of the site. Sensitivity provides visitors with experiences that allow for an empathetic response toward the site. Level II: Ownership Goals only have only two components. Ownership seeks to develop cognitive awareness of how visitors' actions influence the quality of the natural resources of the site, and provides knowledge necessary to allow visitors to investigate and evaluate the site's natural resource issues. The last level is Level III: Empowerment Goals. This level seeks to develop skills that are necessary for the participants to take a positive and responsible environmental action in regard to the site issues.

Species Survival Plan

The Species Survival Plan (SSP) is just one of many ways conservation organizations like zoological institutions and aquariums contribute toward the conservation of threatened and endangered species. The World Conservation Union stated that 23% of all evaluated vertebrate species are threatened (Zimmerman 2007). The IUCN (2015) reported 41% of amphibians, 26% of mammals and 13% of bird species that were assessed are listed as threatened. Through input to SSP's, zoos provide one of the few opportunities for guests of zoos and aquariums to experience living wild animals and convey their conservation message. The Species Survival Plan manages specific threatened and endangered species populations within AZA accredited zoos. Currently, there are 500 SSP programs in AZA accredited zoos across the nation and internationally (Species Survival Plan 2016). The animals bred in captivity are the basis for reintroduction of a species back in the wild. When first designed, the focus of SSP required the expertise of the zoological personnel in order to define the carrying capacity for each endangered species at zoological institutions (Read, Vogt, and Houston 1990). Today, SSP's main concern is to maintain genetic diversity for viable populations of species for long-term captivity. Because populations of each species in zoos are small, this task is not the easiest to accomplish. Zimmerman (2007) reported that there are fewer than 200 species of threatened and endangered mammals that were propagated in the world's zoos. Many population management plans predict to lose 10% of their founding genetic diversity in just two years.

Research Questions

National Geographic (Endangered Species 2016) identifies two main reasons for the endangerment of animals: habitat loss and loss of genetic diversity. How can zoos convince guests their daily actions can protect the natural world around them and, in turn, the threatened and endangered species? It is critical for zoos and aquariums to persuade their guests they are able to change behavior locally, and that change will impact conservation issues in other countries. Zoos' main challenge is to convince their guests their individual actions have enormous potential to conserve Earth's resources not only now but for future generations as well (Ballantyne et al. 2007). Guests often fail to see the connection between their everyday actions and broader conservation goals. Zoos and other conservation centers have the opportunity to present their guests with specific management options that will allow them to use their local environments in a sustainable manner (Fig. 4).

By using animals involved in the SSP program specifically, the hope is guests will learn about the specific conservation issues that surround that displayed animal species and, more generally, see the need to actively protect nature as a whole. The third generation enclosure setting, in which zoos now display SSP animals, could influence guests' perceptions of their value to the world (Zimmerman 2007). The animals can help guests learn and reflect on their own relationships with nature by allowing them to develop an emotional tie to wildlife. Zoos offer visitors a chance to engage in "free-choice learning" experiences through interactions with these naturalistic exhibits without going into the wild (Ballantyne and Packer 2011). They can also offer an appreciation for the natural world that visitors can glimpse through these exhibits. In order for

appreciation to become a reality, Ogden and Heimlich (2009) stated that zoos must realize the potential they have to address the world on its conservation needs. The potential impact on guests to address those needs is one way to achieve this goal. Through conservation education, zoos can influence visitors' attitudes toward wildlife and hopefully inspire consistent behavioral changes towards the environment.

Conservation education programs play an important role in allowing their guests to understand what conservation programs, like SSP, are designed to do, why they are necessary, and what is involved with the program (Fien, Scott, and Tilbury 2001). Through the experiences zoos and aquariums create for their guests, they can increase and inspire them to improve their conservation mindedness. They also provide outlets and opportunities for guests to support conservation organizations or change certain daily activities that can improve the environment. After guests are aware of the conservation issues around SSP species, do they develop positive attitudes that lead to supporting conservation efforts? Does their conservation mindedness change? And, do they adopt responsible environmental behavior? In Falk, Reinhard, Vernon, Bronnenkant, Heimlich, and Deans' (2007) study, researchers discovered that many guests of large urban city zoos believed that zoos and aquariums did play an important role in conservation education and animal care. The guests also saw themselves as part of a solution for environmental problems and conservation actions. Can this same outcome be true using only SSP animals in a smaller zoo setting?

Interpretive Program	Program Strategies to Enhance Recall	Episodic Memories Held	Semantic Memories Developed
	<ul style="list-style-type: none"> •Active based •Personally relevant •Concept repetition 	Vivid recall of experiences	Conceptual knowledge attained

Fig. 1. A Learning Model for an Interpretive Program (Knapp 2007).

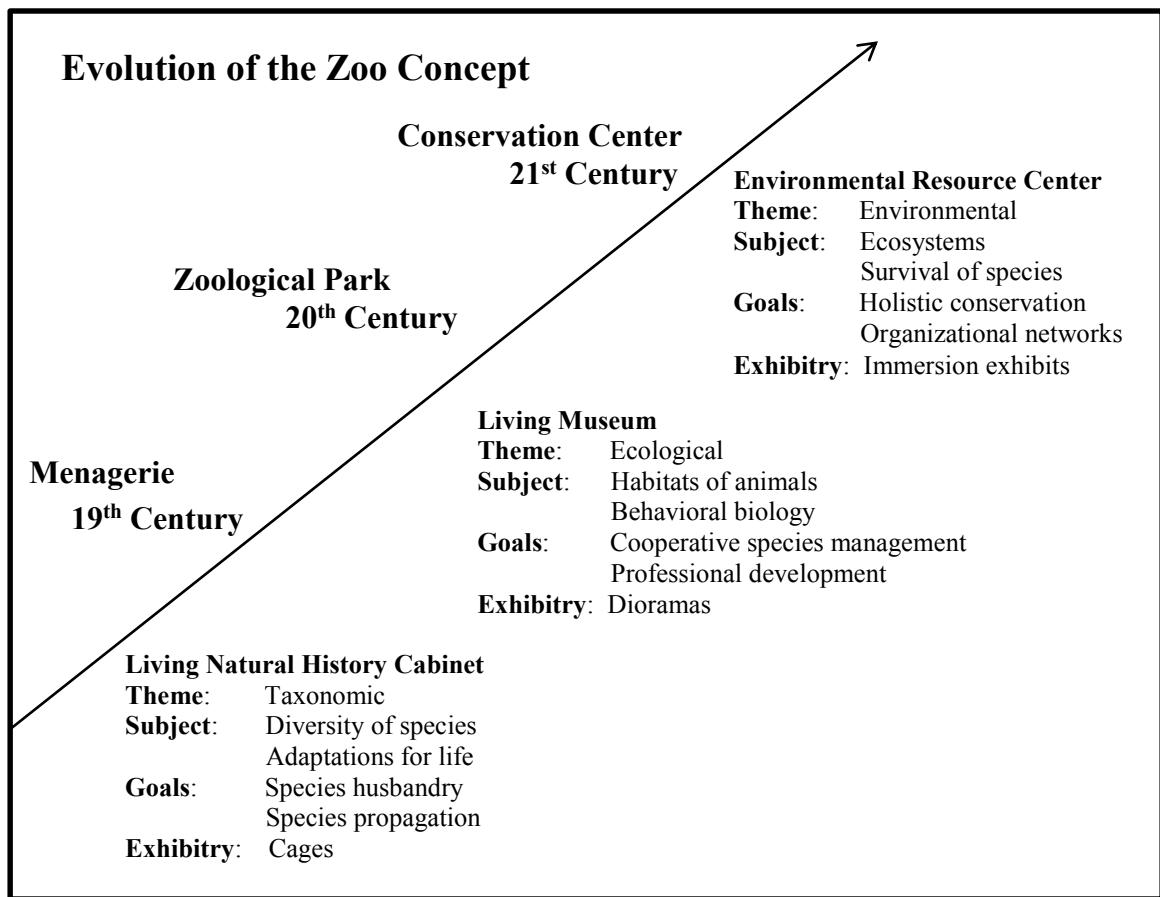


Fig. 2. Evolution of zoos to conservation centers (Zimmerman 2007; Rabb and Saunders 2005).

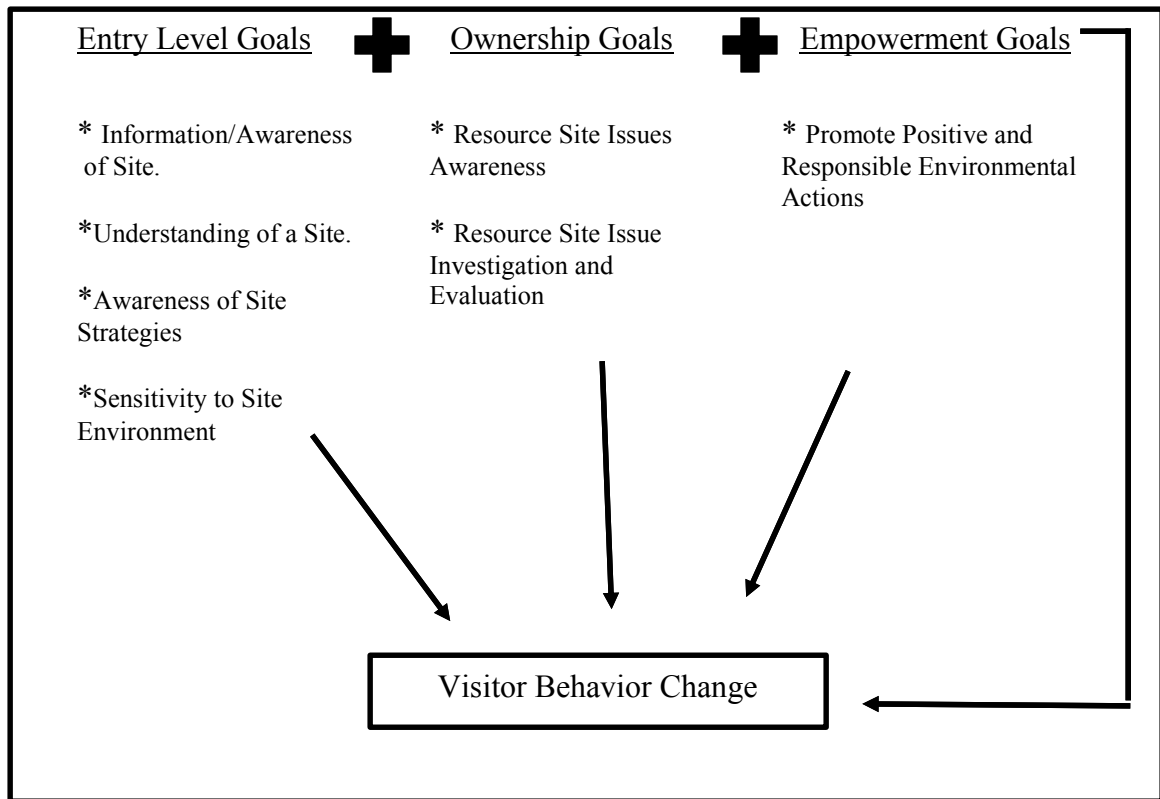


Fig. 3. Environmental Interpretation Behavior Change Model (Knapp 2007).

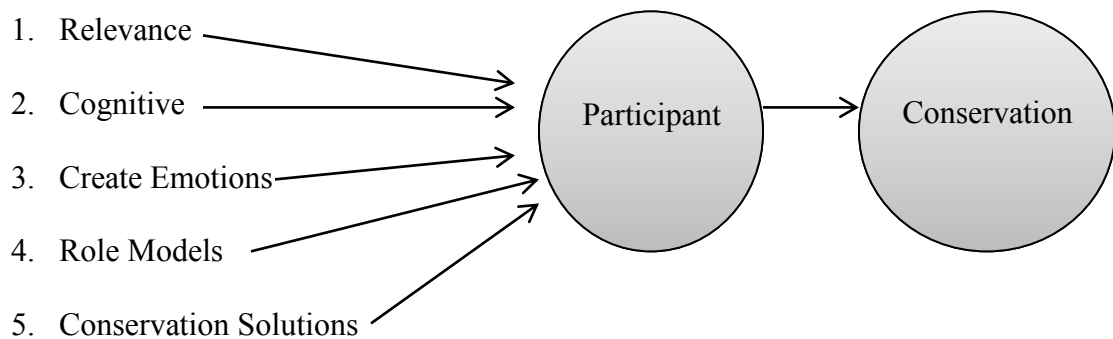


Fig. 4. Five forces that influence inspiration for conservation. (Zimmerman 2007)

METHODS

Human Research IRB Approval

Notice of IRB Human Subjects approval was obtained on 26 March 2015 under study number 15-0382 (Appendix A).

Study Population

This study was conducted at the Dickerson Park Zoo in Springfield, Missouri. The zoo exhibits 153 species on 40 developed acres. During the 2015 summer, Dickerson Park Zoo admitted up to 764 visitors on a daily basis (Pam Price, Personal Communication). Guests under the age of 18, staff and volunteers were excluded from the study. Most of Dickerson Park Zoo's guests come from the rural regions of the Ozarks and Springfield, but guests of the zoo are not limited to this region.

Experimental Design

This study used a volunteer sampling design to quantitatively assess the impact the Species Survival Plans (SSP) at Dickerson Park Zoo have on guests' conservation mindedness and behavioral change after the visit. The study took place over a four-month period on weekends from 1 June through 4 September of 2015. The average zoo attendance numbers are larger during the summer months while children are out of school. Weather conditions varied throughout the summer with June being a rainy month that hindered collection of data.

A mixed-method survey strategy was chosen to collect data on experimental and control days. Surveys are often used to assess guests' knowledge and attitude in zoos and aquariums. Surveys also provide exposure to an issue the guest may not have known about before entering the zoo, and it allows guests to contemplate their opinions by simply answering the questions in the surveys (Swanagan 2000). Experimental days consisted of volunteers choosing a charismatic megafauna species involved in SSP and presenting their conservation concerns to guests (Fig. 5). Volunteers chose which species from a randomized table posted by the presentation information. Although a table was posted, volunteers could have deviated from the schedule. I chose this method because highlighting "iconic" or "popular species" that are involved in SSP should automatically have a positive impact on the experience of the visitors (Ballantyne et al. 2007). Volunteers could choose to present information on Asian Elephants (*Elephas maximus*), African Lions (*Panthera leo*), Giraffes (*Giraffa camelopardalis rothschildi*; *Giraffa camelopardalis reticulata*), or Cheetahs (*Acinonyx jubatus*). These species were selected because the zoo had numerous prepared biological and ecological facts available for presenters. Presentations included biological facts, fun facts, conservation status and threats to the species (Appendix B). On experimental days, volunteers and I administered surveys to guest who had attended an SSP presentation. The presentations were set near species' exhibits to insure guests could see the table but also not block any access to pathways. Tables were set up with pelts and skulls, and presenters were behind the tables presenting information on that species. Control days consisted of volunteers and myself roaming the zoo and asking guests to take the initial survey; no presentation was available.

Instruments

The initial survey had several sections including questions about membership of Friends of the Zoo, number of guests' previous visits, conservation-responsible actions before the survey date, and which SSP presentation guests attended and what they learned. The survey also included how familiar the guest was to the Species Survival Plan, and which Quick Response codes they scanned. Twelve questions examined guests' personal opinion about their contribution to conservation using a four-point Likert-scale. The follow-up survey included the same conservation responsibility questions that were included in the initial survey. The goal of the follow-up survey was to compare the guests' conservation mindedness and behavior after attending a Species Survival Plan presentation.

Paper surveys were the primary method of data collection (Appendix C). Systematic sampling of visitors was taken by trying to select every 3rd guest who approached the presentation in the zoo as in Falk et al., 2007. Email addresses were collected at the end of each survey for guests that were willing to take a follow-up web-based survey. At the completion of the study, a total of 437 surveys were collected with 190 (43%) emails given. Email surveys were sent out approximately one month after the visit date (Appendix D). From the 190 follow-up surveys sent through SurveyMonkey.com, 48 (25%) guests completed the survey.

I assumed that all participants received the original survey link, but it is possible emails were intercepted by spam filters, potential respondents did not check their emails, or had abandoned their accounts. A reminder email was sent on 9 September 2015, and a thank you email was sent to the 48 respondents of the online survey on 22 October 2015.

The text of the email thanked everyone for their participation and informed them who won the two free tickets to Dickerson Park Zoo for their next visit.

Quick Response codes were attached to 10 species' informational signs involved in the Species Survival Plan. The codes referred the guests to Dickerson Park Zoo's website which included a picture of the DPZ's own animals with information on range, habitat, diet in the wild and in captivity, size, lifespan in the wild and captivity, gestation, conservation status and threats, and fun facts (Appendix E). The 10 species included Rothschild and Reticulated Giraffes (*Giraffa camelopardalis rothschildi*; *Giraffa camelopardalis reticulata*), Siamangs (*Sumphalangus syndactylus*), Chilean Flamingos (*Phoenicopterus chilensis*), White-throated Capuchins (*Cebinae*), Plains Zebras (*Equus quagga*), African Lions (*Panthera leo*), North American River Otters (*Lontra canadensis*), Guereza Colobus (*Colobus guereza*), Cotton Top Tamarins (*Saguinus oedipus*) and the Panamanian Golden Frog (*Atelopus zeteki*).

Data Analysis

Data collected through the initial and follow-up surveys were entered manually into a spreadsheet. Although only 53% of the respondents went to a Species Survival Plan presentation, all respondents were included in the data analysis for a better understanding of the general zoo guests. Frequency distributions and means were calculated for all questions on the initial and follow-up surveys. Mean scores were tested with a 2-sample t-test between control and experimental days. A paired *t*-test was used to compare the scores for the twelve conservation mindedness questions between the initial survey and those guests who responded to the follow-up survey.

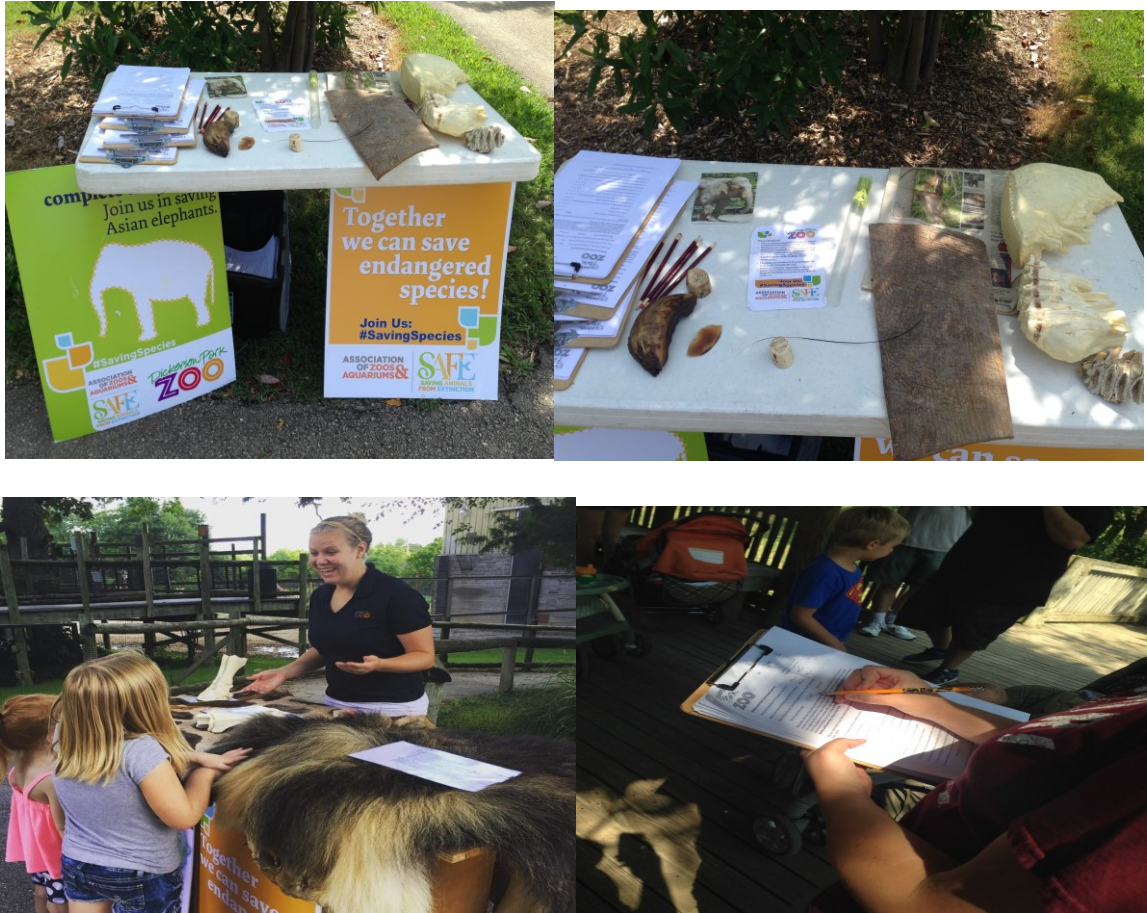


Fig. 5. Species Survival Presentations and guests taking the initial survey.

RESULTS

Demographic Results

A total of 437 initial surveys were completed from May through September of 2015. Every question was not always answered on the initial survey. Demographic characteristics were collected for respondents including age, gender, race/ethnicity, education, employment, and income. Because surveying was done to maximize the number of respondents who attended SSP presentations and selected control respondents, these demographic data are not necessarily representative of the entire population of zoo visitors. Over 33% (n=139) of the respondents were 25-34 years of age. Twenty-nine percent (n= 125) were males and 70% (n=296) were females. The majority of respondents were Caucasian (93.4%) and approximately 50% had less than a college degree. Of the respondents, 40% reported earning a yearly household income of \$20,000 to 49,000 (Table 1). Analysis of variance was done for all demographics to the mean of the 12 “at home” questions. Age was the only demographic to show significant variation to responses ($P=0.003$). Gender, education, employment and income showed no significant effect on responses.

Initial Survey

Over the course of research, 233 surveys were collected on experimental presentation days while 204 surveys were collected on control or non-presentation days. The same 12 “at home” conservation questions were asked for both presentation and control days. Respondents could answer ranging from 1 to 4; 1= never accomplished the

task, 2= rarely accomplish the task; 3= often accomplished the task, 4= always accomplished the task. All “at home” questions showed moderate level of positive responses. Means above 2.5 indicated a high level of positive responses. These behaviors included recycling at home and/or work, using florescent light bulbs, and watering lawns during summer months. Two questions showed the highest means above a 3.0; turning off lights and not using pesticides or herbicides on lawns. The two lowest means were riding a bike/ walking to work and using public transportation (Table 2).

Surveys from experimental and control days were combined to determine the conservation mindset of members of Friends of the Zoo (FOZ) that attended Dickerson Park Zoo over the summer of 2015. There were no significant differences between FOZ members and non-members ($P = 0.57$; $T = 0.56$). Results showed that only 20% of respondents were FOZ members while 79% ($n=352$) were non-members. Of the non-members, 77.9% stated that the survey day was their first time visiting DPZ. Both members and non-members showed similar mean scores in “at home” question responses (Table 3). Visitors were asked if they had attended a Species Survival Plan presentation, and if so, which one they attended. Out of 437 surveys attained, 22.1% of respondents stated they attended a presentation, while 77.9% stated they did not attend a presentation (3 did not answer the question). It should be noted that visitors were told when they approached the information table that they were attending a SSP interactive talk. Out of the 22.1%, the highest percentage of presentation attended was for the cheetah SSP at 54.6%.

Follow-up Survey – Conservation Mindedness Growth

A paired t-test between the total initial mean and total follow-up mean was used to determine the overall mean difference for any behavioral changes. There was a significant difference ($P < 0.01$) of behavioral changes between initial and follow-up behaviors for age. Table 3 shows results of paired t-test between each initial and follow-up questions. Using florescent light bulbs was significantly lower for the follow-up ($P=0.04$). This difference could be due to sampling error in the follow-up survey. Turning off lights approached significance with a decreased behavioral change between the initial and follow-up survey ($P=0.06$; Table 3).

Quick Response Code Usage

Eight species were not used for presentations made to the public, but the same information was given in a QR code (Appendix F). The initial surveys indicate that only 21.7% of visitors scanned a QR code. It should be noted that codes could have been scanned on days when surveys were not taken. The African lion (*Panthera leo*) and the North American River Otter (*Lontra canadensis*) were the two QR codes scanned the most frequently (Table 4).

Presentation Knowledge Responses

When guests of DPZ attended a SSP presentation, they were asked in the initial survey what they learned from the presentation. Responses varied from certain characteristics of the animal being presented (AC), the conservation of the animal (CON), SSP in general or the SSP plans for the animal (SSP), environmental education (EE) and

enrichment (E) for the animal. Forty-five of 233 (19%) guests who attended presentations responded. The highest responses were animal characteristics with (62.2%), information from SSP (20%), conservation of the species (17.8%) learning about environmental education in general and enrichment of the animal (10%). Of all respondents, 81% (n=356) responded with how familiar they were to the SSP before listing what they learned from the interactive talk. Of those 356, 44.7% stated that they were just learning about SSP, and 40.5% were not familiar with the program. Table 5 lists a few SSP responses on presentation days. Additional responses are in Appendix E.

Table 1. Frequency and percentages of all demographic characteristics of respondents.

Variable	Frequency	%
Age		
18-24	45	10.8
25-34	139	33.5
35-44	106	25.5
45-54	58	13.9
55-64	44	10.6
65-74	30	4.8
75 or older	3	0.7
Ethnicity		
Caucasian	396	93.4
Hispanic/Latino	5	1.2
Black/African American	4	0.9
Native American/ American Indian	9	2.1
Asian/Pacific Islander	7	1.6
Other	3	0.7
Education		
High School/ GED	84	20.1
Trade/Vocational/ Technical Training	21	5.0
Some College	107	25.6
Associate's Degree	44	10.5
Bachelor's Degree	95	22.7
Master's Degree	66	15.8
Employment		
Employed	256	60.8
Self-Employed	39	9.2
Homemaker/ Stay at Home Parent	57	13.5
Student	28	6.6
Retired	29	6.8
Other	12	2.8
Income		
< 20,000	74	18.7
20,000-49,000	158	40.0
50,000-74,000	87	22.0
75,0000 +	76	19.2

Table 2. Mean Conservation Mindedness of Initial Survey Responses. PA n=233 PUA n=204; FOZ Members n=86 Non-FOZ Members n=233. PA represents presentation available, PUA represents presentation unavailable, FOZ represents Friends of the Zoo, and Non-FOZ represents respondents not being a Friend of the Zoo member.

Questions	FOZ Members	Non-FOZ Members	PA	PUA
4 Ride bike/walk to work	1.17	1.25	1.24	1.23
5 Recycle (home)	2.71	2.61	2.65	2.62*
6 Recycle (work)	2.72	2.65	2.62	2.71*
7 Canvas Bags	2.06	2.00	2.01	2.03
8 Econ-Car	1.95	2.03	2.01	2.07
9 Unplug Electronics	2.51	2.43	2.45	2.44
10 Turn off Lights	3.74	3.70	3.69	3.73**
11 Public Trans.	1.24	1.38	1.35	1.34
12 Florescent Bulbs	3.00	2.85	2.90	2.89*
13 Water Lawn	2.83	2.92	2.80	3.01*
14 Pest/Herb	3.07	3.17	3.02	3.31**
15 Donated to Conservation	2.19	1.91	1.88	2.04

* Means of 2.5 and higher resulted in positive responses.

** Indicates highest positive means.

Table 3. Mean comparison of behavior change between initial survey and follow-up survey.

Initial Survey	Follow-up Survey	Initial Mean	Follow-up Mean	T-value	P-value
4 Ride bike or walk to work	1. Ride bike to work/carpool	1.18	1.18	0.00	1.00
5 Recycle at Home	2. Recycle at home and/or work	3.01	2.85	1.14	0.25
6 Recycle at Work					
7 Canvas Bags	3. Use canvas bags	2.22	2.16	0.41	0.68
8 Econ-friendly Car	4. Eco-friendly car	2.10	2.22	0.90	0.37
9 Unplug Electronics	5. Unplug electronics	2.39	2.14	1.55	0.12
10 Turn off lights	6. Turn off lights	3.70	3.43	1.91	0.06**
11 Public Trans.	7. Use public transportation	1.58	1.50	0.49	0.62
12 Florescent Light bulbs	8. Use florescent light bulbs	2.79	2.41	2.11	0.04*
13 Water Lawn	9. Water lawn/Use pesticides or herbicides on lawn	1.62	1.52	1.00	0.33
14 Pesticides/Herbicides					
15 Donated to Conservation	10. Donated to conservation	1.93	2.06	0.71	0.47

* Significant at $P < 0.05$

** Approached significance.

Table 4. Quick Response Code Usage. Panamanian Golden Frog was removed from exhibit during research process.

Species Survival Plan Animal	Number of Scans
Chilean Flamingo	18
White-throated Capuchin	1
Plains Zebra	34
Siamangs	15
African Lions	49
North American River Otter	42
Guereza Colobus	10
Giraffes	19
Cotton-top Tamarin	20
Panamanian Golden Frog	6

Table 5. Characteristics and responses on initial survey to SSP presentation.

Characteristics	Responses
AC	“Cheetah claws do not retract, large chest to house lungs for increased oxygen, small skull.”
AC	“Giraffes have 7 bones in neck, 20 in. tongue, and lions can live up to 15 years.”
AC	“How to tell the difference between Asian and African elephants.”
AC and CON	“Ten thousand lions left and on endangered species list, giraffe has same number of neck bones.”
AC and CON	“Have same # of vertebrae as humans and are endangered because of human encroachment.”
CON	“Endangered species”
CON	“Only 10,000 cheetahs left in the wild”
CON and SSP	“Threatened species are being bred to maintain stable populations”
SSP	“How animals being rotated for gene variation”
SSP	“Zoos partner and other zoos to preserve elephants and also have education programs.”
EE	“Natural elephant interactions with kids, ivory trade, education, elephants at DPZ”

DISCUSSION

Using zoo and aquarium animals as ambassadors to the public can promote increases in knowledge, enhancement of environmental attitudes, and create a positive perception for conservation (Ballantyne et al. 2007). However, persuading visitors that changing personal behaviors can impact conservation issues abroad is critical if zoos and aquariums are to bring changes in their guests' day-to-day behavior. The main challenge for wildlife attractions is to convince their guests that individual actions have the potential to conserve the earth's resources for future generations. Guests often fail to see the link between their everyday actions and broader conservation goals but want tools and solutions to help. Zoos and aquariums need to continue to present their guests with specific manageable options that will enable them to use their local environment in a more sustainable manner (Ballantyne et al. 2007).

Presentation attendance or their Friends of the Zoo status did not influence respondent results. No difference could be expected due to the fact that all guests of DPZ came into the research with their daily actions set before attending a presentation. The highest positive responses of the 12 "at home" questions were questions that have been known to save homes and families money and are easiest to do. These included unplugging electronics, turning off lights when leaving a room, using florescent light bulbs and not watering lawns nor using pesticides/herbicides on lawns (Tables 3). In recent years, recycling has become a more common practice across the country. Therefore, it was no surprise that recycling at home and in work places were the biggest conservation actions of respondents. Some respondents' answers that contradicted

conservation actions could have been a result of misinterpretation of the questions themselves. Watering lawns during the summer and using pesticides or herbicides were often answered positively. Also, respondents might have considered the portion of zoo admission for conservation just zoo fees not a personal conservation donation.

Riding a bike, walking to work, and using a form of public transportation showed the lowest behavioral changes. In today's society, people have become more independent, live further away from work and activities, and have different schedules that keep them extremely busy. People want the convenience of having their own form of transportation to ensure they can keep to their schedule. Using a form of public transportation seems to be uncommon in Springfield's culture. People may expect that those who use public transportation have lower incomes; when in reality, it could be the answer to several environmental problems.

Zoo education is a unique and unrealized conservation impact tool to reach the millions of guests that enter their gates each year (Zimmerman 2007). However, this impact may be lessened by two characteristics of zoos: (1) the public sees most zoos and other conservation institutions as local education and recreation services not as a part an "urgent national and global environmental obligation" (pg. 14); and (2) education programs are often oriented towards children, but maybe they should be focusing on generations that can make more immediate decisions to save what magnificence of the Earth that is left (Zimmerman 2007).

The major question of this research was to see if DPZ guests' conservation behavior changed in any way after being presented with information of how the zoo animals are being affected out in the wild. When comparing responses from the initial

survey responses and the follow-up survey responses, only two questions showed significant behavior changes, turning off lights and using florescent light bulbs (Table 3). This could be due to the sampling error of the follow-up respondents.

Interpretation is a field that has not developed a definite plan to achieve attitude or behavioral change goals. Knapp (2007) claims a non-definitive plan may be due to a lack of time with visitors that creates a significant gap for a person to attain a behavioral change. The two crucial variables for any visitor of an interpretation program are their in-depth knowledge of environmental issues and an investment of time regarding these issues. Time is a characteristic interpretive programs lack, but is necessary in order for guests to attain any sensitivity, knowledge, and attitudes required for a positive environmental response (Knapp 2007). If conservation institutions want to be able to really reach out to the public, maximize the impact and engage guests in caring for biological diversity, a more extended close, caring relationship to the challenges on a more emotional level needs to occur. Caring is strongest when people, plants and animals are closest to environments surrounding the individual. A challenge for zoos and aquariums is to incorporate this localized caring out towards caring for more distant issues of different environments (Rabb and Saunders 2005).

It was expected that behavioral changes between members of FOZ would show more significant changes between the initial survey to the follow-up online survey compared to non-members. Members of any conservation institution are interpreted to have higher conservation awareness than non-members. Is this always the case? Being a member of zoos and aquariums comes with a lot of “perks” for families to allow them to visit these places more often and get discounts along the way. Are members the

demographic population that zoos and aquariums need to be focusing their conservation efforts? Do members carry more conservation awareness, more wealth to help towards conservation efforts, or are they just interested in the recreational aspect of conservation institutions and discounts? Either way, zoos need to discover new ways to maximize a conservation impact through all demographic populations that attend.

Guests perceive, interpret, and assimilate conservation information in different ways. Zoos and wildlife tourism settings need to design experiences that enable each visitor to connect the new information to their existing knowledge, interests, and experiences (Ballantyne et al. 2007). Because of the different styles of learning guests contribute to their visit, we wanted to see if using another route for guests to receive information would have an impact. With technology becoming an increasing innovation in education, Quick Response (QR) codes were a way to use that technology for learning beyond the presentations given. Research has shown that information signage can be an important way for zoos and aquariums to enhance the education and recreational experiences for their guests (Sanford and Finlay 1988). The QR codes placed on DPZ's animal exhibits showed potential for further education for guests to have an interactive way to learn about those animals. Where the codes were placed on exhibit signs could have had a possible hindrance of their effectiveness for guests to learn. The codes might have been too far away for guests to reach or they were covering information on the original exhibit sign.

Future Research

Research at conservation institutions such as zoos and aquariums has mainly focused on knowledge and attitude changes. Research on behavioral changes by zoos is lacking. Future research needs to be done on how zoos and aquariums can influence behavioral changes in their guests. Zimmerman (2007) states that in the future, zoos must learn how to detect behavioral changes, use that knowledge to shape and design old exhibits, and develop any associated interpretation tools so they can be more effective in getting their conservation message across more clearly to the public. Then they need to assess whether the increased awareness or understanding results in behavioral changes.

Zoos and aquariums need to decide what behaviors they wish their guests to be a part of in order to increase conservation impacts (Zimmerman 2007). Are there cultural differences that guests bring with them that determine if a conservation message comes across in an effective way? Do some exhibits have a more effective way to changing guests' behaviors? Zoos must find a way to be more deliberate on how they inspire their visitors, both children AND adults, and be more than a recreational experience.

REFERENCES

- Ballantyne, R., J. Packer, K. Hughes, and L. Dierking. 2007. Conservation Learning In Wildlife Tourism Settings: Lessons from Research in Zoos and Aquariums. *Environmental Education Research* 13 (3): 367-383.
- Ballantyne, R., and J. Packer. 2005. Promoting Environmentally Sustainable Attitudes and Behavior through Free-Choice Learning Experiences: What Is the State of the Game? *Environmental Education Research* 11 (3): 281-295.
- Ballantyne, R., and J. Packer. 2011. Using Tourism Free-Choice Learning Experiences to Promote Environmentally Sustainable Behavior: The Role of Post-Visit Action Resources. *Environmental Education Research* 17 (2): 201-215.
- Balmford, A., N. Williams, G.M. Mace, A. Manica, O. Walter, and A. Zimmerman. 2007. Message Received? Quantifying the Impact of Informal Conservation Education on Adults Visiting UK Zoos. *Zoological Society of London*: 120-34.
- Endangered species. (2011). Retrieved from:
<http://education.nationalgeographic.org/encyclopedia/endangered-species> (April 18, 2016)
- Falk, J.H., E.M. Reinhard, C.L. Vernon, K. Bronnenkant, J.E. Heimlich, and N.L. Deans. 2007. Why Zoos and Aquariums Matter: Assessing the Impact of a Visit to a Zoo or Aquarium. *Association of Zoos and Aquariums*.
- Fien, J., W. Scott, and D. Tilbury. 2001. Education and Conservation: Lessons from an Evaluation. *Environmental Education Research* 7 (4): 379-95.
- IUCN 2015. *The IUCN Red List of Threatened Species. Version 2015-4*. Retrieved from:
<http://www.iucnredlist.org> (April 15, 2016)
- Knapp, D. 2007. Applied Interpretation: Putting Research into Practice. Fort Collins, CO: National Association for Interpretation.
- Kruse, C.K., and J.A. Card. 2004. Effects of a Conservation Education Camp Program on Campers' Self-Reported Knowledge, Attitude, and Behavior. *The Journal of Environmental Education* 35 (4): 33-45.
- Marino, Lori, Randy Malamud, Nathan Nobis, Ron Broglio, and Scott O. Lilienfeld. 2010. Do Zoos and Aquariums Promote Attitude Change in Visitors? A Critical Evaluation of the American Zoo and Aquarium Study. *Society & Animals* 18 (2): 126-38.

- Ogden, J., and Joe E. Heimlich. 2009. Why Focus on Zoo and Aquarium Education? *Zoo Biology* 28: 357-360.
- Patrick, P., C. Matthews, D. Ayers, and S. Tunnicliffe. 2007. Conservation And Education: Prominent Themes In Zoo Mission Statements. *The Journal of Environmental Education* 38 (3): 53-60.
- Powell, D.M., and E.V. W. Bullock. 2014. Evaluation of Factors Affecting Emotional Responses in Zoo Visitors and the Impact of Emotion on Conservation Mindedness. *Anthrozoos: A Multidisciplinary Journal of The Interactions of People & Animals* 27 (3): 389-405.
- Rabb, G.B., and C.D. Saunders. 2005. The Future of Zoos and Aquariums: Conservation and Caring. *International Zoo Yearbook* 39: 1-26.
- Read, Bruce, Dale Vogt, and E. W. Houston. 1990. Breeding Program for the Lesser Kudu (*Tragelaphus imberbis*) in North America. *Zoo Biology*, 9 (4): 287-96.
- Sanford, J., and T. Finlay. 1988. The effects of exhibit signage on visitor behavior. *Nineteenth Annual Conferences of the Environmental Design Research Association*. 19.
- Species Survival Plan® (SSP) Programs. (n.d.). Retrieved from: <https://www.aza.org/species-survival-plan-program> (April 18, 2016)
- Swanagan, J. 2000. Factors Influencing Zoo Visitors' Conservation Attitudes and Behavior. *The Journal of Environmental Education* 31 (4): 26-31.
- Zimmermann, A. 2007. In Press. Conservation Education in Zoos: An Emphasis on Behavioral Change. *Zoos in the 21st Century: Catalysts for Conservation?*

APPENDICES

Appendix A. Human Research IRB Approval Email

To: Janice Greene
Bull Shoals Field Station
Kings 201 901 S. National Avenue Springfield MO 65897

From: MSU IRB

Date: 3/26/2015

RE: Notice of IRB Exemption
Exemption Category: 5.Federal demonstration projects
Study #: 15-0382

Study Title: Zoo Visitors' Conservation Mindedness

This submission has been reviewed by the Missouri State University IRB and was determined to be exempt from further review according to the regulatory category cited above under 45 CFR 46.101(b).

Investigator's Responsibilities:

If your study protocol changes in such a way that exempt status would no longer apply, you should contact the above IRB before making the changes.

CC:
Sarah Foster, Biology

Appendix B. Species Survival Plan Presentation Information

1. **Reticulated Giraffe**- www.blankparkzoo.com/www.saczoo.org
 - a. Range: Northern Kenya (Somalia)
 - b. Habitat: Dry savannas, open woodlands
 - c. Diet: Herbivores; acacia tree leaves, vines, creepers, evergreens.
 - d. Size: males- up to 18 ft. and 2300 lbs. females- 13-15 ft. and 1200 lbs.
 - e. Lifespan: 25 years in wild; 30 years in captivity
 - f. Gestation: 455 days (14 – 14 ½ months)
 - g. Conservation: Stable; human encroachment, loss of habitat, and tails are considered “good luck” charms in some African tribes. Also hunted for meat by tribes.
 - h. Fun Facts: Tallest mammal, can be found in herds of up to 40 giraffes, sleep and give birth standing, has 20-inch prehensile tongue that is purple to prevent sunburn. They are ruminants that have a four multi-chambered stomach. Their chestnut-colored square patches distinguish them, which can be as different as human fingerprints.
2. **Rothschild Giraffe**- www.giraffersearch.com
 - a. Conservation- most endangered subspecies due to human population expansion, poaching and habitat loss. There are only 13 remaining in Uganda and are extinct in Sudan.
 - b. Fun Facts- Coat patches much less “jagged” and are found on a cream colored background. They have no markings found below their knees.
3. **Lions** – nationalgeographic.com
 - a. Range: Saharan Africa
 - b. Habitat: grasslands, shrubs, open woodlands, savannas, grassy plains
 - c. Diet: Carnivore – antelopes, zebras, wildebeest
 - d. Size: head to body- 4.5- 6.5 ft. tail – 26.25-39.5 inches. 265-420 lbs.
 - e. Lifespan: 15 years in wild, 30 in zoos.
 - f. Gestation: 4 months
 - g. Conservation: Vulnerable- 6,000-10,000 lions in wild Africa. About 400-460 subspecies live on reserves. They are being killed by disease, hunting and loss of habitat.
 - h. Fun Facts: Only cats to live in groups (prides); they contain 3 males with about a dozen females and their young. The males defend territory up to 100 square miles. The females are the primary hunters of the pride. The male’s mane function is to make them look more impressive to the female and protects their neck against claws during fights with other males. Lions usually sleep or rest 21 hours of the day. Their roar can be heard up to 3 miles away.
4. **Asian Elephant** – animals.nationalgeographic.com/nationalzoo.si.edu/www.worldwildlife.org
 - a. Range – India, Sri Lanka, Myanmar, Indonesia, Thailand, Cambodia, Vietnam, Laos, southern China

- b. Habitat – Forests, grasslands
 - c. Diet – Herbivore
 - d. Size – 10 ft. tall; 2.25-5.5 tons
 - e. Lifespan – 60 years in the wild
 - f. Gestation – 22 months
 - g. Conservation – Endangered; killed for ivory, which is illegal today, their forests are also being turned into agriculture use.
 - h. Fun Facts – Smaller than African elephants, their ears radiate heat to help them keep cool, their trunks are used for smelling, breathings, trumpeting, drinking, and grabbing. It contains 100,000 different muscles that have finger-like features on end of the trunk. They consume up to 300 lbs. of food daily. They have the longest pregnancy of any other mammal so they only raise one calf every 2-4 years. When traveling, they can produce 220 lbs. of dung while walking 125 square miles. This helps to disperse germinating seeds.
5. **Cheetah**- cheetah.org/animals.nationalgeographic.com/animals.sandiegozoo.org
- a. Range – Eastern and southwestern Africa
 - b. Habitat – wide open grasslands and savannas
 - c. Diet – carnivores
 - d. Size – 4-5 ft. tall, 77-143 lbs., tail: 25-32 in. long
 - e. Lifespan – 10-12 years in wild; 17 in captivity
 - f. Gestation – 3 months
 - g. Conservation – Vulnerable; 7,000-10,000 remain in wild due to human impact
 - h. Fun Facts – They are the world's fastest land mammal and can go from 0-60 mph in 3 seconds. Due to this their hunting is over than less than a minute before they have to rest. When running, they use their long tail to help them steer and turn in the direction they want to go-like a rudder on a boat. They only drink water once every 3-4 days. They usually have 3 cubs per liter.

Appendix C. Initial Survey Instrument

☐

pa

☐

pua

Date _____

Dickerson Park Zoo Guest Survey

Survey # _____

Are you a member of Friends of the Zoo? Yes _____ No _____

Have you visited Dickerson Park Zoo before? Yes _____ No _____

How often do you visit Dickerson Park Zoo a year? (Average)

This is my first visit 2-3 times 4 or more

Recently, the Zoo has partnered with Missouri State University for research on visitor's conservation mindedness. Interactive talks and Quick Response codes have been placed throughout the Zoo for part of this research and for guests to have an active involvement in learning about our animals. We hope that you will take time to complete this survey for the fulfillment of this research. **You will not be identified in any way with the information given today and you may stop at any time.**

Please rate from 1 to 4 how often these are done in your everyday life. 1 being never to 4 they are done daily.

NeverDaily

- | | | | | |
|--|---|---|---|---|
| 1. I ride my bike or walk to work: | 1 | 2 | 3 | 4 |
| 2. I recycle at home: | 1 | 2 | 3 | 4 |
| 3. I recycle at work: | 1 | 2 | 3 | 4 |
| 4. I take canvas bags to the grocery store instead of using plastic: | 1 | 2 | 3 | 4 |
| 5. I drive an economically friendly vehicle: | 1 | 2 | 3 | 4 |
| 6. I unplug electronics and other devices from the wall after use: | 1 | 2 | 3 | 4 |
| 7. I turn off the lights off when I leave a room: | 1 | 2 | 3 | 4 |
| 8. I take public transportation or carpool: | 1 | 2 | 3 | 4 |

9. I use florescent light bulbs at home: 1 2 3 4
10. I water my lawn during the summer season: 1 2 3 4
11. I use pesticides or herbicides on my lawn or in my house: 1 2 3 4
12. I have donated to an environmental or conservation organization or program:
1 2 3 4
13. How likely are you to recommend Dickerson Park Zoo to a friend?

Not Likely 1 2 3 4 5 6 7 8 9 10 Highly Likely

1. Did you attend a Species Survival Plan interactive talk today at DPZ?
Yes _____ No _____
2. If yes, which interactive talk(s) did you attend?
3. How familiar were you with the Species Survival Plan prior to the interactive talk?
- 1 – Just learned about it 2 – Not familiar 3 – Familiar
- 4 – Somewhat familiar 5- Very familiar
4. Please list what you learned about the Species Survival Plan or any Conservation programs from the interactive talk(s):
5. Did you look at any Quick Response codes marked on the animal's exhibit signs?
Yes _____ No _____
6. If yes, which exhibits?
7. Did you know that a portion of your entrance fee goes toward conservation efforts made by Dickerson Park Zoo?
- Yes _____ No _____

This information is only to determine who visits the zoo. It will not be used to identify.

Age: 18-24 25-34 35-44 45-54 55-64 65-74 75 years or older

Gender: Male Female

Ethnicity:

White

Hispanic or Latino

Black or African American

Native American or American Indian

Asian/ Pacific Islander

Other _____

Education: High School graduate/ GED

Trade/Technical/Vocational Training

Some College

Associates Degree

Bachelor's Degree

Graduate Degree

Employment: Employed

Self-employed

Homemaker/ Stay at Home Parent

Student

Retired

Other _____

Income:

Less than 20,000

20,000-49,000

50,000-75,000

75,000 +

Would you be willing to take another survey 1 (one) month from today at SurveyMonkey.com? Yes _____ No _____

If yes, please enter your email below. **Your email will ONLY be used for this survey and will not be distributed to the zoo or any other organization.**

Appendix D. Follow- Up Survey Instrument

1. I ride my bike to work?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4

2. I recycle at home and/or work?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4

3. I take canvas bags to the grocery store instead of using plastic bags?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4

4. I drive an economically friendly vehicle?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4

5. I unplug electronics and other devices from the wall after use?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4

6. I turn off the lights off when I leave the room?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4

7. I take public transportation or carpool?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4

8. I use florescent light bulbs at home?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4

9. I water my lawn during the summer season and use pesticides or herbicides on my lawn

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4

10. I have donated to an environmental or conservation organization or program?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4

*** One indicates that guests never or rarely complete these tasks; four indicates that guests always complete these tasks.**

Appendix E. Example Species SSP Knowledge Responses

"Number of vertebrae, bones in giraffe feet."

"Ten thousand lions left and on endangered species list, giraffe has same number of neck bones."

"Elephants eat 300 lbs. of food a day." "7 bones in giraffe's neck."

"Bone structure, skin." "Cheetah" "Cheetahs chirp"

"Cheetahs are endangered, zoos working together to breed animals."

"Cheetah claws do not retract, large chest to house lungs for increased oxygen, small skull."

"Discover Nature" "Elephant" "Elephants need stimulation."

"Elephant skin and teeth." "Elephant teeth, tail, baby." "Elephant toenail and skin."

"Endangered species" "Fast runners, tail helps on corners."

"Felt the skin, how much they eat, difference in elephants." "Giraffe feet"

"Giraffes have 7 bones in neck, 20 in. tongue, and lions can live up to 15 years."

"Giraffes have no teeth and their tongue is purple as sunscreen."

"Giraffes not as soft as I thought and have no teeth and four stomachs."

"Giraffes run 30 miles per hour, 10,000 lions left in wild."

"Have same # of vertebrae as humans and are endangered because of human encroachment."

"How animals being rotated for gene variation"

"How big their (elephant) teeth are" "How fast cheetahs run"

"How fast they can run and how they live." "How much they (elephant) eat."

"How to tell the difference between Asian and African elephants."

"Hunted for Ivory" "Kids learned about elephants" "Lion's roar distance"

“Natural elephant interactions with kids, ivory trade, education, elephants at DPZ.”

“Only 10,000 cheetahs left in the wild”

“They (elephants) have hair”

“They (DPZ) trade species with other zoos for breeding.”

“Threatened species are being bred to maintain stable populations”

“Treading cheetah in zoos”

“Unable to breed cheetah at this facility”

“Vertebrae in neck (Giraffe)”

“We trade other animals with other zoos for species survival.”

“Zoos partner and other zoos to preserve elephants and also have education programs.”

“Zoos benefit from the SSP as do the individual species”

“Zoos trade for breeding purposes.”

Our Zoo Animals – Lion

[Home](#) [Zoo Exhibits](#) Our Zoo Animals – Lion



Lion

- Range: Throughout Africa and Asia
- Habitat: Grasslands, shrubs, open woodlands, savannas, grassy plains
- Diet: Antelopes, zebras, wildebeests. Lions are carnivores.
- Size: Head and body – 4.5-6.5 feet long. Tail is 26-29 inches. Males weigh an average of 400 pounds (up to 550 pounds), while females average 280 pounds.
- Gestation: Four months
- Median life expectancy: 10-15 years in wild

Status of wild populations: Conservation: **Vulnerable**. 6,000-10,000 lions in wild Africa. About 400-460 live on reserves. They are being killed by disease, hunting and loss of habitat.

Fun Facts

- Only cats to live in groups (called prides).
- Prides may have a few males with about a dozen females and their young.
- The males defend territory up to 100 square miles.
- The females are the primary hunters of the pride.
- The male's mane helps the cat look more impressive to the female and protects their necks against claws during fights with other males.

- Lions usually sleep or rest 21 hours of the day.
- Their roar can be heard up to three miles away.