Developing Sense of Place in USA Zoos: Effect of Featuring Local Versus Exotic Species

Mireille Bejjani

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DEVELOPING SENSE OF PLACE IN USA ZOOS: EFFECT OF FEATURING LOCAL VERSUS EXOTIC SPECIES

An Honors Thesis Submitted to the Department of Biology in partial fulfillment of the Honors Program at STANFORD UNIVERSITY

by MIREILLE BEJJANI
May 2018
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EFFECT OF FEATURING LOCAL VERSUS EXOTIC SPECIES

by
MIREILLE BEJIANI

Approved for submittal to the Department of Biology
for consideration of granting graduation with honors:

Research Sponsor
Rodolfo Dirzo (signature) Date May 10th, 2018

Second Reader
Gretchen Daily (signature) Date 10 May 2018
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Abstract

Zoos are already important institutions for educating the public to be effective stewards of the environment and passionate nature conservation actors, yet their influence could be increased. For example, the type of species exhibited can impact visitors differently: featuring exotic animals can provide broad knowledge, while focusing on species from local ecosystems can offer more relational and specialized information. The effect of varying emphasis on local versus exotic species remains unknown despite many papers analyzing zoo education. Research has shown that a stronger ecological sense of place (an individual’s connection to a space based on experiences and memories related to people, nature, or other local features) encourages more pro-environmental behavior. Therefore, promoting sense of place is one way zoos could motivate behavior changes in visitors. In this study, it was hypothesized that visitors at zoos that emphasize local species would exhibit greater ecological sense of place. Ecological sense of place was measured through Likert scale statements, whereby the more visitors agreed with statements on an area’s characteristics, the higher their sense-of-place score. These questions were disseminated through a survey at nine zoos across the country, matched geographically to contrast local and exotic species emphases and providing a substantial sample size (N = 1008 respondents). Based on a linear mixed-effects model, zoos with a local species emphasis significantly correlated with higher sense-of-place scores. Focusing on individual zoo pairs, the local-focused zoos in Nebraska and Arizona correlated with higher sense-of-place scores (a significant increase, in both cases) but those in New York and California did not. In addition, across all zoos, visitors who were local to the zoo’s area or who were zoo members had significantly higher sense-of-place scores. These results demonstrate that local-focused zoos, local visitors, and zoo members should be further investigated as promising catalysts for conservation. These groups could be targeted through outreach and educational efforts in order to maximize the development of pro-environmental behavior and to cultivate the animal conservation advocates of the future – a critical societal need in light of the current anthropogenic impact on ecosystems and wildlife in particular.
Introduction

Zoos are longstanding and widespread institutions that have come a long way from their menagerie origins to become bastions of conservation and education (Rabb 2004). They dedicate around $350 million per year to conservation efforts worldwide (Gusset and Dick 2011), and they curate programs and exhibits that aim to teach their visitors about animals, including endangered species and their futures. The Association of Zoos and Aquariums (AZA), one of the world’s leading organizations in the realm of captive animals, states that its mission is advancement in the areas of conservation, education, science, and recreation (Association of Zoos and Aquariums 2018a), and its member institutions reflect these priorities. At a time when one out of every three amphibians and one out of every four mammals are considered threatened (Rabb 2004), and populations of all vertebrates are dramatically declining or going extinct (Ceballos et al. 2017), zoos can help preserve the wildlife that is left, both in captivity and in the wild.

Zoos go about that conservation mission through a wide variety of methods and projects. Some form strong partnerships with global conservation organizations, while others focus on smaller-scale efforts, and still others do a combination of the two or something in between (Zimmerman 2007).

An example of a prominent global effort is the coordination of Species Survival Plans on the part of the AZA (Association of Zoos and Aquariums 2018b). Through over 500 programs at 232 accredited institutions, the AZA manages gene pools to ensure a strong breeding system for threatened and endangered species (Association of Zoos and Aquariums 2018c). While this project is necessary and usually effective, it is not an
A more public-facing example of conservation is Zoos Victoria’s Fighting Extinction Schools initiative (Zoos Victoria 2018a). Through curricula, Zoos Victoria partners with schools in Australia to provide students with experiences that develop their knowledge of endangered species and concretely contribute to conservation. Some of their programs, such as Love Your Locals, are specifically tailored toward native Australian species and the work that can be done to help conserve them (Zoos Victoria 2018b). As the institution explains it, the goal is “connecting future generations to the world’s unique wildlife and shaping personal values to include positive conservation principles” (Zoos Victoria 2018b). This is an instance of a zoo combining conservation efforts with education in order to involve the general population.

Research has shown that strengthening people’s sense of place could be one way to effectively include the public in zoo projects and strengthen the connection between visitors and conservation (Ardoin 2006). Sense of place is a familiarity with the history, community, and nature of one’s place based on experience (Sanger 2010). These experiences can be related to buildings, people, animals, or any aspect of a specific space that increases a person’s knowledge of and attachment to it (Ardoin 2006). Sense of place requires a space to be distinct and different from its surroundings – locations such as chain restaurants and shopping malls are often used as examples of placelessness due to their homogeneity and non-specificity (McCarthy et al. 2007; Augé 2009). Though the concept of these functional and emotional bonds has existed for many years, geographer Yi-Fu Tuan was one of the first to bring the phrase “sense of place” into the academic
realm in the 1970s (Tuan and McCalmont 2014). The topic has been explored in much more depth in the last 25 years in anthropology, environmental psychology, sociology, architecture, urban design, and other fields (Cross 2001; Hashemnezhad et al. 2013).

Some of these papers suggest that people with a more ecologically informed sense of place are more inclined to perform pro-environmental behaviors (Stedman 2002; Gordon and Chapman 2003; Scannell and Gifford 2010; Halpenny 2010). For example, a study of a community in Wisconsin found that individuals with a higher level of place attachment were more likely to act to counter environmental changes to their lake (p<0.001) (Stedman 2002). Another example is a study in a Canadian National Park, which found that park visitors with higher place-identity and place-dependence had more pro-environmental behavioral intentions, as is shown by the correlation coefficients in Table 1 reproduced from that paper (Halpenny 2010). Additionally, an analysis of two proximate towns in British Columbia, Canada distinguished between types of place attachment, revealing that natural place attachment predicted pro-environmental behavior, while civic place attachment did not (Scannell and Gifford 2010). This particular study underlines the importance of the kind of connection a person develops with their surroundings within the wide scope of sense of place. Altogether, these papers have proven an association specifically between ecological sense of place and pro-environmental behavior.

As a result of the growing evidence for this link between place attachment and behavior, environmental educators suggest that sense-of-place education become a widespread tool to reestablish or renew our connection to our natural spaces (Kudryavtsev et al. 2012). However, little work has been done to determine whether or
how zoos could contribute to sense-of-place education to increase the likelihood of their visitors taking action in defense of the environment.

*Table 1 – Demonstrated correlation between sense of place and pro-environmental behavior* from Halpenny (2010). The key numbers to look at are the correlation coefficients for identity-affect and park intentions, and for depend-affect and park intentions.

<table>
<thead>
<tr>
<th></th>
<th>Identity-Affect</th>
<th>Depend-Affect</th>
<th>Park Intentions</th>
<th>General Intentions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identity-Affect</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depend-Affect</td>
<td>.64**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Park Intentions</td>
<td>.43**</td>
<td>.53**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>General Intentions</td>
<td>.28**</td>
<td>.38**</td>
<td>.72**</td>
<td>1</td>
</tr>
<tr>
<td>M</td>
<td>2.97</td>
<td>3.98</td>
<td>3.8</td>
<td>3.7</td>
</tr>
<tr>
<td>SD</td>
<td>.857</td>
<td>.604</td>
<td>.696</td>
<td>.680</td>
</tr>
<tr>
<td>N</td>
<td>353</td>
<td>355</td>
<td>344</td>
<td>349</td>
</tr>
</tbody>
</table>

Note 1: Variables were analyzed using Pearson’ correlation coefficient; Note 2: **p < .001.

The potential of zoos to participate in this effort is all the more important to explore given zoos’ extensive reach. The 2018 AZA Annual Survey reported that AZA member institutions, which comprise a subset of the world’s zoos, served more than 195 million visitors (Association of Zoos and Aquariums 2018d). A survey in 2011 documented over 700 million annual visitors at all zoos worldwide (Gusset and Dick 2011). Seeing that a considerable number of people visit zoos, these institutions are a valuable opportunity to influence a broad audience.

Equally important to the breadth of zoos’ reach is the potential extent of zoos’ impact. An AZA study conducted in 2007 to explore the effects of a visit to a zoo or aquarium found that a sizable percentage of visitors became more aware of their personal role in conservation and the work the zoos and aquariums were doing in education (Falk et al. 2007). While a study in the United Kingdom found that visitors at seven UK
zoological institutions showed no measurable increase in their conservation knowledge or concern following a visit to the zoo, the researchers suggested that impacts may be more substantial for more intense, focused experiences (such as keeper talks) or curated conservation exhibits (such as the Bronx Zoo’s Congo Gorilla Forest) (Balmford et al. 2007). This is supported by more recent reports on the significant positive impacts of specific initiatives, namely the Melbourne Zoo’s “Don’t Palm Us Off” campaign (Pearson et al. 2014) and the World Association of Zoos and Aquariums’ “Biodiversity Is Us” campaign (Moss et al. 2017). The “Don’t Palm Us Off” initiative led to increases in palm oil awareness, support for palm oil labeling, and self-reported conservation behavior (Pearson et al. 2014). The “Biodiversity Is Us” initiative improved visitors’ understanding of biodiversity and actions they could take to protect it (Moss et al. 2017). Overall, previous research indicates that zoos can have a lasting influence and are most effective when the educational message conveyed is specific and targeted.

Finally, zoos are in the unique position of putting people face to face with species they would never see otherwise, thereby filling an education niche and offering myriad opportunities to create distinct encounters (Whitehead 1995). Zoos also provide a chance for visitors to develop a caring bond with the specific animals exhibited, which can extend to caring about the broader environment (Kahn and Keller 2002). Given that zoos have many visitors, tangibly affect people, and provide an experience that no other place can, it would be useful to know how to best craft the zoo environment for maximum impact to encourage millions of visitors to take concrete action for conservation.

This study sought to combine the power of sense of place with the education potential of zoos by searching for patterns in zoo visitors’ level of connection to their
environment. In particular, it evaluated how the amount of focus a zoo places on local species, compared to exotic species, could be linked to the strength of sense of place demonstrated by that zoo’s visitors. The central hypothesis was that having more local species on exhibit to educate visitors on the zoo’s immediate ecosystem would correlate with a stronger sense of place. This hypothesis resulted from the reasoning that, at local-focused zoos, local visitors (those living in the proximity of the zoo) could feel more familiar with and attached to species they could encounter in their own “backyard,” and nonlocal visitors with less knowledge of the ecosystem could better understand the area to which they were traveling. Overall, the goal was to determine whether contrasting levels of focus that zoos put on local, more familiar species are connected to the sense of place visitors develop, and therefore to their inclination for pro-environmental behavior.

To accomplish this, a zoo visitor survey was conducted at nine zoos across the United States. These zoos were selected in pairs to provide a direct comparison between zoos focused on local species and zoos focused on exotic species. The survey examined visitors’ general background, their preference for some species over others, and most importantly the information necessary to determine their sense-of-place score (see Methods section). The scores for 16 statements in the survey were averaged to create a sense-of-place score for each respondent. This survey method allowed for accrual of a large dataset (N = 1,110 respondents total), offering substantial visitor information within which to search for patterns. It also aligned with previous studies done on sense of place (Bott 2000; Mayer and Frantz 2004; Brehm et al. 2013), contributing to the developing narrative on this potential educational tool by examining how it can be used in a new context.
This study offers insight into the future development of zoos, examining whether a stronger focus on local species is a more effective way to turn zoo visitors into conservation actors. In this period of global environmental change and mass wildlife extinction (Ceballos et al. 2015; Ceballos et al. 2017), the limited resources available must be strategically employed to slow or reverse the trend. Zoos are a considerable part of the worldwide conservation effort, and this study seeks to illustrate how they can be more efficient agents of influence and change. Conservation is only as powerful as the people who are working towards it. Zoos, endangered species, natural spaces, and by extension all sectors of society could benefit from the inclusion of more people in the conservation movement. By evaluating how well different zoo models create a connection to the public, this research informs how to expand and strengthen that bridge.

Materials and Methods

1. Sampling design - zoo selection and contact

After first securing approval from the Stanford Institutional Review Board, or IRB (as the project involved human subjects as participants in surveys and interviews), zoos were selected to be studied. The goal was to find zoos paired geographically (a matched pair design; Zar 2010) and scattered around the United States to represent ecosystems in different regions. Each pair had to contain one zoo focused primarily on local species and one zoo focused primarily on exotic species. This matched-pair design allowed for comparison between different zoo types in the same geographic area in order to attempt to control for confounding variables, such as variation in “outdoorsy-ness” of the region, general climatic conditions potentially affecting visitation rates, etc. The
placement of the pairs across the country (Fig. 1) allowed for examination of variation between pairs as well.

Figure 1 – Distribution of study sites across the country. The zoos are paired geographically with each pair presenting a “replicate” and collectively covering ample variety of social, geographic, and environmental settings.

Zoos fitting the general criteria (focusing on local or exotic species, providing a pair for another zoo, and allowing for geographic diversity throughout the United States) were found using a combination of the Association of Zoos and Aquariums (AZA) lists of institutions and suggestions from knowledgeable zoo affiliates (Dr. Greg Vicino at the San Diego Zoo and Dr. Joseph Garner at Stanford). Once a strong candidate was found, if a counterpart zoo was not immediately evident for the region, Google Maps was used to search the surrounding area for potential suitable counterparts for a pair. This especially applied to local-focused zoos, as they were usually not AZA accredited or were smaller and not easily searchable. Zoos’ websites were the primary tool used to determine the types of species housed and the institution’s conservation education goals. The list of pairs developed can be found in Table 2.
The last zoo, the California Living Museum, was added later in the study as an additional point of comparison for the San Diego Zoo. It was only discovered during the course of data collection (mentioned by staff at the Santa Barbara Zoo) and had not come up in searches of Southern California zoos. It was a better fit for the local-focused zoo category than the Santa Barbara Zoo due to its exclusive focus on species endemic to the Bakersfield region, so it was added to the list. To keep the matched-pair design even with this set of three zoos, both of the local-focused zoos were compared individually to the San Diego Zoo. This created two California pairs: CA 1 for the San Diego Zoo and the Santa Barbara Zoo, and CA 2 for the San Diego Zoo and California Living Museum.

Once the zoos were selected, their staff were contacted by email through direct addresses or general “Contact Us” forms located on their websites. In some cases, such as for the San Diego Zoo, a specific employee was reached by phone thanks to connections. Each zoo was provided with a short description of the proposed project and was asked if it would be willing to participate. Only one zoo (the St. Louis Zoo in St. Louis, MO) declined participation and did not cite a reason.

After a zoo agreed to the project, the appropriate paperwork was filled out to secure research permissions according to each institution’s individual process and the IRB approval letter was shared. The key person of contact at each zoo then helped assure and schedule interviews with zoo staff in positions related to conservation and education. While most interviews were arranged for the few days when data collection would be conducted at that particular institution, some were conducted over the phone due to difficulties in scheduling.
Table 2 - Local-focused and exotic-focused matched zoo pairs. Zoo acreage is included as a point of comparison between zoos – the local-focused zoos tend to be smaller. An exception was the Lee Simmons Wildlife Safari Park, due to the nature of the preserve as a drive-through park.

<table>
<thead>
<tr>
<th>Geographic Region</th>
<th>Local-focused zoo</th>
<th>Zoo Acreage</th>
<th>Exotic-focused zoo</th>
<th>Zoo Acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York (Northeast)</td>
<td>New York State Zoo at Thompson Park (Watertown, NY)</td>
<td>11</td>
<td>Bronx Zoo (Bronx, NY)</td>
<td>265</td>
</tr>
<tr>
<td>Nebraska (Midwest)</td>
<td>Lee Simmons Wildlife Safari Park (Ashland, NE)</td>
<td>440</td>
<td>Henry Doorly Zoo (Omaha, NE)</td>
<td>130</td>
</tr>
<tr>
<td>Arizona (Southwest)</td>
<td>Arizona-Sonora Desert Museum (Tucson, AZ)</td>
<td>21</td>
<td>Reid Park Zoo (Tucson, AZ)</td>
<td>24</td>
</tr>
<tr>
<td>Southern California (West)</td>
<td>Santa Barbara Zoo (Santa Barbara, CA)</td>
<td>30</td>
<td>San Diego Zoo (San Diego, CA)</td>
<td>99</td>
</tr>
</tbody>
</table>

California Living Museum (Bakersfield, CA) 14

2. Data collection tools – zoo visitor surveys and zoo employee interviews

The forms for the zoo visitor survey and the zoo employee interviews were developed through the venue of a class on qualitative research methods and study design (the PEDS 202A, 202B, and 202C series). The survey went through a rigorous process, including peer and instructor feedback and practice surveys, to analyze how well each question fulfilled a certain purpose or intent, how well it would be understood by participants, and how unbiased the entire questionnaire was. Revisions were made for the clarity and intentionality of the data collection tool (see Appendix A for survey sample).

A crucial element of the survey was the chart for measuring a visitor’s sense-of-place score. This score was the average of responses given to statements regarding one’s connection to and familiarity with the area within a 20-mile radius of the zoo (strongly disagree = 1; disagree = 2; neutral = 3; agree = 4; strongly agree = 5). The statements in
the chart were taken from two previous studies done on sense of place (Bott 2000; Williams and Vaske 2003) and were selected for their relevance to the ecological/environmental aspects of sense of place. The first six statements were related to place dependence – the ability of a place to support a person’s goals or desired behaviors (Ardoin 2006) – and place attachment – the psychological and emotional bond between a person and a place (Williams and Vaske 2003). The last ten statements referred to the natural setting of the physical domain as outlined in Suzanne Bott’s theoretical framework (Bott 2000), chosen to connect specifically to ecological sense of place.

The scale provided was carefully evaluated by Dr. Joseph Garner at Stanford University, a professor familiar with zoo education work to determine whether it should be a 5-option Likert scale including a neutral option (strongly agree, agree, neutral, disagree, strongly disagree) or a 4-option scale where participants would be required to lean one way or the other (strongly agree, agree, disagree, strongly disagree). In the end, given the lack of consensus in the field regarding what format of scale was best (Matell and Jacoby 1971), the 5-option scale was selected to better imitate the previous studies on sense of place from which the survey statements were developed (Bott 2000; Williams and Vaske 2003).

Though the finalized survey remained essentially the same for every zoo, one section was changed for each pair of zoos visited due to geographic specificity. Question eight (as seen in Appendix A) related to visitors’ preference for local or exotic but otherwise comparable endangered species held at the paired zoos. For each pair, the species listed in the table given were chosen based on the local endangered species
housed at the local-species emphasis zoo, and the exotic endangered species housed at the exotic-species emphasis zoo (see Table 3). Lists of animals on each zoo’s website were used to determine what species were present, and official state endangered species databases served to indicate the conservation status of species in that particular region of the country. Every effort was made to select pairs of species that were at least in the same taxonomic family, though sometimes that was difficult given the available options. The six pairs were always chosen to represent different broad categories of animals (mammals, birds, reptiles, occasionally amphibians), with one or two pairs per category.

The process for developing the interview questionnaire was very similar to that of the survey, also through the venue of the class on qualitative research methods and study design. The questions were evaluated for purpose and intention and their phrasing was carefully analyzed to avoid bias and leading questions. Practice interviews were conducted to ensure that the questionnaire was clear, that it could be fully answered in at most 60 minutes as per the study’s protocol, and that it yielded the full extent of information desired, based on the questions and the potential prompts and probes. Once the questionnaire was finalized (Appendix B), the same version was used for all interviews at all zoos (though some questions were not asked of people if they were not relevant to that person’s position at the zoo).

Before data collection began in earnest, a practice run was conducted at CuriOdyssey in Burlingame, CA on June 15th and June 16th, 2017. CuriOdyssey is a small experiential science and wildlife center with primarily native California animals that are injured or otherwise unable to survive in the wild. Permission was secured to survey zoo visitors for a few days, and approximately 40 surveys were collected. In
addition, two interviews were conducted with zoo educators. This provided a chance to test the data collection tools and determine if they were indeed accomplishing what they were designed to accomplish.

The results led to changes in the presentation of some questions in the survey. The aforementioned question eight was found to be confusing in prompt and layout, so the table provided was reformatted to better distinguish between the pairs of animals. In addition, the open-ended questions at the end of the survey were adjusted to be more relevant to the topic of sense of place, rather than prompt zoo visitors on conservation stories and knowledge of local species. The employee questionnaire did not change.

Table 3 - Local and exotic species for conservation preference. Species varied by zoo pair to reflect the animals included in each zoo’s collection. Species were selected for inter-pair taxonomic variety and intra-pair taxonomic similarity. The animals varied slightly for the Santa Barbara Zoo and the California Living Museum.

<table>
<thead>
<tr>
<th>Zoo Pair</th>
<th>NY Zoos</th>
<th>NE Zoos</th>
<th>AZ Zoos</th>
<th>CA Zoos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local 1</td>
<td>Golden Eagle</td>
<td>Whooping Crane</td>
<td>Thick-billed Parrot</td>
<td>California Condor</td>
</tr>
<tr>
<td>Exotic 1</td>
<td>King Vulture</td>
<td>Grey-Crowned Crane</td>
<td>Military Macaw</td>
<td>Andean Condor</td>
</tr>
<tr>
<td>Local 2</td>
<td>Mountain Lion</td>
<td>American Bison</td>
<td>Mountain Lion</td>
<td>Giant Kangaroo Rat</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tipton Kangaroo Rat</td>
</tr>
<tr>
<td>Exotic 2</td>
<td>African Lion</td>
<td>Bongo</td>
<td>African Lion</td>
<td>Mexican Agouti</td>
</tr>
<tr>
<td>Local 3</td>
<td>Gray Wolf</td>
<td>Gray Wolf</td>
<td>Mexican Gray Wolf</td>
<td>Channel Islands Fox</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>San Joaquin Kit Fox</td>
</tr>
<tr>
<td>Exotic 3</td>
<td>African Wild Dog</td>
<td>Bat-eared Fox</td>
<td>Fennec Fox</td>
<td>African Painted Dog</td>
</tr>
<tr>
<td>Local 4</td>
<td>Northern Cricket Frog</td>
<td>Piping Plover</td>
<td>Chiricahuia Leopard Frog</td>
<td>California Least Tern</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>American Coot</td>
</tr>
<tr>
<td>Exotic 4</td>
<td>Poison Dart Frog</td>
<td>Bernier’s Teal</td>
<td>Poison Dart Frog</td>
<td>Madagascar Jacana</td>
</tr>
<tr>
<td>Local 5</td>
<td>Queen Snake</td>
<td>Massasauga</td>
<td>Western Diamondback Rattlesnake</td>
<td>California Tiger Salamander</td>
</tr>
<tr>
<td>Exotic 5</td>
<td>Boa Constrictor</td>
<td>Woma Python</td>
<td>Eyelash Viper</td>
<td>Kaiser’s Spotted Newt</td>
</tr>
<tr>
<td>Local 6</td>
<td>Bog Turtle</td>
<td>Blanding’s Turtle</td>
<td>Desert Tortoise</td>
<td>Desert Tortoise</td>
</tr>
<tr>
<td>Exotic 6</td>
<td>Yellow-Headed Box Turtle</td>
<td>Radiated Tortoise</td>
<td>Radiated Tortoise</td>
<td>African Spurred Tortoise</td>
</tr>
</tbody>
</table>
3. Data collection process – zoo visits

Zoo visits occurred between July 21st and August 25th, 2017, with the California Living Museum added from March 27th to March 29th, 2018. The data collection plan included three days budgeted for each zoo in order to accommodate surveying visitors, interviewing employees, and exploring the zoo to get a good sense of the conservation education messaging and programs. The zoos were visited in the following order: New York State Zoo at Thompson Park (henceforth referred to as Thompson Park Zoo), Bronx Zoo, Omaha’s Henry Doorly Zoo, Lee Simmons Wildlife Safari Park, San Diego Zoo, Santa Barbara Zoo, Arizona Sonora Desert Museum, Reid Park Zoo, and lastly California Living Museum.

Each visit consisted of approximately the same procedure. First was checking in and securing a “Visiting Researcher”-type badge to indicate legitimacy to visitors, and asking zoo employees for suggestions regarding good places to set up to easily survey visitors. Next was picking a spot from among the suggested places where visitors were sedentary for long enough that filling out a quick survey would be feasible and where children were occupied enough that parents could afford to be distracted. Some photos of the data collection locations can be found in Figure 2, and all of the selected locations and survey collection times are listed in Table 4.
Figure 2 – Examples of data collection locations at the Arizona-Sonora Desert Museum by the stingray touch tank (top) and at the Lee Simmons Wildlife Safari Park by the goat petting pen (bottom).
Zoo visitors over the age of 18 were asked to fill out the survey using two sampling methods. In the case of a crowded area, everyone who walked into a specific spot would be approached. In the case of a non-crowded area, everyone who entered the area would be approached. Each visitor was asked if they would be willing to fill out the survey, in accordance with the IRB protocol, and verbal consent was all that was required. Each visitor would then be handed a clipboard with several survey sheets and a pencil.

The goal was to analyze 100 surveys per zoo. However, it became evident early on at the first zoo that some surveys were incomplete. Therefore, the goal became to

Table 4 - Zoo visitor survey collection locations and times. Locations were chosen for likelihood of stationary visitors (watching kids play, feeding ducks...). Times denote start to finish of total collection time on a given day; times are much earlier and later for Arizona zoos to avoid the heat of midday in August.

<table>
<thead>
<tr>
<th>Zoo</th>
<th>Survey Collection Location(s)</th>
<th>Survey Collection Times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thompson Park Zoo</td>
<td>Playground</td>
<td>10:00 am-2:00 pm; 10:30 am-2:00 pm</td>
</tr>
<tr>
<td>Bronx Zoo</td>
<td>Sea lion pool</td>
<td>11:30 am-2:25 pm; 10:30 am-12:00 pm</td>
</tr>
<tr>
<td>Henry Doorly Zoo</td>
<td>Covered bridge with fish-feeding stations</td>
<td>11:20 am-2:30 pm; 10:15 am-12:20 pm</td>
</tr>
<tr>
<td>Lee Simmons Wildlife Safari Park</td>
<td>Goat petting pen</td>
<td>10:10 am-1:25 pm; 10:15 am-1:00 pm</td>
</tr>
<tr>
<td>San Diego Zoo</td>
<td>Penguin pool; condor exhibit; orangutan exhibit</td>
<td>10:00 am-1:20 pm; 10:35 am-11:50 am; 2:25 pm-3:55 pm</td>
</tr>
<tr>
<td>Santa Barbara Zoo</td>
<td>Playground; giraffe feeding station</td>
<td>10:50 am-2:45 pm; 10:50 am-2:10 pm</td>
</tr>
<tr>
<td>California Living Museum</td>
<td>Playground</td>
<td>10:30 am-1:15 pm; 10:20 am-1:05 pm</td>
</tr>
<tr>
<td>Arizona-Sonora Desert Museum</td>
<td>Stingray touch tank</td>
<td>5:20 pm-9:00 pm; 9:15 am-10:55 am</td>
</tr>
<tr>
<td>Reid Park Zoo</td>
<td>Elephant exhibit</td>
<td>8:30 am-12:30 pm; 8:30 am-10:35 am</td>
</tr>
</tbody>
</table>
collect 125 surveys at each zoo, in the hopes that at least 100 would be complete. The Thompson Park Zoo had 110 respondents as the protocol was still being finalized, and each subsequent zoo had 125 respondents. This led to a total of 1,110 surveys collected, including those that were incomplete and were later excluded from the study. Within a few days of being collected, the survey data were entered into a large spreadsheet to compile all the information.

Survey collection would normally take a total of around six hours over two days, leaving the rest of the time for interviews and exploring. As interviews were specifically scheduled, the time in between was spent walking around the zoo to see all the exhibits and gain a better understanding of the institution. Photos were taken of zoo layout and general features, some of which can be found in Figure 3 for a better sense of the appearance of the zoos. In addition, at each zoo at least one educational program was attended and recorded for qualitative anecdotal data. This usually consisted of a keeper talk or a feeding session, which are common at most zoos. In some places, docent tables were also approached and docents were questioned to learn how zoo volunteers communicate with the public and what messages are emphasized across the zoo staff. Finally, notes were taken during and after walking around, in order to capture the feel of the zoo and the experience of being a visitor.

The interview process was essentially identical across interviewees. Written consent would first be secured via a printed consent form (as per IRB protocol) – this included consent to be recorded for transcription, and consent for names to be shared in potential papers. Then recording would begin, and the pre-established questionnaire would be used to navigate the conversation. Interviews would range in duration from 10
minutes to one hour, depending on the level of knowledge of the interviewee and the uniqueness of their perspective (meaning how much additional information they could provide). Interviews were recorded with two recording devices, in case one malfunctioned, and were then uploaded onto a computer for transcription. Those from the Thompson Park Zoo were manually transcribed, while the rest were transcribed using an online service called Trint (Kofman 2018) and reviewed and edited.
Figure 3 – Contrasting appearances and contexts of zoos studied. Various parts of each zoo look very different from each other, so these images do not represent the zoo as a whole. Rather, they were selected to highlight key points of contrast between institutions. (A) New York State Zoo at Thompson Park, small zoo with playground and many green open areas between exhibits, located within city park. Image shows walkway near raptor exhibit. (B) Bronx Zoo, large zoo with high exhibit density and attractions that require additional admission fee, located in the middle of urban Bronx. Image shows one of zoo’s century-old buildings. (C) Lee Simmons Wildlife Safari Park, drive-through park with some walkable exhibits (bears, wolves, eagle aviary), located off interstate 30 miles from Omaha. Image shows entrance where visitors can pay from their car. (D) Henry Doorly Zoo, large zoo with high exhibit density, ski-lift style ride and steam locomotive, located within walking distance of downtown Omaha. Image shows Desert Dome seen from new Children’s Adventure Trails. (E) Arizona-Sonora Desert Museum, large space with animal exhibits, art gallery, and other facilities, located next to Saguaro National Park 15 miles northeast of Tucson. Image looks into coyote exhibit. (F) Reid Park Zoo, small zoo, giraffe feeding opportunity daily, located within Reid Park in city of Tucson. Image shows new Elephant Walkabout exhibit. (G) Santa Barbara Zoo, small zoo with central open grass space and playground, giraffe feeding opportunities daily, located 10-minute drive from downtown Santa Barbara. Image shows walkway lined with palm trees. (H) San Diego Zoo, large zoo with very high exhibit density, many attractions and performances, double-decker tour bus runs throughout, located in Balboa Park in city of San Diego. Image shows main road lined with exhibits. (I) California Living Museum, small zoo with playground and lots of open space, small railroad and petting zoo, located 8 miles from downtown Bakersfield. Image shows undeveloped area in middle of zoo.
4. Data refinement – local versus nonlocal visitor distinction

Due to the geographic aspect of the study and the effect of proximity on sense of place, determining which survey respondents were local and which were nonlocal was a necessary precursor to analyzing the survey data. This was done using the respondents’ listed hometowns, according to two different criteria. First, “local” was defined as a 20-mile radius around the zoo, as that had been the definition used in the survey itself when identifying the “place” referred to in the sense of place chart. This 20-mile radius was a somewhat arbitrary delineation, meant to encompass the average distance most Americans drive in a typical day while commuting to work (Statistic Brain Research Institute 2018). Second, “local” was defined as within the same ecoregion as the zoo, according to a map of ecoregions created by the United States Department of Agriculture (Appendix D). An ecoregion is an area with a similar ecosystem and topography, therefore visitors would presumably recognize flora, fauna, and landscapes surrounding a zoo in their ecoregion even if the zoo is many miles away.

The GPS coordinates of each hometown given were found using a latitude and longitude website (https://www.latlong.net/). These coordinates were then used to place points on a map in GIS to identify where each respondent was from. This map was overlaid with a 20-mile radius circle around the point representing the zoo and with the map of ecoregions in order to classify each respondent point as local or nonlocal according to the previously mentioned criteria. Each respondent could be local for both definitions, local for one and nonlocal for the other, or nonlocal for both. Each categorization was evaluated separately in analysis.
The situation was a little more complex in the case of people who listed simply a
country or state, but no city. For people just listing a country, they were considered
nonlocal (as they would evidently be outside the 20-mile radius and outside the
ecoregion), except in the case of respondents listing Canada at the Thompson Park Zoo
and respondents listing Mexico at the San Diego Zoo. For the Thompson Park Zoo, all
parts of Canada fall outside of the 20-mile radius, making all respondents from the
country nonlocal by that definition. However, parts of Canada across the border fall
within the same ecoregion as the zoo. Therefore, local or nonlocal characterization is
impossible to determine and respondents from Canada who did not specify a city were
eliminated from consideration. For the San Diego Zoo, some small sections of Mexico
are within the 20-mile range and some parts are in the same ecoregion. So, respondents
from Mexico at that zoo who did not specify a city were eliminated from consideration.

5. Statistics and analysis – zoo visitor surveys

All of the data from the surveys were compiled in a spreadsheet for analysis in
RStudio, an open-source platform for R (RStudio Team 2016). A linear-mixed effects
model was used to determine if certain fixed effects significantly affected the sense-of-
place scores of different subsets of the zoo visitor respondents. The same test was used
with four different fixed effects: zoo type (local-focused or exotic-focused), visitor
hometown (within a 20-mile radius of the zoo or not), visitor ecoregion (same as the zoo
or not), and visitor member status (member or non-member). These models were applied
to subsets comprising each matched pair, as well as the pool of zoos on the whole. For
each test, age and gender were included as random variables, along with member status
when it was not a fixed effect, to help account for some of the variability in the data. The results of the linear-mixed effects models were analyzed based on the t-value obtained, using a comparison chart with p-values for relative significance (Zhou 2018).

One-way ANOVAs were also calculated in RStudio for the factors included as random variables, to see if they were or were not significantly linked to trends in sense-of-place scores. This test was applied to gender and age demographics, and to the number of times visitors had gone outside in the last week. It was also used for visitor level of familiarity with the zoo’s surrounding area in order to confirm what seemed to be a strong correlation between familiarity and sense-of-place score based on graphical visualization of the data (Fig. 4).

After results from the linear mixed-effects model and the ANOVAs were tabulated, a proportions test was used to compare the proportions of local and non-local visitors by radius, local and non-local visitors by ecoregion, and member and non-member visitors. This was done to determine whether a significant difference in proportions was potentially a factor in significant differences in sense-of-place scores.

Lastly, a proportions test was also used to compare the responses given to the aforementioned question 8 on the survey (Table 3), regarding donating to the conservation of a local or an exotic species. The goal here was to determine if there was a significant difference in preference for one type of species or the other between the zoos in each pair. This allowed for exploration into whether visitors develop a connection specifically with the animals they see in front of them at zoos.

To provide context for the statistical results, general information on each zoo was collected: zoo size, number of species, number of animals, number of members, annual
visitors, and years of operation. A table summarizing this information can be found in Appendix C.

6. Qualitative analysis – Zoo employee interviews

As previously mentioned, the majority of the interviews recorded were transcribed using the online platform Trint, which takes in an audio file and automatically generates the transcript (Kofman 2018). These transcriptions were reviewed for accuracy and then read through to highlight key points and arguments. This process was less detailed and rigorous than the survey analysis. Its purpose was simply to identify the core elements of each zoo’s conservation and education strategies and to collect anecdotes that could provide clarifying context for the other data. It also helped illustrate general patterns across zoo conservation education activities. The goal was to see how a zoo’s view and its visitors’ views on conservation education and the zoo space overlapped or aligned.

7. Contextual information – zoo background

As described throughout the methodology, anecdotal data were collected on zoo educational programs, exhibit signage, zoo layout, and general visitor experience during zoo visits. This information was compiled and synthesized to provide additional context for and insight into the results obtained from the quantitative and qualitative analyses described above. However, not all of this contextual material was used in data interpretation due to large amounts of data and extensive processing required.
Results

1. Survey respondent generalities

Across the nine zoos studied, a total of 1,110 surveys were collected. Of these, 102 had to be withdrawn due to incomplete vital questions relating to hometown and sense-of-place score. This left 1,008 surveys for analysis. The breakdown of these surveys by zoo and local/non-local categorization is shown in Table 5.

Table 5 – Zoo visitor survey respondent overview. Radius definition threshold for local/non-local was 20 miles from the zoo. Ecoregion definition for local/non-local was within the same ecoregion as zoo, based on the ecoregions map generated by USDA (Appendix D).

<table>
<thead>
<tr>
<th>Region</th>
<th>Zoo</th>
<th>Location</th>
<th>Zoo Type</th>
<th>Number of surveys</th>
<th>Percent Local (radius definition)</th>
<th>Percent Local (ecoregion definition)</th>
<th>Percent member</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>New York State Zoo at Thompson Park</td>
<td>Watertown, NY</td>
<td>Local</td>
<td>105</td>
<td>40% Local 60% Non-Local</td>
<td>51% Local 49% Non-Local</td>
<td>17% Member 83% Non-Member</td>
</tr>
<tr>
<td></td>
<td>Bronx Zoo</td>
<td>Bronx, NY</td>
<td>Exotic</td>
<td>104</td>
<td>32% Local 68% Non-Local</td>
<td>23% Local 77% Non-Local</td>
<td>13% Member 87% Non-Member</td>
</tr>
<tr>
<td>Nebraska</td>
<td>Lee G. Simmons Wildlife Safari Park</td>
<td>Ashland, NE</td>
<td>Local</td>
<td>116</td>
<td>13% Local 87% Non-Local</td>
<td>70% Local 30% Non-Local</td>
<td>39% Member 61% Non-Member</td>
</tr>
<tr>
<td></td>
<td>Henry Doorly Zoo and Aquarium</td>
<td>Omaha, NE</td>
<td>Exotic</td>
<td>111</td>
<td>23% Local 77% Non-Local</td>
<td>50% Local 50% Non-Local</td>
<td>32% Member 68% Non-Member</td>
</tr>
<tr>
<td>Arizona</td>
<td>Arizona-Sonora Desert Museum</td>
<td>Tucson, AZ</td>
<td>Local</td>
<td>110</td>
<td>68% Local 32% Non-Local</td>
<td>71% Local 29% Non-Local</td>
<td>45% Member 55% Non-Member</td>
</tr>
<tr>
<td></td>
<td>Reid Park Zoo</td>
<td>Tucson, AZ</td>
<td>Exotic</td>
<td>115</td>
<td>57% Local 43% Non-Local</td>
<td>63% Local 37% Non-Local</td>
<td>46% Member 54% Non-Member</td>
</tr>
<tr>
<td>Southern CA</td>
<td>Santa Barbara Zoo</td>
<td>Santa Barbara, CA</td>
<td>Local</td>
<td>112</td>
<td>12% Local 88% Non-Local</td>
<td>62% Local 38% Non-Local</td>
<td>31% Member 69% Non-Member</td>
</tr>
<tr>
<td></td>
<td>California Living Museum</td>
<td>Bakersfield, CA</td>
<td>Local</td>
<td>116</td>
<td>72% Local 28% Non-Local</td>
<td>87% Local 13% Non-Local</td>
<td>24% Member 76% Non-Member</td>
</tr>
<tr>
<td></td>
<td>San Diego Zoo</td>
<td>San Diego, CA</td>
<td>Exotic</td>
<td>119</td>
<td>31% Local 69% Non-Local</td>
<td>48% Local 52% Non-Local</td>
<td>43% Member 57% Non-Member</td>
</tr>
</tbody>
</table>

The original pool of surveys collected was 110 for the New York zoos and 125 for all the other zoos (after the visits to the New York zoos, goal sample size was expanded to ensure ample complete surveys), and no more than 13 surveys were...
discarded for any site. The percentages of local visitors were much higher for the ecoregion definition, since ecoregions tend to span a much larger area than the 20-mile radius around the zoo and therefore include more towns and more people. Survey respondents who could be classified according to at least one local definition were included even if the other was non-determinable due to vague hometown information.

2. Visitor familiarity with zoo area

One of the metrics gathered through the survey was how familiar the zoo visitors were with the zoo’s surrounding area (outlined by the 20-mile radius). As would be expected, visitors’ level of familiarity was linked to their characterization as local or non-local, for both the radius definition and the ecoregion definition: respondents who were classified as local had higher levels of familiarity with the zoo’s area. To confirm this, a one-way ANOVA was used, revealing a very strong positive relationship between familiarity and local characterization (p < 2x10^{-16} for the radius definition, p < 2x10^{-16} for the ecoregion definition).

This link between high familiarity and being local is important to keep in mind when considering sense-of-place scores, and is one of the primary reasons for the distinction between local and nonlocal of visitors used in this study: local respondents are more familiar with the zoo regardless of its structure as a local or exotic species-focused institution, and that should make their sense-of-place scores higher. The one-way ANOVA of the level of familiarity and the sense-of-place scores confirmed that there was a strong relationship between how familiar a zoo visitor was with the area and how high their sense-of-place score was (p < 2.2x10^{-16}; Fig. 4). A post-hoc Tukey test of the
ANOVA showed that all of the different levels of familiarity (“Not at all familiar,” “Slightly familiar,” “Moderately familiar,” and “Very familiar”) were significantly different in their sense-of-place scores except for the “Slightly familiar” group compared to the “Moderately familiar” group. This relationship also helps to confirm that the sense of place measurement used here does indeed incorporate a person’s awareness of a given space.

![Graph showing sense of place scores by level of familiarity](image)

**Figure 4 – Strong positive correlation between visitor level of familiarity and sense-of-place score.** These results include all visitors from all nine zoos. The numbers on the bars represent sample size and the error lines represent standard error of the mean.

One-way ANOVAs were also used to look for patterns between sense-of-place scores and other variables included in the survey. Gender of visitors had no correlation to scores (p = 0.192), and neither did the number of times visitors had gone outside in the last week with the intent of spending time outside (p = 0.216). This indicated that those visitor characteristics did not play a significant role in the attachment and familiarity each person had. In contrast, there was a strong positive relationship between sense-of-place score and age (p = 0.00462). A Tukey test revealed that the significance came from
differences between the 66+ age group and the younger categories. One hypothesis is that age could be linked back to level of familiarity with the place, since older visitors will have more experiences and memories, and therefore be more attached. However, a two-way ANOVA showed no significant interaction between age and level of familiarity (p = 0.750). Another potential explanation is that maturity brings greater sensitivity to sense of place, but this study as designed did not include data that could support or refute that hypothesis.

3. Sense-of-place scores: overview

The key point in this study – the sense-of-place scores – were explored by graphing the score means of various groupings of visitors and performing unpaired two sample T-tests on those means to determine significant differences. The scores of all visitors (Fig. 5A) revealed an overall stronger sense of place at zoos with a local species focus compared to zoos with an exotic species focus. Since each pair of zoos varied greatly based on where in the country they were, scores were also compared between zoos within pairs (Fig. 5B). It then became clear that the overall difference in sense-of-place scores was driven by the large contrast between the paired zoos in Nebraska, Arizona, and one of the two comparisons in California.
**Figure 5 – Positive relationship between zoo type and visitor sense-of-place score.** (A) The local category includes all respondents’ scores from the Thompson Park Zoo, the Lee Simmons Wildlife Safari Park, the Santa Barbara Zoo, the California Living Museum, and the Arizona-Sonora Desert Museum. The exotic category includes all respondents’ scores from the Bronx Zoo, the Henry Doorly Zoo, the San Diego Zoo, and the Reid Park Zoo. (B) All of the respondents for each zoo were included in the calculation of the mean. The CA 1 pair compares the Santa Barbara Zoo and the San Diego Zoo; the CA 2 Zoo compares the California Living Museum and the San Diego Zoo. For all graphs, the numbers on the bars represent sample size and the error lines represent the standard error of the mean. *p < 0.05; **p < 0.01; ***p < 0.001.

In order to better understand what was causing the differences in sense-of-place scores between the zoos, some zoo visitor characteristics were compared: visitor hometown within a 20-mile radius of the zoo (**Fig. 6**), visitor hometown within the same ecoregion as the zoo (**Fig. 7**), and visitor membership to the zoo (**Fig. 8**).
Figure 6 – Positive relationship between visitor local classification (by 20-mile radius definition) and sense-of-place score. (A) Visitors across all zoos who were from a town within 20 miles of the zoo they visited compared to visitors across all zoos who were from a town further than 20 miles from the zoo they visited. (B) All of the respondents for each category were included in the calculation of the mean. For all graphs, the numbers on the bars represent sample size and the error lines represent the standard error of the mean. *p < 0.05; **p < 0.01; ***p < 0.001.

To examine effect of distance within the context of the 20-mile radius, Figure 6A encompasses groups all of the zoos together, and again individual graphs were made for each matched pair to visualize any patterns and determine whether some pairs had larger differences than others (Fig. 6B). Whether a visitor was from a town within a 20-mile radius of the zoo led to significantly higher sense-of-place score across most of the zoos studied (all but the Lee Simmons Wildlife Safari Park, the California Living Museum, and the Reid Park Zoo). This effect was most pronounced at the Thompson Park Zoo.

Since the 20-mile radius covered a rather small area surrounding each zoo, the categorization of zoo visitors by ecoregion was also graphed (Fig. 7) to see if proximity or type of surroundings mattered more in people’s sense of place. Again, whether a visitor was local was significantly linked to higher sense-of-place score across most zoos. While the results for the Thompson Park Zoo, the Lee Simmons Wildlife Safari Park, and
the Reid Park Zoo were not statistically significant, they still followed the trend of local
visitors having higher sense-of-place-scores. The greatest differences in scores were at
the Bronx Zoo and the Arizona-Sonora Desert Museum.

Figure 7 – Positive relationship between visitor local classification (by ecoregion
definition) and sense-of-place score. (A) Visitors across all zoos from a hometown in the
same ecoregion as the zoo they visited compared to visitors across all zoos who were
from a town outside the ecoregion of the zoo they visited. (B) All of the respondents for
each category were included in the calculation of the mean. For all graphs, the numbers
on the bars represent sample size and the error lines represent the standard error of the
mean. *p < 0.05; **p < 0.01; ***p < 0.001; ****p < 0.0001.

The last key visitor characteristic was membership status, given that being a
member would lead to more frequent and regular zoo visits and could therefore affect
sense-of-place scores. The last factor analyzed for patterns across the zoos studied was
zoo membership (Fig. 8). This pattern that emerged for this factor significantly linked
member status to higher sense-of-place scores across all zoos studied. The California
Living Museum, where the nonmember visitors had a higher mean, and the Reid Park
Zoo, where there was no variation in sense of place based on zoo membership, were
exceptions to this finding.
Figure 8 – Positive relationship between visitor membership and sense-of-place score. (A) Visitors across all zoos who were members at the zoo they visited compared to visitors all zoos who were not members at the zoo they visited. (B) All of the respondents for each category were included in the calculation of the mean. For all graphs, the numbers on the bars represent sample size and the error lines represent the standard error of the mean. *p < 0.05; **p < 0.01; ***p < 0.001; ****p < 0.0001.

For all of the graphs above, the possible range of values for the sense-of-place scores of visitors was between one and five, therefore averages of these scores for each zoo or group of visitors also range between one and five too. Given this range, there was a rather small margin for any large differences to appear from group to group. This is why the scales for the graphs were chosen to be 3.5 to 4.3, 4.4 or 4.6, depending on the results. The graphs showed some distinctions between groups, but visualization of patterns and t-tests for single variables were not enough to fully determine what the data were indicating. The more detailed statistical analysis performed provided more multi-dimensional interpretation.

4. Sense-of-place scores: detailed analysis

A linear mixed-effects model was used across all zoos, and again within each pair (Table 6). Linear mixed-effects models are a tool for analyzing data that are non-
independent or correlated by allowing for a balance between aggregating and performing individual regressions. They are a method for exploring the difference between and within groups, which is the structure the survey data fall into. The fixed effects are the variables being tested for an impact on the sense-of-place scores. Here, they are the type of zoo visited (local-focused or exotic-focused), the radius of the visitor (local or nonlocal by the 20-mile radius definition), the ecoregion of the visitor (within the same ecoregion as the zoo or not), and the membership status of the visitor (member of the zoo visited or not). For all tests, the random effects included were age, gender, and number of intentional periods outdoors in the past week to account for some of the additional variance in the data. The column for “T-values” shows the statistical significance of the analysis.

Given the sample size used here (over 1000 for all zoos, and over 200 for each pair of zoos), a t-value greater than 1.6 is significant with p < 0.05 (Zhou 2018). Two sets of mixed effects models were run in order to separately consider the two definitions of being local, to prevent one definition from confounding the results for the other (given that a visitor could be local for one definition and non-local for the other, local for both, or non-local for both). These two sets are shown in parallel in Table 6 for comparison: the models with radius as a fixed effect are on the left, and the models with ecoregion as a fixed effect are on the right.
Table 6 – Influence of multiple factors on sense-of-place scores. Results of linear mixed-effects models using zoo type, visitor locality by radius, visitor ecoregion, and visitor member status as fixed effects (all tests used age, gender, and times gone outside as random variables). T-value column indicates whether result was significant at $p < 0.05$ (*), $p < 0.01$ (**), $p < 0.001$ (***) or not significant (NS). All significant results are highlighted in grey. The “CA Zoos 1” pair includes the Santa Barbara Zoo and the San Diego Zoo, while the “CA Zoos 2” pair includes the California Living Museum and the San Diego Zoo.

<table>
<thead>
<tr>
<th>Zoo group</th>
<th>Fixed effects</th>
<th>T-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All zoos</td>
<td>Zoo type</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>Radius</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>***</td>
</tr>
<tr>
<td>NY Zoos</td>
<td>Zoo type</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Radius</td>
<td>**</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>***</td>
</tr>
<tr>
<td>NE Zoos</td>
<td>Zoo type</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Radius</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>**</td>
</tr>
<tr>
<td>CA Zoos 1</td>
<td>Zoo type</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Radius</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>***</td>
</tr>
<tr>
<td>CA Zoos 2</td>
<td>Zoo type</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Radius</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Member</td>
<td>NS</td>
</tr>
<tr>
<td>AZ Zoos</td>
<td>Zoo type</td>
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</tr>
<tr>
<td></td>
<td>Radius</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Member</td>
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<table>
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<tr>
<th>Zoo group</th>
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<th>T-value</th>
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<tbody>
<tr>
<td>All zoos</td>
<td>Zoo type</td>
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</tr>
<tr>
<td></td>
<td>Ecoregion</td>
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<td>Member</td>
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<td></td>
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<td>Zoo type</td>
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</tr>
<tr>
<td></td>
<td>Ecoregion</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Member</td>
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</tr>
<tr>
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<tr>
<td></td>
<td>Ecoregion</td>
<td>NS</td>
</tr>
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<td></td>
<td>Member</td>
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<tr>
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<td>Ecoregion</td>
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<tr>
<td></td>
<td>Ecoregion</td>
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<tr>
<td></td>
<td>Member</td>
<td>NS</td>
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These results confirm what was shown visually by the graphs above. There is no factor among those included here that significantly and consistently correlated with higher sense-of-place scores at all zoos studied. Rather, each factor played a significant role in some matched pairs and not others. This illustrates the nuance behind developing a connection with visitors and crafting a strong sense of place, which will be further explored in the discussion.
To better understand whether different proportions of local or member visitors were causing the higher sense-of-place scores at some zoos, proportions tests were conducted on the numbers of local visitors by radius definition, local visitors by ecoregion definition, and member visitors within each pair (Table 7). Proportions of local visitors by radius and of members did not differ significantly across most pairs. None of the categories yielded substantial proportions disparities for the Arizona zoo pair, while all of them did for the second California zoo pair (CALM and San Diego Zoo).

Table 7 – Minimal disparity in proportions of types of zoo visitors. Proportions tests performed on numbers of local visitors (by radius and by ecoregion) and number of members. Significant results are highlighted in grey. *p < 0.05; **p < 0.01; ***p < 0.001.

<table>
<thead>
<tr>
<th>Zoo</th>
<th>Percent local (radius)</th>
<th>Proportions test significance</th>
<th>Percent local (ecoregion)</th>
<th>Proportions test significance</th>
<th>Percent member</th>
<th>Proportions test significance</th>
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<tr>
<td>Thompson Park Zoo</td>
<td>40.00</td>
<td>NS</td>
<td>51.43</td>
<td>***</td>
<td>17.14</td>
<td>NS</td>
</tr>
<tr>
<td>Bronx Zoo</td>
<td>32.04</td>
<td>NS</td>
<td>23.08</td>
<td></td>
<td>12.62</td>
<td>NS</td>
</tr>
<tr>
<td>Lee Simmons Wildlife Park</td>
<td>12.93</td>
<td>NS</td>
<td>70.69</td>
<td>**</td>
<td>38.79</td>
<td>NS</td>
</tr>
<tr>
<td>Henry Doorly Zoo</td>
<td>22.52</td>
<td>NS</td>
<td>50.45</td>
<td></td>
<td>31.53</td>
<td>NS</td>
</tr>
<tr>
<td>Santa Barbara Zoo</td>
<td>12.50</td>
<td>**</td>
<td>62.50</td>
<td>*</td>
<td>31.25</td>
<td>NS</td>
</tr>
<tr>
<td>San Diego Zoo</td>
<td>31.09</td>
<td></td>
<td>47.90</td>
<td></td>
<td>42.86</td>
<td></td>
</tr>
<tr>
<td>CALM</td>
<td>72.41</td>
<td>***</td>
<td>86.96</td>
<td>***</td>
<td>24.14</td>
<td></td>
</tr>
<tr>
<td>San Diego Zoo</td>
<td>31.09</td>
<td></td>
<td>47.90</td>
<td></td>
<td>42.86</td>
<td>**</td>
</tr>
<tr>
<td>Arizona-Sonora Desert Museum</td>
<td>68.18</td>
<td>NS</td>
<td>70.91</td>
<td>NS</td>
<td>45.45</td>
<td>NS</td>
</tr>
<tr>
<td>Reid Park Zoo</td>
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<td></td>
<td>62.61</td>
<td></td>
<td>46.09</td>
<td></td>
</tr>
</tbody>
</table>

One last minor result regarded the survey question relating to preference for species to conserve through donations. The responses were analyzed through proportions tests comparing the number of people who had selected local versus exotic species at each zoo (Appendix E). No zoo pair consistently had significant differences in proportions, though the Arizona zoos had the most differences (three out of six). Looking at the species, of the nine pairs that had significant differences in preference, six were
pairs of mammal species. In contrast, only one of the bird pairs, one of the reptile pairs, and one of the amphibian pairs yielded significant differences.

**Discussion**

This study set out to determine whether certain types of zoos – specifically those focused on local species – were linked with stronger sense of place in their visitors, and therefore higher levels of attachment for an area and greater inclination to preserve that area. The results show that there is indeed a relationship between local-focused zoos and stronger sense of place. The data also show that other factors are linked to visitors’ attachment, and that the relative influence of each factor varies from zoo to zoo.

1. **Local-focused zoos and exotic-focused zoos**

The first key point is that there was a significant difference in sense-of-place scores between local-focused zoos and exotic-focused zoos overall and within most zoo pairs. The pair differences occurred between the Arizona zoos, the Nebraska zoos, and the California zoos when considering the California Living Museum and the San Diego Zoo. The largest differentiation in scores was between the Arizona zoos, followed by the Nebraska ones, and then the California pair just mentioned. In contrast, the New York zoos and the second pair of California zoos – the Santa Barbara Zoo and the San Diego Zoo – did not have significant differences in the sense-of-place scores of visitors.

This variation in scores could be due to numerous influences, but one potential cause is the contrasting settings the zoos are located in: Nebraska and Arizona are not as popular as tourist destinations as New York and California are (Cooperstein 2014).
Having more tourists could lower the sense-of-place score because more people will be very unfamiliar with the region and feel very unattached. This point is addressed further below, in an analysis of how the characteristics of visitors contribute to zoos’ scores. However, this argument perhaps does not hold for the New York zoos, seeing as the Thompson Park Zoo is in upstate New York, close to the Canadian border and far from Manhattan or other regions of the state that are most frequently visited.

That being said, the New York pair seems to be influenced by different forces altogether, given that those two zoos had the lowest sense of place means of any of the nine zoos studied (under 3.8). A possible explanation for this finding is the New York region’s habits concerning outdoor resources compared to the other regions studied. Several national monuments and historic parks in New York state have experienced declines in annual visitation in recent years, in contrast with increases at national parks near the zoos in Arizona, Nebraska, and Southern California (National Park Service 2018). While not directly related, this National Park Service data could indicate a lower level of enthusiasm for the outdoors within the New York population, which could contribute to less attachment to natural spaces there.

Another interesting result was that the San Diego Zoo is the only exotic species-focused zoo to have a sense of place mean higher than one of its local-focused counterparts, though not significantly. Perhaps this is because the San Diego Zoo is one of the country’s most renowned zoos (San Diego Zoo 2015), and visitors come from all over the world to visit it. This global presence could increase visitors’ attachment, or make them feel more familiar even though they have not visited before because they have heard so much about the zoo elsewhere. However, this argument does not hold true for
the Henry Doorly Zoo as well, which was named the “World’s Best Zoo” by TripAdvisor in 2014 (Laukaitis 2014). The Henry Doorly Zoo’s sense of place mean was significantly lower than that of its local-focused counterpart, the Lee Simmons Wildlife Safari Park. The world reputation may not apply to the Henry Doorly Zoo because Nebraska has not historically been a popular destination for Americans (Young 2017) or for international travelers (Hicks 2010), so people around the country and around the world do not hear about its attractions as much.

2. Local and non-local visitors, according to 20-mile radius

Looking at other factors that could affect visitors’ familiarity and attachment, there are other patterns that emerged from the data. For one, the categorization of visitors as local or non-local according to a 20-mile radius around the zoo strongly correlated with the relative scores of the resulting groups. Across almost all of the matched pairs, local visitors had a significantly higher sense of place mean. The only exceptions were the Lee Simmons Wildlife Safari Park in Nebraska and at the Reid Park Zoo in Arizona. This break from the pattern is likely explained at the Lee Simmons Wildlife Safari Park by the small sample size of local visitors (N = 15) compared to non-local visitors (N = 101). The Safari Park is located in a rural part of Nebraska with a low popular density, so very few towns fall within the 20-mile radius defined. Therefore, very few visitors qualified as local by this definition, and the sense of place mean calculated includes too few individuals to make a reasonable conclusion. In contrast, the Reid Park Zoo had 65 local visitors and 50 non-local visitors, so lack of significance cannot be attributed to sample size. As will be discussed for the
other factors, the Reid Park Zoo is an outlier for all of the patterns observed, suggesting that some other influence is playing a role at that zoo.

Separately, it is also important to note how high the means for local visitors were at the Arizona-Sonora Desert Museum and at the Santa Barbara Zoo: these were the only means approaching 4.3, meaning visitors agreed or strongly agreed to most of the sense of place statements. For the Santa Barbara Zoo, the uncommon result could be related to sample size again. There were only 14 local visitors compared to 98 non-local visitors, so those few local respondents could have circumstantially have had higher than average sense-of-place scores and raised the mean. For the Desert Museum, this high mean could be due to the distinctiveness of the ecosystem the zoo is showcasing. The Sonoran Desert is nationally and internationally famous and is very different from most other regions of the country, with great diversity of life forms as well as high plant, mammal, and reptile endemism (Nabhan and Holdsworth 1998). This uniqueness may lead local visitors to feel more pride in and attachment to their hometown’s environment. The Desert Museum could be highlighting and boosting that pride, or it could be that the visitors who choose to go to the Desert Museum are those who are already most attached to their surroundings, and they therefore raise the sense of place mean.

Another outcome was that, when looking at the same visitor type within zoo pairs, only the Nebraska zoos and the Arizona zoos had significantly different means – between groups of non-local visitors for the Safari Park and the Henry Doorly Zoo, and between groups of local visitors for the Desert Museum and the Reid Park Zoo. This suggests that the Safari Park is better at connecting visitors who are not from the area to the ecosystem of the Nebraska grasslands than the Henry Doorly Zoo is at connecting people from
outside Omaha to the city’s environs, and that the Desert Museum increases locals’ attachment to their hometown more than the Reid Park Zoo does. However, causation is impossible to determine from this study.

Alternatively, the results in Nebraska could again be linked to the Safari Park’s location: because it is in an unpopulated area, most people will be coming from just outside that 20-mile radius and will be labeled as non-local but will still be familiar with the area’s ecosystem because the ecoregion spans a large area. In contrast, the non-local visitors at the Henry Doorly Zoo are more likely to be visiting the city from out of state and would be unfamiliar with the area. Therefore, the significant difference in sense-of-place scores of non-local visitors between the Nebraska zoos could be due to distinct attributes of those non-local visitors. The results in Arizona cannot be explained by this argument, as the zoos are within each other’s 20-mile radius and thus could share local and non-local visitors. Rather, it could indeed be that the Desert Museum instills more pride in local visitors for the surrounding environment because that is what the zoo focuses on entirely. Local people are reminded of how unique and special the Sonoran Desert is (Nabhan and Holdsworth 1998) when they visit, which potentially reinforces their sense of place and boosts their score.

3. Local and non-local visitors, according to ecoregion

Moving to the categorization of visitors by ecoregion, again there was a significant positive correlation between sense-of-place scores and visitors being from the same region as the zoo at which they were surveyed. This held for every study site except for the Thompson Park Zoo, the Lee Simmons Wildlife Safari Park, and the Reid Park
Zoo. For these outliers, the distribution of respondents across groups was even enough that there are no very small sample sizes to potentially explain sense-of-place means being higher or lower than expected.

It could be that the ecoregion definition is not as good of a qualification for being local, and that the radius definition better captures the more immediate connection that comes with living in or near an area. This is surprising, given that the 20-mile radius was somewhat of an arbitrary delineation, while the ecoregion boundary is something more meaningful and empirical. In fact, a paper written in 1994 argued that historians should write about geographic places in terms of bioregions, which reflect the diversity and personality of various spots throughout the country better than designations for vast areas such as “the West” or “the South” (Flores 1994). Bioregions (or ecoregions) have been described as the foundation for a spiritual connection to a specific kind of nature, forming a stepping stone to land care (Flores 1994). It would then seem logical to assume that sense of place would be closely tied to ecoregion, which is supported by a study of three different ecoregions: in two of the three regions, a greater proportion of respondents had an ecological sense of place than a local sense of place (local defined using a scale-of-place index) (Ardoin 2014).

Therefore, the score pattern depicted is counterintuitive and perhaps due to the New York and Nebraska areas sampled not having as much of a distinctive ecoregion character. Strong sense of place findings for the legendary Galápagos system, which has a very unique ecoregion and associated place attachment and dependency (Ardoin 2014), lends some support to this point through contrast. Overall, the two definitions of local visitors used here complement each other and allow for different interpretations of the
data, but they are far from comprehensive, and other approaches could be used to explore additional trends.

Within these ecoregion results, again the zoo pairs included a few significant differences between zoos in the same pair: between local groups at the Arizona zoos and New York zoos, and between non-local groups at the Nebraska zoos. Since the ecoregion definition spans a much larger area of Nebraska, the previous argument regarding proximate non-local visitors at the Safari Park cannot be applied here. Instead, it could be inferred that the Safari Park is the cause for the higher sense-of-place scores in non-local visitors, introducing people to the wildlife that make the grasslands of North America special. The reasoning used before for the Desert Museum still holds here, suggesting that residents of the Sonoran Desert ecoregion are already attached to their unique environment, and those who visit the Desert Museum are the ones who are most attached.

The New York zoos are particularly interesting because the Bronx Zoo, the exotic-focused one of the pair, was the one with a higher sense-of-place mean for local visitors. One potential reason is the location of the zoos: they represent the pair with the largest distance between the zoos (around 240 miles) and they contrast a zoo in the middle of the largest city in the United States (World Population Review 2018) with a much less populated county of the state (New York State Department of Health 2011). A study exploring sense of place in urban and rural settings in China found no significant difference in the place attachment of those groups (Cui and Ryan 2011), however it focused on tourism and not on ecological sense of place. This specific facet of place attachment could logically be assumed to be inherently lower in urban areas where there is less nature to associate with, which makes the results at the Bronx Zoo all the more
surprising. At the same time, New York City is an iconic urban center, and the Bronx Zoo is one of its most popular attractions (Dao and Phillips 2018), so the zoo could perform well on the sense-of-place survey statements related to place dependency and identity without strong natural features.

4. **Members and non-members**

Another salient aspect of this research was the pattern of positive relationships between zoo membership status and sense of place across all zoos and within matched pairs. Here, the only exceptions were the Reid Park Zoo and the California Living Museum. Members are likely the most frequent or regular visitors to each zoo, which builds up their attachment and familiarity over time. Since sense of place can in many ways be regarded as a compilation of memories, the more time one has to acquire those memories, the stronger the resulting connection will be. This compounding effect of time is supported by the existing literature on sense of place (Hashemnezhad et al. 2013), including papers exploring this concept in the realm of humanistic geography and relating it to the rootedness that comes from living in one place for a long time (Bott 2000).

However, this does not address the unusual data points for the Reid Park Zoo, where sense-of-place means were very similar for the member and nonmember groups, and the California Living Museum, where the nonmember group had a higher mean. For Reid Park, it does not seem to be due to all visitors, including nonmembers, being local and therefore familiar with the area, since the means for both groups are somewhat in between the highest for members and the lowest for nonmembers. These results could be linked to the cost of admission and membership at these zoos: if membership is
expensive, visitors could be visiting semi-regularly without becoming members. However, this seems unlikely because an annual family membership at both the Reid Park Zoo and the California Living Museum pays for itself in two visits or less per year (CALM Zoo 2018; Reid Park Zoo 2018). Additionally, the number of memberships relative to annual visitors is not different at these zoos compared to the other ones studied (see Appendix C).

5. Multi-factor comparisons

Considering that each of these individual characteristics of visitors (hometown within 20-mile radius, ecoregion, member status) correlated with sense-of-place scores to a certain degree at the majority of the study sites, it is imperative to examine how they all interact or overlap in their effects on sense of place. In this regard, the linear mixed-effects model was helpful in that it allowed for the inclusion of multiple factors to determine their relative importance. As shown in the results, all four factors of zoo type, visitor inclusion in radius, visitor ecoregion, and visitor membership had a very significant effect on sense of place ($p < 0.001$) when considering all nine zoos together (though zoo type is significant at $p < 0.01$ for the second model run). Within the zoo pairs, member status was the most consistent significant factor, having an effect at all zoos except the second California pair and the Arizona zoos in the second model.

Regarding the California zoos, it is fascinating to note that the California Living Museum did not lead to a stronger contrast for the San Diego Zoo than the Santa Barbara Zoo did. The California Living Museum was expected to be a clearer counterpart for the San Diego Zoo due to its exclusive focus on species local to Southern California and its
much smaller size, compared to the Santa Barbara Zoo’s mix of local and exotic species and its intermediate size. However, for both California zoo pairs, the zoo type was not a significant factor contributing to sense-of-place score differences. Rather, member status was very important between the San Diego Zoo and the Santa Barbara Zoo (p < 0.001) and visitor radius and ecoregion were moderately important between the San Diego Zoo and the California Living Museum (p < 0.05). This illustrates that not all local-focused zoos are similar, and that every comparison of two institutions can yield vastly different results. Though the California Living Museum was distinctly more local-focused than the Santa Barbara Zoo, that characteristic does not seem to have been a key factor in visitors’ perceptions, thoughts, and attachment.

What is particularly interesting, however, is that the only zoo pair where zoo type was the factor with the most significant effect on sense of place is in the Arizona zoos (p < 0.001). In contrast, radius, ecoregion, and member status were minor factors for these zoos, with statistical effect being either insignificant or barely significant (p < 0.05). This is exciting because it is the strongest confirmation of the hypothesis of the study, proving that there can be a convincing correlation between the types of species a zoo exhibits and the sense of place developed by that zoo’s visitors.

6. Case study: Arizona-Sonora Desert Museum

Given the consistently high sense-of-place scores across all visitor groups at the Arizona-Sonora Desert Museum, this Arizona zoo pair definitely merits more in-depth analysis. The Desert Museum and the Reid Park Zoo are two zoos in the same city (Tucson, AZ) with very different results, prompting the question of why the Desert
Museum’s scores are so much higher (especially since it is not due to more local visitors or members, as shown earlier).

There are a few potential causes for this result. For one, the Arizona-Sonora Desert Museum focuses on a specific ecosystem more than any other zoo visited: the framing for the institution is entirely based on what is present in that ecosystem and how the organisms interact and depend on each other (Arizona-Sonora Desert Museum 2018a). In contrast, the other local-focused zoos housed native species but did not create as much of a comprehensive and cohesive image of the ecosystem the animals belonged to, most likely because those ecosystems are not as distinct and unique as the desert (Nabhan and Holdsworth 1998).

Another potential factor is the Junior Docent program operating at the Arizona-Sonora Desert Museum. Dozens of high school students volunteer their time to teach the public about the animals at the museum, often spending years in the program (Arizona-Sonora Desert Museum 2018b). Most zoos have docents, but they are usually seniors who take on the role in retirement. Having teenagers engaged in their community and excited to share with visitors likely creates a different teaching dynamic that perhaps is more successful at imparting information in a more memorable fashion. Amy Orchard, the Education Specialist in charge of the Junior Docent Program, explained the effect as follows: “There's this real kind of trend of visitors stopping to listen to the teenagers more because they're like – you mean you're volunteering your weekend, you're a teenager and you're here? And [the Junior Docents] are so knowledgeable. So, once they start talking, people are like – oh my gosh you know what you're talking about; I want to listen more” (A. Orchard, personal communication, 2017). In addition to being a refreshing and
captivating experience for the visitors, the program provides a space for the young residents of Tucson to get engaged in their environment and acquire skills that will be useful for careers in conservation or any other field (Orchard 2011). As former docents reach adulthood, they will share the values they learned with their children and continue the cycle of making Tucson more appreciative of its natural surroundings.

Additionally, it is important to note that the Arizona-Sonora Desert Museum’s visitor base may be strongly affected by its location, which may in turn influence its sense-of-place scores. The museum is located about 15 miles outside of Tucson, and is only accessible by personal car (there is no public transportation). Therefore, those who visit must have the means to get there and the determination to travel a certain distance. As pointed out by Sergio Avila, one of the museum’s Education Specialists, during an interview, this inevitably limits the visitor pool to those of a certain socio-economic status who own a car and have the time to spend a day, or multiple days, at the zoo (S. Avila, personal communication, 2017). This high barrier to entry means that those who go to the Arizona-Sonora Desert Museum must already care about their environment to a certain extent and be inclined to learn more about it and protect it. At the same time, most of the local-focused zoos (all but the Santa Barbara Zoo) are located outside of urban areas, which would suggest that all of their sense-of-place scores should be influenced similarly by this factor. Therefore, it would seem that this is not the primary reason for the Arizona-Sonora Desert Museum’s particularly high sense-of-place scores relative to other zoos.

One last factor to consider in examining the Arizona-Sonora Desert Museum is the more intangible aspects of the zoo visit experience. The institution’s location is such
that one sees almost no other buildings surrounding the zoo as one walks around surrounded by miles of open desert. There are no city sounds or other signs of human development, allowing for true immersion in the ecosystem at hand. The only other zoo studied that comes close to this is the Lee Simmons Wildlife Safari Park. However, the Safari Park’s format as a drive-through experience makes it more difficult for its visitors to feel a part of the nature around them. The Desert Museum is a pioneer in the area of innovative unobtrusive exhibit design, wanting specifically to make enclosures seem as naturalistic as possible (Arizona-Sonora Desert Museum 2018a). This could very well be the reason the Desert Museum is most strongly linked to visitors feeling connected with the space.

7. **Minor associated findings**

Moving past the direct correlates to sense-of-place score, there are other data collected that are worth considering here, such as visitor preferences for local versus exotic species in choosing what to support with a donation. The percentage of selection for the local species was almost always higher at the local focused zoos, and all of the significant results occurred where the percentage at the local focused zoo was higher than at the exotic focused zoo. This illustrates the concept that people develop more caring for species that they are directly exposed to; they are more likely to donate to a species that is present at the zoo they are visiting. These results align with a study conducted at zoos in the United Kingdom, where visitors could much more easily name exotic threatened species than British threatened species (Balmford et al. 2007). Since the zoos studied were exotic-focused, the visitors were much more exposed to exotic species. Information
like this is useful for developing conservation plans: if we want to protect the species closer to home, it would be helpful to cultivate caring for them in the public through exposure in zoos or similar institutions.

Beyond this general pattern, another point of note is the stronger preference distinctions between the mammal pairs. This is most likely due to the general public’s higher level of knowledge regarding mammals: species like the African Lion and the Gray Wolf are more recognizable by name than the Massasauga or the Bog Turtle, for instance. Fondness for these mammalian species is no surprise given the well-known widespread appeal of charismatic megafauna – they were, after all, the main selling point for the Endangered Species Act in 1973 (Petersen 1999). These species are often used as the “poster children” for conservation, such as the iconic Giant Panda that serves as the icon for the World Wildlife Fund. A layperson will find it much easier to conjure up an image, and the associated emotions and attachment, for a charismatic mammal than for an unknown reptile, and will therefore donate to the protection of the mammal.

In a similar vein, data collected on survey respondents’ favorite species revealed how integral interaction and intimate experiences are in establishing a connection with a species. At zoos with a hands-on opportunity for visitors to engage with a certain animal, that animal regularly appeared as a visitor favorite: giraffes at the Reid Park Zoo and the Santa Barbara Zoo, where giraffe feeding was available; stingrays at the Arizona-Sonora Desert Museum, where there was a stingray touch tank. The importance of interaction in visitors selecting these species as their favorites is supported by responses given to an open-ended survey question on what experiences increased their connection to natural spaces, such as: “getting up close and personal with an animal” (Reid Park Zoo),
“interactive displays like zoo lights and giraffe feeding” (Reid Park Zoo), “watching the interactive and stimulation animal activities” (Henry Doorly Zoo), and many more. Memories of interactive moments are more vibrant for the public, which contributes to the attachment and feelings that visitors develop for a zoo and its animals, thereby increasing their sense of place (Kahn and Keller 2002).

8. Limitations

Given the complexity of the topic addressed in this study (and the confluence of ecological, social, psychological, geographical, and economic factors), a number of caveats need to be considered. For one, sense of place is a difficult metric to measure in a clear, definitive manner due to its conceptual and multifaceted nature (Williams and Vaske 2003; Cheng et al. 2003; Gosling and Williams 2010). That is no exception for zoos, where countless factors affect the visitor experience. Because sense of place is a feeling that grows out of multiple occurrences and interactions, it is almost impossible to determine one single most important factor in developing a strong sense of place. Indeed, many are arguing for studies to be more multidisciplinary in their approach in order to fully capture respondents’ feelings and attitudes (Ardoin 2006). That being said, this study focused on the ecological aspect of sense of place due to its link to pro-environmental behavior.

Second, zoos are incredibly complex and diverse institutions, making it nearly impossible to compare two, or nine, or them while accounting for all potential confounding variables. This study’s matched pair design was chosen to eliminate some of
the problems related to regional differences and cultural diversity, but the study sites still varied tremendously within pairs.

Additionally, there is a piece of information that could be included regarding whether visitors had visited the zoo before. The survey attempted to cover these data through the questions on zoo membership and level of familiarity with the area, but a direct question would have been helpful as well.

Further, the study design for data collection could be improved to ensure maximum diversity in survey respondents. Since a few survey locations were near playgrounds, the majority of respondents were parents with young children. While this demographic does represent a large part of zoo visitors, it excludes some other population groups and could affect the results. Another imbalance in respondent demographics was related to gender: a vast majority of visitors surveyed were women taking their kids to the zoo. This is logical given society’s current gender roles for mothers and fathers, but it could skew the sense-of-place scores obtained. In both of these cases, the respondent demographics are representative of zoo visitor populations, but not of the general population, and that is something to be taken into account when attempting to generalize these findings to the general public.

Lastly, this research is an exercise in correlation rather than causation, meaning that the findings relate to observing patterns rather than coming to firm conclusions. This study is the first to explore the link between zoos and sense-of-place scores. Therefore, it is aiming to begin charting the waters for others to hopefully follow and map out the details with ever more precision. The primary goal was to apply the sense-of-place framework to the field of conservation education in zoos and prompt questions, not to
prove zoos right or wrong or give specific answers. Now that a clear general pattern in sense-of-place scores among zoos has been established, it can be learned from and further investigated.

9. Future directions

This study sets the foundation for follow-up work on several different topics. First, it would be fascinating to look more closely at the relationship between the distance of visitors to a zoo and their attachment to the area. The different definitions for “local” used in this project barely skim the surface of all of the possible dimensions of distance and what is truly familiar to people. Exploring other facets of “home” and “local” in more depth could yield some key insight into how to build connections between the public and natural spaces.

Next, the effect of a zoo’s global or local reputation on visitors’ sense-of-place scores is something that merits more analysis. Everyone has preconceptions about places, institutions, and other people based on what they read or hear, so understanding how those prejudices or biases influence the attachment we develop for a place could be invaluable for cultivating stronger sense-of-place.

In addition, the argument relating to visitors who are already most attached to the surrounding area being those who visit zoos certainly warrants further exploration. If it is indeed true that zoo visitors already have higher sense-of-place scores compared to the general population, the challenge becomes how to involve and create connections with those who are disinterested, unattached, and not visiting these institutions that could
make a difference in their behavior. Therefore, better understanding the baseline attitudes of zoo visitors regarding sense of place would be incredibly helpful.

Last and perhaps most importantly, the next steps for this field and this line of work involve seeking out the potential causal links between local-focused zoos and higher sense-of-place scores in order to understand how to cultivate that place attachment in areas that are currently lacking it. Focusing on the zoos that already do have that strong sense of place (such as the Arizona-Sonora Desert Museum), it would be useful to analyze exactly what creates that sense of place, and whether the communities surrounding those zoos are in fact doing more for conservation and performing the pro-environmental behaviors that would correlate with their attachment. This would determine whether that link between ecological sense of place and environmental concern and protection holds true in the realm of zoo education and conservation work with the public.

Thus, this research outlines a two-branched path forward – figuring out how to raise sense of place where it is low, and turning groups with already high place attachment into real conservation actors. Given that we are entering into a sixth mass biological extinction, signaled by population extinctions and local declines in abundance worldwide (Ceballos et al. 2017), these two branches can build a desperately needed network of people who understand, care for, and act to protect our planet and all its inhabitants.
Conclusion

Overall, the key point to take away from this study is that there is a strong correlation between local-focused zoos and the higher sense-of-place scores that can positively influence pro-environmental behaviors. In addition, visitor hometown, ecoregion, and member status are all also linked to sense of place and all play a role in individuals’ place attachment, though to varying degrees at different zoos.

This information can help zoos and other conservation organizations shape their educational efforts and target them toward certain groups that are most likely to turn conservation knowledge into action. In this study, audiences at local-focused zoos have been shown to have a stronger attachment to and familiarity with their immediate environment. This makes them a good choice for inclusion in concerted conservation projects. The study also supports the idea that exotic-focused zoos could benefit from incorporating more local-focused exhibits and messaging that will connect visitors to their surroundings in a complementary and yet more tangible, action-oriented way. Through these local connections and the reinforcement of sense of place they will encourage, zoos can propel the conservation movement at a small scale and create a public network that will take great strides at a global level.
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2018
Zoos Victoria (2018b) Love Your Locals Teacher Resource
Appendices

Appendix A – Survey Sample. This one was used for California Zoos 1 (Santa Barbara Zoo and San Diego Zoo)

Zoo Visitor Survey
Thank you for agreeing to complete this survey. Please circle the answers in the survey as in the following example:
Example: We are in the year...

2016 2017 2018 2020

The survey should take 5 minutes to complete.

1. Please circle your age range.
   18-25 26-35 36-45 46-55 56-65 66+

2. What is your gender identity? (Optional) Male Female Other________________

3. What town and state are you from? (add country, if not US) __________________________

4. Are you a member of this zoo? (circle) Yes No
   If yes, how long have you been a member?
   Less than 6 months 6 months-1 year 1-2 years 3-4 years 5+ years

5. Do you donate to conservation organizations? If so, which ones? (Optional)


6. How many times in the last week have you gone outside with the intent of spending time outdoors (biking, walking, gardening, camping, hiking...)?
   Never 1-2 times 3-5 times 6+ times

7. What is your favorite animal at this zoo? __________________________

8. If you were given $50 to donate, please select one animal in each row (select 6 total) whose conservation you would donate to:

<table>
<thead>
<tr>
<th>Andean Condor</th>
<th>OR</th>
<th>California Condor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Giant Kangaroo Rat</td>
<td>OR</td>
<td>Mexican Agouti</td>
</tr>
<tr>
<td>African Painted Dog</td>
<td>OR</td>
<td>Channel Islands Fox</td>
</tr>
<tr>
<td>Madagascar Jacana</td>
<td>OR</td>
<td>California Least Tern</td>
</tr>
<tr>
<td>California Tiger Salamander</td>
<td>OR</td>
<td>Kaiser’s Spotted Newt</td>
</tr>
<tr>
<td>African Spurred Tortoise</td>
<td>OR</td>
<td>Desert Tortoise</td>
</tr>
</tbody>
</table>

Please turn over.
9. Each of the 16 statements in this table refers to the place that is this zoo’s local area (within a 20-mile radius of the zoo). Please circle the number that best matches your own personal response to each statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel that this place is a part of me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>This place is the best place for what I like to do.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>This place is very special to me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I feel that I belong to this place.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I am very attached to this place.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I am committed to this place and ready to do something to protect it.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>For me, this place is...</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>safe</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>clean</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>familiar</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>meaningful</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>natural</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>beautiful</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>peaceful</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>comfortable</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>alive</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>distinctive</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

10. Regarding the location you just reviewed, how familiar are you with it?

<table>
<thead>
<tr>
<th>Very familiar</th>
<th>Moderately familiar</th>
<th>Slightly familiar</th>
<th>Not at all familiar</th>
</tr>
</thead>
</table>

The phrase “sense of place” refers to an individual’s feelings towards, familiarity with, and attachment to a certain place. It can be influenced by experiences, relationships, knowledge, and more.

11. In what ways do you think visiting this zoo affects your “sense of place”?

12. What experiences increase your “sense of place” and connection to local natural spaces most?

*End of survey. Thank you!*
Appendix B – Interview Questionnaire. The same questions were posed for every interview at every zoo.

Study of the Effectiveness of Conservation in Zoos Based on Focus on Local Species

Interview

Zoo of employment: ____________________________

Position at this zoo: __________________________

Number of years working in this position: __________

Section 1: Build connection
What brought you to zoo conservation work?

Section 2: Zoo Overview
What are the zoo’s main goals?

Prompts:
• Where does research figure in your priorities?
• Where does conservation figure in your priorities?
• Where does education figure in your priorities?

How does the zoo approach conservation and conservation education?

Prompts:
• What different audiences do you target (schools, families...)?
• What are some recent developments/projects?

What would you estimate is the zoo’s ratio of local to nonlocal species? What about the ratio of local to nonlocal visitors?

Prompts:
• Has the ratio shifted over time?
• How do you see the ratio shifting in the future?

Section 3: Conservation
What process do you follow in setting your priorities for conservation?

Prompts:
• To what extent are these decisions based on research?
• To what extent are these decisions based on visitor base?

What conservation efforts have been most successful? Least successful?

Prompts:
• Why do you think something worked or didn’t work?

How do you see the zoo’s conservation education strategy evolving in the near future?

Prompts:
• What do you think needs the most attention going forward?
• What aspects do you think need to be changed or even eliminated?
Does the zoo engage in reintroduction programs? What is the zoo’s balance between reintroducing animals to the wild and captive breeding for captive populations?

Section 4: Local focus
To what extent does the zoo undertake conservation efforts linked to local ecosystems? What are they/have they been?

Probes:
- What sorts of animals do you use as your “poster child” for conservation? How do you choose these animals?

Do you think an increased focus on local species could benefit zoos,

a) by creating more sense of place for visitors? If so, how?
   a. Probes:
      i. Do local visitors feel more connected to the zoo?
      ii. Do you think a zoo’s function is to expose people to animals they wouldn’t see otherwise, or to solidify connections with nature, (or other or both)?

b) by facilitating reintroduction efforts? If so, how?

c) by creating unique zoos, each representative of their immediate ecosystem? If so, how?
Appendix C – Table of general zoo characteristics. Data collected online and through zoo employees. Numbers of species and animals exclude invertebrates. Numbers of visitors per year are approximate.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>32 acres (11 developed)</td>
<td>265 acres</td>
<td>440 acres</td>
<td>130 acres</td>
<td>30 acres</td>
<td>99 acres (developed)</td>
<td>21 acres</td>
<td>24 acres</td>
<td></td>
</tr>
<tr>
<td>Animals</td>
<td>85</td>
<td>8,745</td>
<td>325</td>
<td>7,101</td>
<td>500</td>
<td>3,500</td>
<td>411 (800+ with rehab)</td>
<td>1,940</td>
<td>300</td>
</tr>
<tr>
<td>Species</td>
<td>32</td>
<td>780</td>
<td>34</td>
<td>530 without</td>
<td>160</td>
<td>650</td>
<td>116</td>
<td>230</td>
<td>100</td>
</tr>
<tr>
<td>Visitors per year</td>
<td>45,000</td>
<td>2,150,000</td>
<td>N/A</td>
<td>2,000,000</td>
<td>N/A</td>
<td>3,000,000+</td>
<td>162,207</td>
<td>360,000</td>
<td>500,000+</td>
</tr>
<tr>
<td>Memberships</td>
<td>1,776</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>~250,000</td>
<td>2,763</td>
<td>22,000 households</td>
<td>14,226 households</td>
<td></td>
</tr>
<tr>
<td>Years of operation</td>
<td>27</td>
<td>119</td>
<td>20</td>
<td>124</td>
<td>55</td>
<td>102</td>
<td>35</td>
<td>66</td>
<td>53</td>
</tr>
</tbody>
</table>
Appendix D – Map of the ecoregions of the United States generated by the USDA (USDA Forest Service 2018)
Appendix E – Conservation preferences for local versus exotic species within each zoo pair. The species are listed with local one first and the exotic one second. The percentage of visitors who picked the local species is listed for each donation pair at each zoo, and the instances when local selection was greater than 50% at local-focused zoos (preference over exotic species) or when exotic selection was greater than 50% at exotic-focused zoos (preference over local species) are highlighted in green. The proportions of selection between zoos were compared with a proportions test, yielding the $p$-values listed. Significant results are highlighted in grey.

<table>
<thead>
<tr>
<th>Zoos</th>
<th>Species</th>
<th>Local %</th>
<th>Sig</th>
<th>Species</th>
<th>Local %</th>
<th>Sig</th>
<th>Species</th>
<th>Local %</th>
<th>Sig</th>
<th>Species</th>
<th>Local %</th>
<th>Sig</th>
<th>Species</th>
<th>Local %</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thompson Park Zoo</td>
<td>Golden Eagle/ King Vulture</td>
<td>90.5</td>
<td>NS</td>
<td>Mountain Lion/ African Lion</td>
<td>77.3</td>
<td>***</td>
<td>Gray Wolf/ African Wild Dog</td>
<td>97.7</td>
<td>***</td>
<td>Northern Cricket Frog/ Poison Dart Frog</td>
<td>46.8</td>
<td>NS</td>
<td>Queen Snake/ Box Constrictor</td>
<td>43.1</td>
<td>NS</td>
</tr>
<tr>
<td>Bronx Zoo</td>
<td></td>
<td>89.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bog Turtle/ Yellow-Headed Box Turtle</td>
<td>28.6</td>
<td>NS</td>
</tr>
<tr>
<td>Lee Simmons Wildlife Safari Park</td>
<td>Whooping Crane/ Grey-Crowned Crane</td>
<td>67.9</td>
<td>NS</td>
<td>American Bison/ Bongo</td>
<td>84.5</td>
<td>NS</td>
<td>Gray Wolf/ Bat-eared Fox</td>
<td>82.5</td>
<td>*</td>
<td>Piping Plover/ Bernier’s Teal</td>
<td>52.9</td>
<td>NS</td>
<td>Massasauga/ Woma Python</td>
<td>62.7</td>
<td>NS</td>
</tr>
<tr>
<td>Henry Doorly Zoo</td>
<td></td>
<td>62.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Blanding’s Turtle/ Radiated Tortoise</td>
<td>30.3</td>
<td>NS</td>
</tr>
<tr>
<td>Santa Barbara Zoo</td>
<td>California Condor/ Andean Condor</td>
<td>87.8</td>
<td>NS</td>
<td>Giant Kangaroo Rat/ Mexican Agouti</td>
<td>57.3</td>
<td>NS</td>
<td>Channel Islands Fox/ African Painted Dog</td>
<td>67.6</td>
<td>NS</td>
<td>California Least Tern/ Madagascar Jacana</td>
<td>46.2</td>
<td>NS</td>
<td>California Tiger Salamander/ Kaiser’s Spotted Newt</td>
<td>78.1</td>
<td>NS</td>
</tr>
<tr>
<td>San Diego Zoo</td>
<td></td>
<td>81.9</td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Desert Tortoise/ African Spurred Tortoise</td>
<td>70.4</td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>California Living Museum</td>
<td>California Condor/ Andean Condor</td>
<td>94.9</td>
<td>NS</td>
<td>Tipton Kangaroo Rat/ Mexican Agouti</td>
<td>70.0</td>
<td>NS</td>
<td>San Joaquin Kit Fox/ African Painted Dog</td>
<td>82.0</td>
<td>***</td>
<td>American Coot/ Madagascar Jacana</td>
<td>51.1</td>
<td>NS</td>
<td>Desert Tortoise/ African Spurred Tortoise</td>
<td>87.5</td>
<td>NS</td>
</tr>
<tr>
<td>San Diego Zoo</td>
<td></td>
<td>81.9</td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Desert Tortoise/ Radiated Tortoise</td>
<td>61.9</td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arizona-Sonora Desert Museum</td>
<td>Thick-billed Parrot/ Military Macaw</td>
<td>49.5</td>
<td>NS</td>
<td>Mountain Lion/ African Lion</td>
<td>80.4</td>
<td>***</td>
<td>Mexican Gray Wolf/ Fennec Fox</td>
<td>83.7</td>
<td>*</td>
<td>Chiricahua Leopard Frog/ Poison Dart Frog</td>
<td>68.9</td>
<td>NS</td>
<td>Western Diamondback Rattlesnake/ Eyelash Viper</td>
<td>76.3</td>
<td>NS</td>
</tr>
<tr>
<td>Reid Park Zoo</td>
<td></td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Desert Tortoise/ Radiated Tortoise</td>
<td>88.5</td>
<td>NS</td>
</tr>
</tbody>
</table>