RESEARCH ARTICLE

Conservation Caring: Measuring the Influence of Zoo Visitors' Connection to Wildlife on Pro-Conservation Behaviors

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Zoos in the 21st century are striving to make effective contributions to conservation. Although zoos are extremely popular and host over 600 million visitors worldwide, one challenge zoos face is how to effectively engage visitors and raise awareness and action for conservation. To this end, zoos commonly rely on charismatic megafauna, which have been shown to elicit a connection with zoo visitors. However, little is known about how to measure a connection to a species or how this connection may influence conservation behaviors. This study had two sequential objectives. The first was to develop a scale to measure visitors' connection to a species (Conservation Caring). The second was to investigate the relationship of Conservation Caring to pro-conservation behaviors, following a zoo experience. Pre- ($n = 411$) and post-visit ($n = 452$) responses were collected from three sites in order to assess the reliability and validity of a scale to measure Conservation Caring. Structural equation modeling was used to explore the relationship between Conservation Caring and pro-conservation behaviors. Conservation Caring was deemed a valid and reliable scale and was a strong predictor of species oriented behaviors ($\beta = 0.62$), for example, "adopting" an animal, but a weak predictor for biodiversity oriented behaviors ($\beta = 0.07$), for example, supporting sustainability policies. Results support the role zoos can play in fostering a connection to wildlife and stimulating pro-conservation behaviors. Additionally, visitors connected to a wide array of animals. On the basis of these results, zoos may recruit a wider assemblage of species as potential flagships. Zoo Biol. XX:XX–XX, 2013.

Keywords: flagship species; connection to wildlife; conservation psychology; pro-conservation behaviors; structural equation modeling; introduction

INTRODUCTION

Can viewing animals in captivity foster a connection to wildlife and drive pro-conservation behaviors? For many of the 600 million annual visitors, zoos and aquariums (hereafter zoos) provide an intimate and extensive encounter with wild animals [Tribe and Booth, 2003; Zimmermann, 2010]. Certain animals (e.g., lions, giraffes, dolphins) are highly popular and attract visitation due to their power, grace, and beauty [Christie, 2007]. However, this situation is at the heart of a controversy over a modern role of zoos, namely balancing visitors' desire for entertainment with the need to contribute to in situ conservation [Rabb, 1995; Tribe, 2004]. If the public is only interested in charismatic megafauna, how can zoos raise awareness of the global biodiversity crisis? Dickie et al. [2007] point out that few zoos link collection plans to biodiversity conservation. Furthermore, Balmford et al. [1995] found that for many charismatic megafauna, in situ conservation was more cost effective than captive breeding, and provided protection for sympatric species.

Despite these concerns, there is belief that zoo experiences may raise concern for biodiversity conservation. As Ryder [1995] states,

> the greatest impact that zoos may have on long-term conservation of biological diversity is through strengthening the concern of the zoo-going public for issues as complex as biological diversity through so simple an experience as seeing living animals on exhibit in naturalistic settings—especially

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adults and their offspring. As people tend to protect what they value, zoo experiences can and do provide new generations of conservationists (p. 117).

Though most zoo managers might take exception to Ryder's classification of the zoo experience as "simple," he does raise a critical point regarding the potential influence direct exposure to an animal may have on visitor behaviors.

Given zoos' massive visitation rates, cultivating visitors' adoption of pro-conservation behaviors is a highly prized outcome. To that end, zoos have embraced a new role for charismatic megafauna; from that of tourist attraction to ambassadors for biodiversity conservation. This corresponds with visitors' expressed desire for zoos to be more conservation driven [Tribe, 2004]. In response, zoos are developing conservation campaigns around select species in the hopes of raising public awareness and action for conservation. If such campaigns are successful, the animal may be designated a flagship.

By definition, a flagship is a species capable of raising public awareness and action for conservation [Simberloff, 1998]. The use of flagships is based, in part, on the assumption that visitors' form an emotional connection with the animal. This connection is expected to translate into action or at least general support for conservation [Lindsey et al., 2007; Manfredo, 2008; Skibins et al., 2012]. Previous studies have explored how an emotional connection can be cultivated during a zoo visit [Myers et al., 2004; Bruni et al., 2008; Smith et al., 2011]. For example, Clayton et al. [2009] found that a zoo visit can develop a shared identity between visitors and animals, and this shared identity might increase visitors' concern for an animals' well-being. However, little work has been done to develop an instrument to measure visitors' emotional connection. Furthermore, despite strong belief that a connection to a species influences pro-conservation behaviors, there is little substantiation of this belief.

Accordingly, this exploratory study used structural equation modeling to: (1) develop a scale to measure visitors' connection to a species, and (2) investigate the relationship between connection to a species and pro-conservation behaviors following a zoo experience using a model derived from Value Belief Norm (VBN) theory [Stern, 2000b; Stern et al., 1999]. Visitors' emotional connection with a species was an operationalization of the theoretical construct, Conservation Caring [Rabb and Saunders, 2005]. An independent sample of pre- and post-visitors was used to test the reliability and validity of the Conservation Caring scale. Next, we examined the influence of Conservation Caring on pro-conservation behavioral intentions (hereafter pro-conservation behaviors) following a zoo experience.

Zoos and Visitor Supported Conservation Outcomes

Zoos have long advocated their role as genetic repositories, captive breeding centers, and refugia when natural habitats are severely threatened [Dickie et al., 2007]. However, these activities are usually restricted to larger institutions and limited to only a small number of the animals in a collection. Furthermore, these activities do not directly involve visitors, which severely underutilizes a strategic zoo asset [Mallinson, 2003]. An emerging challenge for zoos is engaging their publics in supporting broad-scale conservation efforts [Rabb, 1994]. To better maximize visitor supported conservation outcomes, zoos have advanced their role in helping visitors form a connection to wildlife [Broad and Weiler, 1998].

According to Ryder [1995], zoo animals can instill a "sense of awe and wonder that forms the basis of the concern and caring that motivates conservation action" (p. 109). Dickie et al. [2007] go so far as to suggest a key role for 21st century zoos is to parlay visitors' emotional connection with specific animals to support for wider conservation issues. Studies have shown visitors expect zoos to contribute to conservation, and rank zoo conservation efforts as very important [Tribe, 2004; Zimmermann, 2010].

One way zoos have attempted to meet such audience expectations is associating charismatic species with conservation campaigns. Charismatic megafauna may foster an emotional connection, raise awareness, and motivate action in zoo visitors. Such visitor responses align with recommendations for linking in situ and ex situ conservation strategies [Ballantyne et al., 2007; Moscardo, 2008].

Flagship Species

If conservation campaigns built around a charismatic species are successful in raising awareness and action, that species may be considered a flagship [Simberloff, 1998; Caro and Girling, 2010]. Most successful flagship species are traditional charismatic megafauna (e.g., elephants, tigers, pandas) [Goodwin and Leader-Williams, 2000; Okello et al., 2008]. However, charisma does not guarantee awareness and action, and thus does not dictate flagship status. Additionally, recent studies have found invertebrates, birds, and even trees can serve as flagships [Bowen-Jones and Entwistle, 2002; Verissimo et al., 2009]. Thus, not all charismatic megafauna are flagships, and not all flagships are megafauna; which would imply a broader role for zoos' collections. However, to be effective, flagships do need to possess a level of charisma that resonates with its target audience.

For zoo audiences, most traditional megafauna possess hallmark characteristics of charisma. These characteristics can include a similarity to humans, large body size, being highly active, and having large eyes [Rolston, 1987; Kellert, 1996; Sitas et al., 2009]. Additionally, many are endangered and hence rare, which is also a feature associated with charisma [Tisdell et al., 2005; Fuhrman and Ladewig, 2008]. Thus, many animals in a zoos' collection may foster a connection with visitors, and theoretically stimulate awareness and action. For example, Clayton et al.

[2009] found that wanting to learn more about observed zoo animals and a feeling of connection were related to visitors' desire to help the animal.

While several studies have investigated how the zoo experience can facilitate a connection with an individual animal or species [Orams, 1997; Myers et al., 2004; Ballantyne et al., 2010], most stop short of empirically investigating how this connection influences pro-conservation behavior. Furthermore, there is evidence to suggest that the emotional connection is short-lived and may not influence behavior [Stern, 2000a; Smith et al., 2008, 2010].

Conservation Caring

Further complicating matters is a gap in the literature regarding constructs developed to measure visitors' connection to wildlife. To address this, Rabb and Saunders [2005] proposed the concept of Conservation Caring, which consists of three sub-dimensions: care that, care about, and care for. "Care that" captures cognitive elements and marshals values of nature. "Care about" are affective items and are based on experiences. "Care for" are expressions of behavior and opportunities for action. These sub-dimensions parallel the expected flagship behaviors (i.e., increased awareness and conservation behaviors such as greater knowledge of threats and philanthropy) from visitors and align with the conservation psychology goal of understanding how humans care about and value nature [Saunders, 2003; Clayton and Myers, 2009].

Value Belief Norm (VBN) Theory

When attempting to understand what influences pro-conservation behaviors, such as flagship responses, VBN theory is useful because it incorporates environmental concern. This is an important aspect of the VBN model because as Stern [2000a] points out proenvironmental attitudes do not guarantee environmental protection.

VBN (Fig. 1a) proposes that if an individual accepts a set of values (e.g., New Ecological Paradigm [Dunlap and Van Liere, 1978]), believes that valued objects are threatened, and believes they have the ability to act to reduce the threat, then the individual will experience an obligation (i.e., norm) for action [Stern et al., 1999]. Thus, behaviors are at the end of a long causal chain and only weakly influenced by attitudes.

The more proximal influence of proenvironmental behavior is environmental concern. VBN often treats environmental concern as awareness of harm to a valued object, and the predictive precursor to behaviors [Stern et al., 1999; Stern, 2000b; Schultz, 2002]. However, this construct has been difficult to operationalize [Hansla et al., 2008], and awareness is too often solely measured by knowledge gain. Studies have shown that knowledge is not a reliable predictor of pro-conservation behavior [Beaumont, 2001; Shackley, 2001; Barua et al., 2010]. Care has been advanced as a more robust form of awareness, as it can entail cognitive and affective dimensions [Schultz, 2002; Perkins, 2010]. This also allows care to be a representation of visitors' connection with an animal.

Study Objectives

The purposes of this study are to (1) address a gap in the literature by developing a scale to measure Conservation Caring, and then, (2) through an adapted VBN framework, investigate its influence on pro-conservation behavior intentions after a zoo experience. By incorporating cognitive and affective components, Conservation Caring is hypothesized to be a more robust representation of awareness (as represented by "Awareness of Consequences" and "Ascription of Responsibility" in Fig. 1a). Figure 1b represents the hypothesized relationships between visitors' Existing Connection to Wildlife and Conservation Caring, which in turn influences behaviors. This is a basic representation of the direct causal relationships hypothesized by VBN; in which values/beliefs ("New Ecological Paradigm" in Fig. 1a/ "Existing Connection to Wildlife" in Fig. 1b) have a direct effect on awareness (i.e., Conservation Caring), which in turn affects behaviors. Finally, a secondary goal of the study was to explore how Conservation Caring could identify potential flagship species in zoos' collections.

METHODS

Study Sites

The first objective of this study was to develop a scale for Conservation Caring, and measure its reliability and validity. To do so we did not test a predefined list of species. Rather, we allowed visitors to self-describe the species with which they connected. In order to capture as much variation as possible, we selected heavily visited urban zoos that have large, diverse collections of traditional charismatic megafauna as well as lesser known species. All three sites are accredited members of the Association of Zoos & Aquariums.

Brookfield Zoo

Brookfield Zoo, located in Brookfield, Illinois—a suburb of Chicago—receives more than 2,000,000 visitors annually. Founded in 1934, the 216 acre zoo is home to 450 different species and eleven multi-species habitat recreation exhibits. It has taken a leadership role in advancing the field of conservation psychology and is home to the Conservation Leadership Center and Center for the Science of Animal Welfare. The zoo is involved in 35 in situ conservation projects and houses 44 species that are part of a species survival plan [Chicago Zoological Society, n.d.].

Shedd Aquarium

The Shedd Aquarium is located on the shore of Lake Michigan in Chicago, Illinois. When the facility opened in

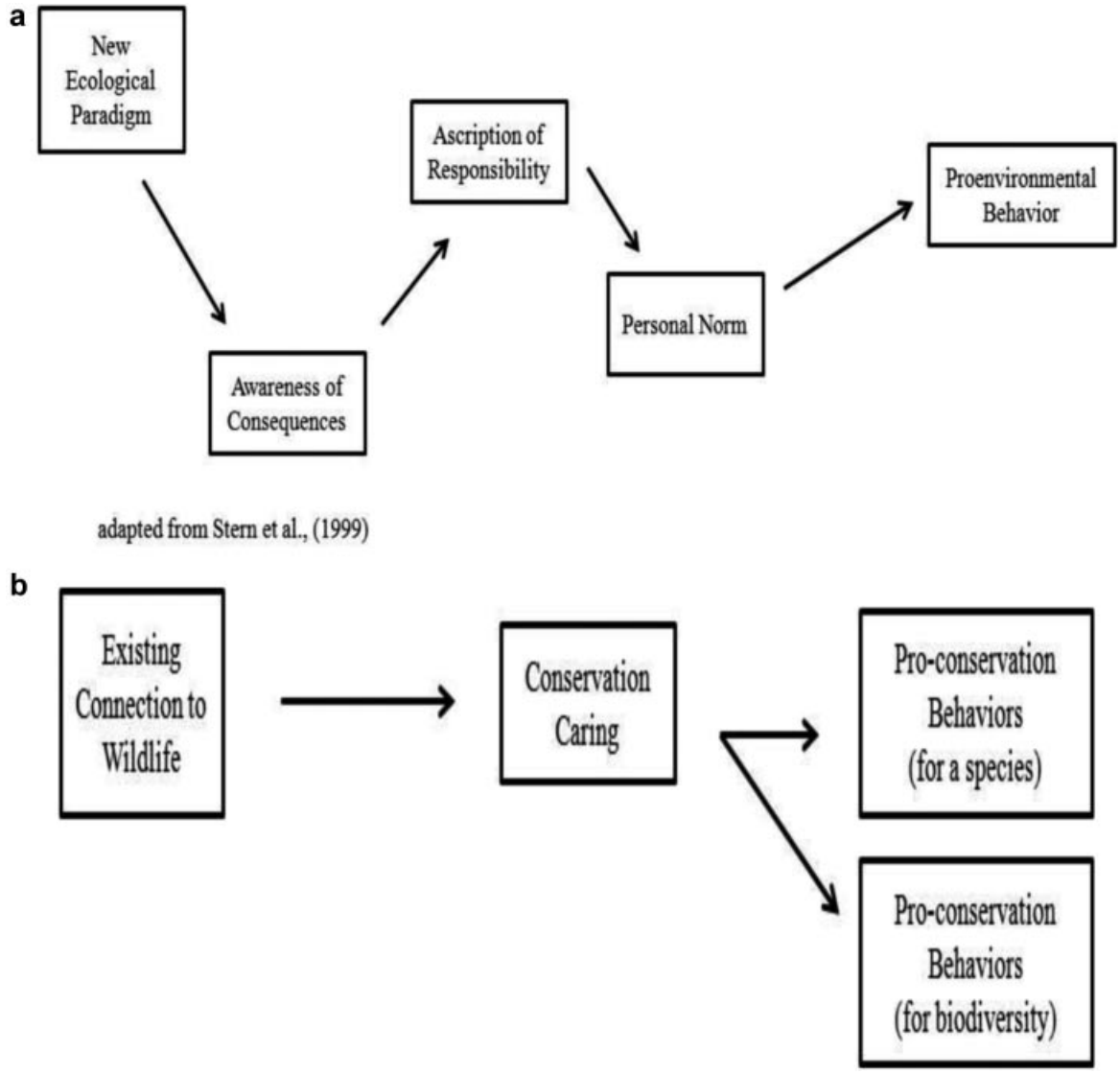

Fig. 1. (**a**) Abbreviated VBN model. (**b**) Hypothesized model

1930, it was the world's largest aquarium, and today receives more than 2,000,000 visitors annually. The aquarium has expanded since its opening and now has four multi-species habitat recreation exhibits, and 32,500 animals representing 1,500 species. Some of the more notable animals include whales, dolphins, otters, sharks, and rays. The Shedd Aquarium is involved in eight large-scale local and global in situ conservation projects [Shedd Aquarium, n.d.].

Zoo Atlanta

Zoo Atlanta was founded in 1889 and has become a nationally recognized leader in zoo-based conservation. The 40 acre site receives 700,000 annual visitors and is home to 900 animals, one of which is the giant panda. The zoo has the nation's largest gorilla and orangutan collection and three multi-species habitat recreation exhibits. The zoo also has several state-of-the-art interpretive exhibits linking in situ conservation to on-site exhibits. Additionally, Zoo Atlanta participates in 30 species survival plans and 17 in situ projects around the world [Zoo Atlanta, n.d.].

Survey Instrument Development

Instruments were developed and modified following DeVellis [2003]. A pilot test ($N = 178$, 75% response rate) was conducted at Brookfield Zoo, in July 2011, to identify construct validity and item clarity issues. The final survey instruments contained four factors and 37 items. All items were measured using nine point Likert scales; 1 = strongly disagree, 9 = strongly agree; 1 = extremely unlikely, 9 = extremely likely).

Factors

Existing connection to wildlife

Items for this factor were adapted from the Relatedness to Nature [Nisbet et al., 2009] and Emotional Affinity to

Nature [Kals et al., 1999] scales. These scales were selected on the basis of their ability to capture the cognitive and emotional components of an individual's relationship to nature. Items from these scales were modified to address a relationship to wildlife in general. The Relatedness to Nature scale proposes three dimensions: self, perspective, and experience. Items from these dimensions have been shown to be solid predictors of environmental activism and behavior. The authors also suggest a deeper understanding of one's connection to nature may increase empathy for wildlife [Nisbet et al., 2009]. The Emotional Affinity to Nature scale also has three dimensions: emotional affinity toward nature, cognitive interest in nature, and emotional indignation about insufficient nature protection. Results have shown this scale is predictive of nature-protective behavior and is particularly well suited to studies involving direct contact with nature [Kals et al., 1999].

Conservation Caring

Visitors' connection to a specific species (as opposed to wildlife in general) is represented by the factor Conservation Caring, and includes the dimensions care *that*, and care *about* (see preceding section for dimension definitions) [Rabb and Saunders, 2005]. Items for this factor were designed to reflect how individuals care, that is, how they think, feel, and act, for a specific species [DeMares and Krycka, 1998; Schultz, 2002; Gwynne, 2007; Curtin, 2009; Perkins, 2010]. Factor development followed DeVellis [2003]. Pre-visit respondents were asked to list their "favorite wild animal" and then respond to Conservation Caring items based on that animal. Post-visit respondents were asked to identify "the animal they formed the strongest connection with during their visit," and then respond to Conservation Caring items based on that animal.

Incorporating cognitive and affective dimensions allows this factor to be a more holistic operationalization of "awareness" as opposed to being a measure of knowledge gained. Additionally, it places "awareness" more in line with empathy. Empathy has been shown to be a better predictor of helping behavior within the context of environmental issues [Schultz, 2000; Ballantyne et al., 2010], and is more aligned with understanding how individuals care for a specific species [Saunders, 2003; Vining, 2003]. Conservation Caring was conceptualized as an intermediary dependent variable to both Species and Biodiversity Oriented Behaviors.

Species & Biodiversity Oriented Behaviors

Behavioral intent was separated into two factors on the basis of how actions pertain to an individual species, or biodiversity as a whole. Both factors were adapted from Stern [2000b] and included the dimensions: non-activist public sphere, behavior in organizations, activism, and private sphere. These dimensions are supported in the literature as being well representative of pro-conservation behaviors [Stern et al., 1999; Schultz, 2000; Kaiser et al., 2005]. They also align well with conservation behaviors typically associated with individual species or species cohorts [Swanagan, 2000; Walpole and Leader-Williams, 2002; Pennisi et al., 2004; Waylen et al., 2009]. Additionally, items focused on highly site-specific behaviors. A criticism of some models is that items are too general. Aligning items to a site has been shown to improve model explanatory capabilities [Stern, 2000b; Powell and Ham, 2008].

Survey Instrument Administration

Zoos were sampled from September to November, 2011. Data from across zoo sites were used to test for the reliability of Conservation Caring. Pre-/post-comparisons were used to test for the validity of Conservation Caring. Independent samples of pre-visit ($n = 411$, 83% response rate) and post-visit ($n = 452$, 89% response rate) visitors were asked to complete the respective survey instrument. A systematic sampling protocol with a random starting point was used to select respondents [Vaske, 2008]. Pre-visit aquarium visitors were approached in the entry queue, and zoo visitors were approached upon passing through entrance kiosks. At both zoos, post-visit intercept sites were central picnic areas. At the aquarium, the intercept site was the main seating area at the Caribbean Reef exhibit. Visitors who indicated they had been on site for at least 3 hr were asked to participate in the survey.

Analysis

Data screening

Data were screened for missing values. Cases exhibiting missing values for more than 50% of items per factor were removed. A total of 105 cases were removed. Data were screened for univariate and multivariate outliers following Tabachnick and Fidell [2007]. No univariate outliers (± 3 SD) were detected. A total of 33 cases were removed for exceeding the criterion Mahalanobis Distance value ($\chi^2(27) = 55.48$, $P < 0.001$). The final sample size was $N = 354$ for pre-visit visitors, and $N = 368$ for post-visit visitors. The software package EQS 6.1 was used for structural equation modeling analyses.

Scale development for conservation caring

The first research objective was to develop Conservation Caring as a scale and confirm its reliability and validity. Pre- and post-visit samples were assessed, as separate groups, to establish the measurement model as invariant across sites. Establishing metric invariance provides a statistical benchmark for accepting differences between samples due to true score differences in the constructs as opposed to inconsistent psychometric properties. Tests for metric invariance followed the hierarchical tests for configural and metric invariance consistent with Byrne [2008]. These tests were used to confirm the fit and invariance of the measurement model and thus reveal issues of scale reliability and validity. Configural invariance was performed on pre-visit and post-visit samples

across zoo sites. This was done in order to determine the reliability of Conservation Caring. Once configural invariance was assessed, pre- and post-visit samples were reviewed for metric invariance. Following the establishment of metric invariance for pre- and post-visit samples, the validity of Conservation Caring was assessed by comparing pre- to post-visit samples.

Influence of conservation caring on pro-conservation behaviors

Once the measurement model was confirmed for acceptable fit and invariance, we were able to proceed to our second objective, determining the relationship between Conservation Caring and behavior. This was assessed using the structural model. The structural model was tested for model fit and configural, metric, and structural invariance. Modification indices (Lagrange Multiplier Test, Wald Test) were analyzed to improve parsimony. R^2 values were assessed in order to gauge the predictive validity of the structural model. It is recommended to assess R^2 values independently of fit indices, as the latter do not pertain to predictive validity [Kline, 2005].

RESULTS

Survey Sample Description

The pre-visit sample had the following demographics: 44% male, 56% female; mean age 38; 60% reported completing at least 4 years of college; 67% reported their race/ethnicity as "white;" and 66% reported an annual income of $50,000 USD or greater. Demographics for the post-visit sample were as follows: 38% male, 62% female; mean age 38; 62% reported completing at least 4 years of college; 72% reported their race/ethnicity as "white;" and 74% reported an annual income of $50,000 USD or greater.

Species Preferences

Pre-visit visitors were asked, "what is your favorite wild animal." Post-visit visitors were asked, "what animal did you form the strongest connection with during your visit." A total of 164 taxa were identified across the two samples. The five most commonly reported taxa are provided for each sample (see Fig. 2). Pre-visit visitors ($N = 354$) reported their favorite species as tiger (all species) (15%), lion (8%), elephant (6%), giraffe (6%), and dolphin (all species; 5%). Post-visit visitors ($N = 413$) reported the species they formed the strongest connection with as bear (all species; 8%), dolphin (all species; 8%), giraffe (6%), gorilla (5%), and jellyfish (5%).

Development of Conservation Caring

To develop and refine a scale to measure Conservation Caring, we used confirmatory factor analysis. Initially this scale consisted of nine items. Pre-visit factor loadings ranged from 0.52 to 0.86, and post-visit factor loadings ranged from 0.56 to 0.86 (Table 1). The item "I am deeply concerned about the care and well-being of this animal at this site" had the lowest factor loading for the pre-visit sample (0.52) and was removed from both samples (0.59 post-visit). The item "This species has as much right to exist as any human being" had the lowest factor loading for the post-visit sample (0.56) and was removed from both samples (0.68 pre-visit). All factor loadings were significant in both samples. Cronbach's alphas for the revised scale with only seven items were 0.93 (pre-visit) and 0.93 (post-visit). The factor had an R^2 value of 0.40 pre-visit, and 0.34 post-visit.

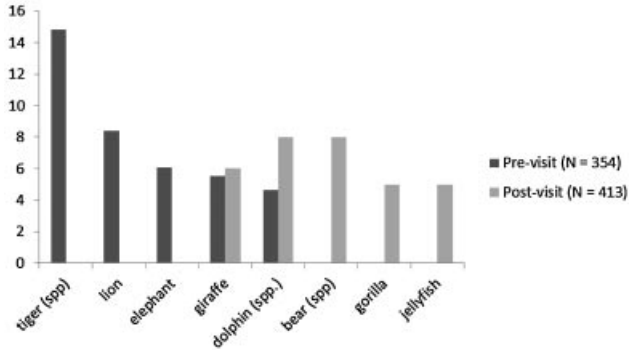

Fig. 2. Percent response of five most commonly reported taxa of species preferences.

Preliminary Measurement Model

In structural equation modeling, measurement models are used to assess how well individual items reflect a factor (scale). Ideally, items should only reflect and load on one factor. A factor loading is the correlation coefficient between the factor and the item. Factor loadings range from 0 to 1, and the higher the value, the stronger the relationship between item and factor. Measurement models may also be used to assess the validity of items in factor or scale development. A measurement model may be tested across multiple samples. The initial model generated for multi-sample comparisons is referred to as the baseline configural model.

A baseline configural model was analyzed for each sample to screen for low or cross loading items, and factor reliability and discriminant validity. No cross loadings were detected. Five items were removed for poor performance [Little et al., 1999]. Fit indices supported the model as an acceptable representation of the data (see Tables 1 and 2 for individual factor loadings and fit indices; pre-visit: CFI $= 0.93$; RMSEA $= 0.080$, post-visit: CFI $= 0.97$; RMSEA $= 0.055$) [Byrne, 2008].

Test for Reliability of Conservation Caring

To identify site level configural and measurement invariance, the baseline configural model for pre-visit and post-visit samples was tested on each zoo site. The model

TABLE 1. Initial factor loadings and item means

Factor and items[a,b]	Pre-visit ($N = 354$) Mean (SD)	λ	Post-visit ($N = 369$) Mean (SD)	λ
Existing connection to wildlife				
I actively seek opportunities to view wildlife			7.09 ± 1.83	0.74
I feel a deep connection to wildlife			6.54 ± 1.93	0.87
I am highly motivated by the need to interact with wildlife			6.13 ± 2.05	0.87
I enjoy viewing all types of wildlife[c]			7.98 ± 1.46	0.60
I spend a lot of time learning about wildlife			5.99 ± 2.02	0.76
I have a responsibility to do all I can to protect wildlife[c]			7.10 ± 1.82	0.71
Conservation caring				
I am deeply concerned about the care and well-being of this animal at this site[c]	7.09 ± 1.92	0.52	6.25 ± 2.16	0.59
This species has as much right to exist as any human being[c]	7.68 ± 1.89	0.68	7.52 ± 2.02	0.56
Ensuring this species' survival is my highest priority	6.05 ± 2.20	0.82	5.51 ± 2.30	0.84
My emotional sense of well-being will be severely diminished by the extinction of this species	6.20 ± 2.26	0.85	5.88 ± 2.38	0.82
I need to learn everything I can about this species	5.93 ± 2.13	0.86	5.23 ± 2.16	0.86
I would protest this site if I learned of the mistreatment of this animal	6.65 ± 2.45	0.71	6.45 ± 2.52	0.68
I will alter my lifestyle to help protect this species	5.73 ± 2.31	0.83	5.18 ± 2.31	0.79
My connection to this animal has increased my connection to the species as a whole	5.89 ± 2.11	0.86	5.66 ± 2.08	0.84
Wildlife protection must be society's highest priority	6.00 ± 2.33	0.83	5.68 ± 2.42	0.81
Behavior—species oriented				
I would support entrance fees at this site being $10–25 higher, if the extra money were used for the care and survival of this species[c]			4.46 ± 2.48	0.68
I will donate up to $75 to "adopt" this animal at this site			3.95 ± 2.44	0.88
I will make a charitable contribution up to $150 to help purchase habitat in the wild for this species			3.57 ± 2.80	0.87
I will become a member of an organization committed to protecting this species, within the next 6 months			3.84 ± 2.40	0.86
I will volunteer at an event designed to help the conservation of this species, within the next 6 months			3.68 ± 2.36	0.82
Before my visit is over, I will sign up for a mailing/email to receive updates about the care and conservation of this animal			3.74 ± 2.48	0.80
I would write a letter/sign a petition to a government official supporting the protection of this species[c]			4.76 ± 2.72	0.67
Behavior—biodiversity oriented				
Even if I never return, I will provide on going financial support to this site			3.74 ± 2.35	0.73
If asked, I would donate as much as $50 to help protect a species I've never heard of			3.36 ± 2.23	0.73
I will endorse public policy that severely restricts future growth & development in order to protect wildlife			5.03 ± 2.64	0.87
Elected officials' views on wildlife will be a major factor in my voting			4.81 ± 2.51	0.86
Even when they are more expensive or harder to find, I will buy groceries & products that support wildlife conservation			5.18 ± 2.49	0.84

λ, standardized factor loading.
[a]Rated as agreement on 9-point Likert scale (1 = strongly disagree, 9 = completely agree).
[b]Robust statistics.
[c]Item not retained.

displayed acceptable fit indices for each site (Table 3). The data was then pooled to identify configural and measurement invariance between sites. Fit indices and Satorra–Bentler scaled chi-square differences revealed sample sites were invariant for pre-visit and post-visit samples ($\Delta SB\chi^2$, $P > 0.05$; Table 3). As factor loadings and parameter estimates were deemed equivalent across sites, Conservation Caring was considered to display reliability. Based on these findings, data could be pooled across sites and treated as a single sample [Byrne, 2008].

Test for Validity of Conservation Caring

The baseline configural model was tested across pre-visit and post-visit samples to check for group invariance of the measurement model (see Table 4). The configural model

TABLE 2. Factor loadings and fit indices for final measurement model of Conservation Caring

Factor and items	Pre-visit λ	Post-visit λ
Conservation caring		
Ensuring this species' survival is my highest priority	0.81	0.82
My emotional sense of well-being will be severely diminished by the extinction of this species	0.84	0.81
I need to learn everything I can about this species	0.86	0.87
I would protest this site if I learned of the mistreatment of this animal	0.69	0.68
I will alter my lifestyle to help protect this species	0.83	0.81
My connection to this animal has increased my connection to the species as a whole	0.86	0.86
Wildlife protection must be society's highest priority	0.81	0.80
Fit indices[a]		
SBχ^2 (*df*)	998.93 (*377*)*	
CFI	0.95	
NNFI	0.94	
SRMR	032	
RMSEA	0.068	

λ, standardized factor loading; SBχ^2, Satorra–Bentler scaled chi-square; *df*, degrees of freedom; CFI, comparative fit index; NNFI, non-normed fit index; SRMR, standardized root mean squared residual; RMSEA, root mean square error of approximation.
[a]Robust statistics.
*$P < 0.05$.

TABLE 3. Fit indices and testing outcomes for metric invariance of measurement model across zoo sampling sites and pooled data

Model	CFI[a]	NNFI[a]	SRMR	RMSEA[a]	SBχ^2 (*df*)[a]	ΔSBχ^2 (Δ*df*)[b]
Preliminary CFA measurement model						
Pre-visit						
Brookfield Zoo	0.94	0.93	0.071	0.078	261.40 (*182*)	
Shedd Aquarium	0.91	0.90	0.067	0.089	391.65 (*182*)	
Zoo Atlanta	0.90	0.88	0.064	0.11	371.70 (*182*)	
Post-visit						
Brookfield Zoo	0.95	0.94	0.073	0.061	264.96 (*179*)	
Shedd Aquarium	0.97	0.97	0.054	0.055	267.94 (*179*)	
Zoo Atlanta	0.94	0.93	0.075	0.074	249.27 (*179*)	
Pre-visit pooled sites						
Configural model	0.92	0.90	0.069	0.091	1072.69 (*546*)	
Measurement invariance	0.91	0.91	0.080	0.090	1124.54 (*580*)	48.92 (*34*)
Structural invariance	0.91	0.91	0.12	0.089	1146.66 (*592*)	70.88 (*46*)
Post-visit pooled sites						
Configural model	0.96	0.95	0.068	0.061	783.17 (*537*)	
Measurement invariance	0.96	0.96	0.078	0.058	819.48 (*579*)	31.85 (*42*)
Structural invariance	0.96	0.96	0.10	0.058	832.92 (*591*)	43.43 (*54*)

CFI, comparative fit index; NNFI, non-normed fit index; SRMR, standardized root mean squared residual; RMSEA, root mean square error of approximation; SBχ^2, Satorra–Bentler scaled chi-square; *df*, degrees of freedom.
[a]Robust statistics.
[b]Difference calculated using the Satorra–Bentler scaled chi-square adjusted difference test [Satorra and Bentler, 2001].

TABLE 4. Fit indices, and invariance testing outcomes across zoo pre-visit/post-visit tourist samples

Model	CFI[a]	NNFI[a]	SRMR	RMSEA[a]	SBχ^2 (*df*)[a]	ΔSBχ^2 (Δ*df*)[b]
Measurement model						
Configural model	0.95	0.94	0.056	0.069	975.13 (*361*)	
Measurement invariance	0.95	0.94	0.060	0.068	1010.94 (*379*)	31.33 (*18*)
Structural model						
Configural model	0.95	0.94	0.056	0.069	975.30 (*361*)	
Measurement invariance	0.95	0.94	0.060	0.068	1010.97 (*379*)	31.21 (*18*)
Structural invariance w/2 constraints released	0.95	0.94	0.060	0.068	1016.35 (*383*)	35.36 (*22*)

CFI, comparative fit index; NNFI, non-normed fit index; SRMR, standardized root mean squared residual; RMSEA, root mean square error of approximation; SBχ^2, Satorra–Bentler scaled chi-square; *df*, degrees of freedom.
[a]Robust statistics.
[b]Difference calculated using the Satorra–Bentler scaled chi-square adjusted difference test [Satorra ans Bentler, 2001].

fit the data well (CFI = 0.95; RMSEA = 0.069) and was deemed an acceptable representation of the factorial structure [Kline, 2005; Byrne, 2008]. Hierarchical testing revealed no overall harm in fit to the model. The baseline configural model was accepted as invariant across pre-visit and post-visit samples. Results of hierarchical testing of the baseline structural model fit the data well (CFI = 0.95; RMSEA = 0.069) and maintained measurement invariance across samples (see Table 4). These data support the validity of Conservation Caring as a scale.

Factors that Influence Conservation Caring and Willingness to Engage in Pro-Conservation Behaviors

In structural equation modeling, structural regression models are used to assess causal relationships between factors. These differ from measurement models, which assess relationships between items and factors. In structural regression models, beta weights reflect the effect size of the predictor factor on the dependent factor. As with measurement models, a baseline structural model can be tested across multiple samples.

Fit indices for the model ($SB\chi^2 = 1016.35$ (*383*), $P < 0.05$; CFI = 0.95; NNFI = 0.94; SRMR = 0.060; RMSEA = 0.068) indicated the model was an acceptable representation of the relationships present in the data [Marsh et al., 2004; Kline, 2005; Byrne, 2008]. The model in Figure 3 (also see Table 5) represents how the factors predicted a willingness to engage in pro-conservation behaviors.

Existing Connection to Wildlife was a strong predictor of Conservation Caring ($\beta = 0.60$, $P < 0.05$) and a weak predictor of biodiversity oriented behaviors ($\beta = 0.070$, $P < 0.05$). It was not a significant predictor of Species Oriented Behavior. Conservation Caring was a strong predictor for Species Oriented Behavior ($\beta = 0.62$, $P < 0.05$) but a weak predictor for Biodiversity Oriented Behavior ($\beta = 0.070$, NS). Species Oriented Behavior was a very strong predictor of Biodiversity Oriented Behavior ($\beta = 0.86$, $P < 0.05$).

The model accounted for 34% (R^2) of the variance in Conservation Caring; 42% (R^2) of the variance in Species Oriented Behavior; and 89% (R^2) of the variance in Biodiversity Oriented Behavior. All R^2 values were relatively high, and provided support for the predictive validity of the model [Noar, 2003; Kline, 2005].

DISCUSSION

This study had two primary objectives. The first was to develop Conservation Caring as a scale to measure zoo visitors' connection to an animal. The second was to investigate the relationship between Conservation Caring

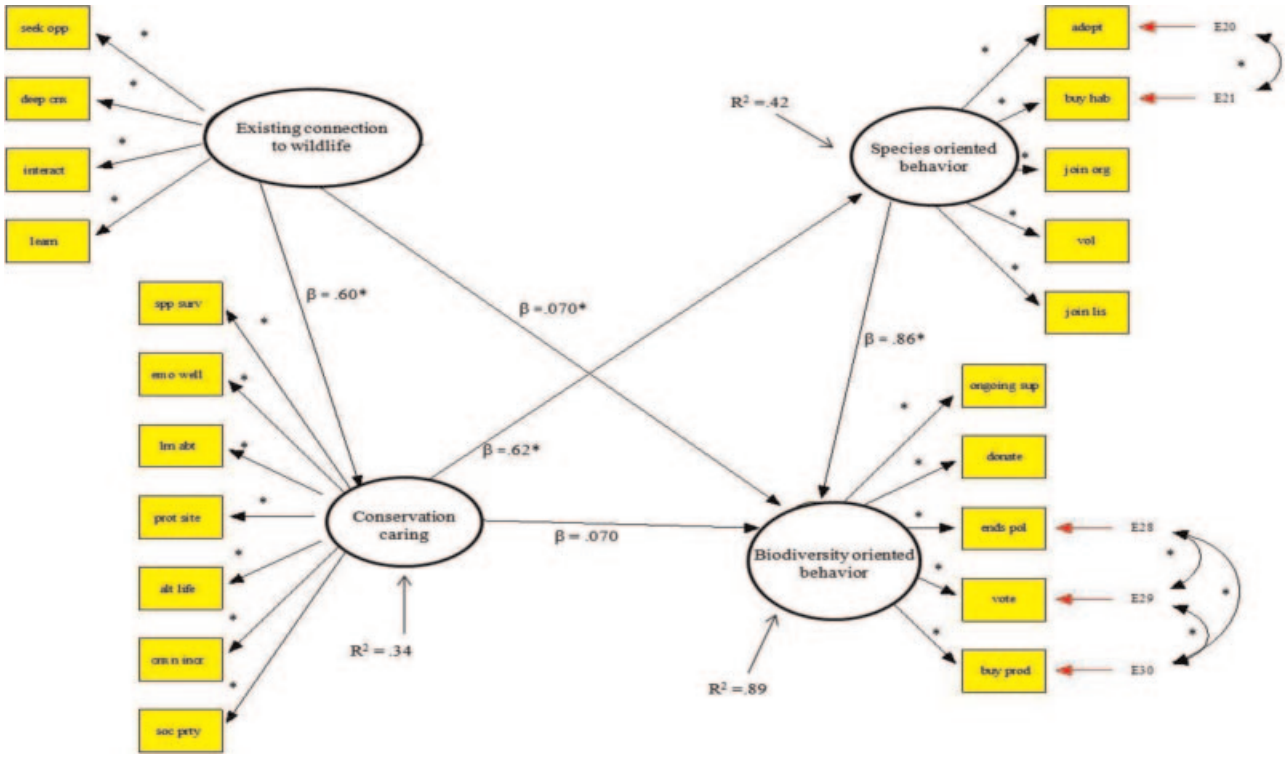

Fig. 3. Final structural model predicting pro-conservation behavioral intent.
Notes. All measurements robust; *$P < 0.05$; β = standardized parameter estimates; R^2 = explained variance. CFI = 0.95; NNFI = 0.94; SRMR = 0.060; RMSEA = 0.068; $SB\chi^2$ (*df*) = 1016.35 (*383*), $P < 0.05$.

TABLE 5. Item means, factor loadings and fit indices of final structural model predicting zoo visitors' pro-conservation behavioral intent

Factor and items[a]	Post visit ($N = 368$)	
	Mean (SD)	λ
Existing connection to wildlife		
I actively seek opportunities to view wildlife	7.10 (1.83)	0.74
I feel a deep connection to wildlife	6.54 (1.93)	0.88
I am highly motivated by the need to interact with wildlife	6.14 (2.06)	0.88
I spend a lot of time learning about wildlife	5.99 (2.02)	0.76
Conservation caring		
Ensuring this species' survival is my highest priority	5.51 (2.30)	0.82
My emotional sense of well-being will be severely diminished by the extinction of this species	5.89 (2.37)	0.82
I need to learn everything I can about this species	5.24 (2.15)	0.87
I would protest this site if I learned of the mistreatment of this animal	6.44 (2.52)	0.69
I will alter my lifestyle to help protect this species	5.19 (2.30)	0.82
My connection to this animal has increased my connection to the species as a whole	5.65 (2.08)	0.87
Wildlife protection must be society's highest priority	5.68 (2.42)	0.81
Behavior—species oriented		
I will donate up to $75 to "adopt" this animal at this site	3.94 (2.43)	0.82
I will make a charitable contribution up to $150 to help purchase habitat in the wild for this species	3.58 (2.40)	0.82
I will become a member of an organization committed to protecting this species, within the next 6 months	3.83 (2.41)	0.88
I will volunteer at an event designed to help the conservation of this species, within the next 6 months	3.68 (2.36)	0.84
Before my visit is over, I will sign up for a mailing/email to receive updates about the care and conservation of this animal	3.72 (2.47)	0.83
Behavior—biodiversity oriented		
Even if I never return, I will provide on-going financial support to this site	3.73 (2.34)	0.88
If asked, I would donate as much as $50 to help protect a species I've never heard of	3.35 (2.31)	0.87
I will endorse public policy that severely restricts future growth & development in order to protect wildlife	5.02 (2.64)	0.70
Elected officials' views on wildlife will be a major factor in my voting	4.81 (2.51)	0.69
Even when they are more expensive or harder to find, I will buy groceries & products that support wildlife conservation	5.18 (2.49)	0.70
Fit indices[b]		
SBχ^2 (*df*)	1016.35 (*383*)	
CFI	0.95	
NNFI	0.94	
SRMR	0.60	
RMSEA	0.068	

λ, standardized factor loading; SBχ^2, Satorra–Bentler scaled chi-square; *df*, degrees of freedom; CFI, comparative fit index; NNFI, non-normed fit index; SRMR, standardized root mean squared residual; RMSEA, root mean square error of approximation.
[a]Rated as agreement on 9-point Likert scale (1 = strongly disagree, 9 = completely agree).
[b]Robust statistics.

and visitors' willingness to engage in pro-conservation behaviors following a zoo experience. Secondarily, this study explored the species that visitors most connected with and how Conservation Caring can help zoos identify potential flagship species.

Conservation Caring's Ability to Measure Visitors' Connection to an Animal

As a scale, Conservation Caring performed very well. The high factor loadings (Tables 2 and 5) and R^2 value of 0.40 support the scale's ability to capture a great deal of the variance of this latent construct. One interesting observation is that cognitive and affective items were not separate dimensions. This is interesting in light of Rabb and Saunders' [2005] proposal of three dimensions. Future research may seek to refine items to better understand if these dimensional aspects exist.

Additional support for the acceptability of Conservation Caring as a scale comes from the invariance tests (Tables 3 and 4). Metric invariance tests assess the equality of factor loadings (λ values) across samples. Factor loadings

for all seven items of Conservation Caring were invariant (i.e., statistically equivalent) across zoo sites as well as between pre- and post-visit samples. Invariance across zoo sites supports visitors interpreting Conservation Caring items in a consistent manner.

Additionally, there was no item variance when the scale measured caring for a favorite species (pre-visit), or a connection developed during a zoo visit (post-visit). This invariance between pre- and post-visit samples supports the validity of items in different contexts. These invariance tests support factor reliability and validity [DeVellis, 2003]. On the basis of statistical performance and applicability in different contexts, these items may serve as a preliminary framework for additional development of the Conservation Caring scale.

Relationship of Conservation Caring and Pro-Conservation Behavioral Intent Following a Zoo Experience

To address our second research question, we investigated what influenced Conservation Caring and pro-conservation behaviors. As a baseline, the factor Existing Connection to Wildlife (Table 5 and Fig. 3) was used to gauge zoo visitors' connection to wildlife in general. The factor is strongly predictive of Conservation Caring, but plays little direct role in predicting pro-conservation behavioral intent. This is promising as it provides evidence contrary to the notion that zoos are "to the choir." Zoos are called upon to widen, and stimulate action from their audience base. However, there is concern that the zoo audience, no matter how wide, is still a self-selected audience that is highly attuned to pro-conservation calls to action, that is, "the choir." While this may be true, data from this study indicate pre-existing levels of a connection to wildlife were not a direct predictor of Species Oriented behaviors, nor a meaningful predictor of Biodiversity Oriented behaviors. So, while zoos' audiences may be predisposed to conservation messages, this predisposition is not leading to action.

More important was the large influence of Conservation Caring on Species Oriented Behavior, but not on Biodiversity Oriented Behaviors. The large influence on Species Oriented Behavior is encouraging as it indicates visitors' connection to a species is predictive of their intent to perform actions to conserve that species. Interestingly, following a zoo experience, Conservation Caring was not directly predictive of Biodiversity Oriented Behavior. This may indicate the connection to a specific species overshadows general concern. However, finding Conservation Caring as a predictor of species-specific behaviors provides more clarity to its theoretical role envisioned by Rabb and Saunders [2005].

Visitors' Species Preferences

A secondary goal of this study was to understand how Conservation Caring could be used to identify species visitors connect with and thus may serve as flagships. Following a zoo experience, visitors connected to a wider array of species than that identified by pre-visit visitors (Fig. 2). When asked what their favorite species was (pre-visit), or what species they felt the strongest connection with (post-visit), visitors could select any animal. A benefit to this approach is that results were not linked to any one species.

Results imply that during a zoo visit, visitors do not necessarily form an emotional connection with their favorite wild animal. However, as this study was conducted using independent samples, individual changes were not tracked. While this study did not investigate if the experiential connection replaced a visitor's favorite animal, it does show the strength of short-term direct exposure to zoo animals. This may be explained, in part, by the nature of an implicit connection to nature [Schultz and Tabanico, 2007].

One of the more interesting examples of a connection formed with a zoo animal was the 5% of post-visit respondents who listed "jellyfish" as the animal with which they formed the strongest connection (Fig. 2). This is most likely due to visitors' experience in the Shedd Aquarium's special "Jellies" exhibit. "Jellies" incorporated the most advanced practices in exhibit design and interpretation. It was also highly publicized and had a gated entrance within the aquarium. The combination of unique viewing opportunities, strategic messaging, and publicity presents an intriguing proposition for zoos seeking to promote lesser-known species. Additionally, post-visitors' greater diversity of responses suggests the ability to connect with a much wider array of species than previously thought [Kerley et al., 2003; Beh and Bruyere, 2007; Okello et al., 2008]. Thus zoos could potentially broaden the marketing of additional species to develop other flagships. Future research may investigate this possibility in greater detail.

Recommendations for Flagship-Based Conservation Campaigns

Getting visitors to adopt pro-conservation behaviors following a zoo visit generally meets with little success [Smith et al., 2011]. Differences between species responses for pre- and post-visit samples provide zoos two specific strategies to address flagship-based conservation campaigns. The first strategy is to cultivate the link between "favorite" animals and behaviors that benefit that species and biodiversity in general. Such a campaign would draw on the strength of the connection to stimulate both specific and generalized behaviors. This approach could target behaviors that are primarily performed outside the zoo. Creating messaging and programming which seeks to influence an existing connection to wildlife and a favorite animal may provide a framework to build joint participation in species specific and general biodiversity behaviors.

The second strategy zoos can adopt to stimulate greater participation in pro-conservation behaviors is to link strategic messaging and exhibit design with any animal of conservation importance (to stimulate

"conservation caring") with on-site, species specific behaviors. This is supported by the results which suggest extremely strong influence of Conservation Caring on Species Oriented Behaviors. Additionally, providing explicit opportunities for visitors to engage in on-site behaviors generally meets with higher levels of success than that for off-site behaviors [e.g., Powell and Ham, 2008]. Thus, opportunities for on-site participation in pro-conservation behaviors, which focus on animals of interest rather than biodiversity, may meet with greater success [Gwynne, 2007]. Zoos that develop an integrated campaign linking on-site and off-site, and species specific and biodiversity oriented behaviors may create greater synergies by being more aligned with visitors' expressed levels of behavioral intent.

Several limitations temper the generalizability of these findings. First, visitors were asked which species they connected with during their visit. As such, responses were restricted to observed species. Viewing different species may alter results. Second, the items that constitute Conservation Caring may be further refined to potentially improve the model. Third, behavioral intentions and not actual behaviors were assesses. Therefore, results represent visitors' *willingness to engage* in behaviors and not actual behavior performances.

CONCLUSION

Zoo visitors' connection to an animal can be measured and is a strong predictor of pro-conservation behavioral intent for that species. Although this study did not investigate the longevity of intentions, they are widely recognized as being ephemeral. One method to overcome this obstacle is to provide opportunities on-site that are clearly linked to specific animals. In this way, zoos may be able to capitalize on the experiential condition and provide immediate opportunities for behavior adoption.

The successful operationalization of Conservation Caring also provides zoos a starting point to understand visitors' emotional connections to their collections. In putting these findings into practice, zoos may be able to stimulate greater levels of Conservation Caring through more targeted interpretation and exhibit design. While this study did not attempt to isolate the role of interpretation and exhibits in facilitating a connection, it is important to note they are widely acknowledged to do so [Gwynne, 2007; Bruni et al., 2008; Smith and Sutton, 2008].

Additionally, the diversity of species visitors connected with would suggest that zoos have greater flexibility in selecting flagships for conservation campaigns than previously thought. It also provides tantalizing evidence for zoo visitors' growing appreciation for biodiversity and extends the work of Clayton et al. [2009]. On the basis of these findings, zoos may be better positioned to support a wider role for their collections and promote biophilically challenged species [Myers et al., 2004] as potential flagship candidates.

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