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# Impact of Animal Programming on Human Attitudes of Local Wildlife

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# IMPACT OF ANIMAL PROGRAMMING ON HUMAN ATTITUDES OF LOCAL WILDLIFE

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To Ashton Jerger,

April 24th 2020

Cc: Dr. Michele Acker
Dr. Deborah Solomon
Dr. Karen Steigman

I am pleased to report that you have passed your Honors thesis defense! Your honors committee was very impressed with your presentation, it was clear and professional. You demonstrated a solid grasp of the concepts and could apply questions and ideas from a wide range of areas to your study. Your rewrites of the discussion and introduction based on feedback from the committee satisfy the written requirements of the thesis. Excellent job, we are very proud of your accomplishments!

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**Abstract:**

Attitudes towards wildlife can have direct implications on peoples' interest in conserving local habitats and their overall ecological choices. Attitudes are formed by multiple components of an individual's life history. However, through interactive, educational experiences, there is a potential to change current attitudes. Animal programs are an example of interactive, educational experiences that provide individuals the opportunity to get up-close to animal ambassadors and participate in engaging conversations about them. An animal program assessment was conducted with the 2019 summer camps at the Ohio Wildlife Center to quantify the changes in peoples' affiliation for local wildlife and their willingness to live near local wildlife. Of the 244 campers present, 144 campers, aged six to fifteen, took a survey before witnessing the animal programs and then again following their participation in the animal programs. Matched paired t-tests showed an overall increase of affiliation scores from "pre" to "post," although with small effect size ($\overline{X}$ pre = 4.18, $\overline{X}$ post = 4.34, $d$=.154). There was a significant increase from the "pre" to "post" affiliation scores for six of the ten ambassador animals. Overall mean willingness scores were not as high as affiliation scores, and a larger increase occurred in the post survey, although the effect size was still small ($\overline{X}$ pre = 3.56, $\overline{X}$ post = 3.85, $d$= .243). A strong correlation was found between affiliation and willingness scores, meaning the higher the score of affiliation for an animal, the more willing an individual is to live near the animal (pre: $r(1)= 0.89$, $p = 0.0006$; post: $r(1)=0.97$, $p < 0.0001$). Overall, the study found that these animal programs positively influenced their audiences' attitudes towards local wildlife, although with a small effect size.

**Introduction:**

Human attitudes of local wildlife can have direct influences on peoples' interest in conserving habitats and their behavioral intentions (Fernández-Llamazares, Western, Kathleen,

McElwee, & Cabeza, 2020; Arnulphi, Lambertucci, & Borghi, 2017). Attitudes towards wildlife are defined as the mental reaction of individuals when presented with wildlife and the social context of how the perception is formed (Fernández-Llamazares et al., 2020; Costa, Casanova, Sousa, & Lee, 2013; Heberlein, 2012). The dimensions of attitudes towards local wildlife are influenced by personal factors such as experience, social norms, values, and beliefs (Van Deth & Scarbrough, 1998; Fernández-Llamazares et al., 2020; Smith & Sutton, 2008). Although attitudes do not solely impact behavior change, attitudes have the role of impacting behavioral intentions; these behavioral intentions can then directly shape actions or pro-environmental behavior (Kollmuss & Agyeman, 2002). Kollmuss and Agyeman (2002) suggest the role of individual attitudes in the formation of the "environmental consciousness," with conjunction of knowledge, values, and emotional involvement. "Pro-environmental consciousness" influences the internal factors of an individual that can then directly influence environmental behavior changes (Kollmuss, 2002). With positive internal incentives, there is a direct path from internal factors, like attitudes, to pro-environmental behavior changes.

Pro-environmental behavior changes are especially relevant to the promotion of biodiversity in today's era, with extinction rates estimated to be escalating a thousand times higher than the long-term average (Roe & McConney, 2015). Biodiversity conservation is an issue with a growing need for attention as human development continues and populations grow (Mukhacheva, Derugina, Maksimova, & Soutyrina, 2015; Patrick, Matthews, Ayers, & Tunnicliffe, 2007). This growth and development cause the encroachment of humans into wildlife's areas, and wildlife into human's areas. This overlap can cause undesired interactions between humans and wildlife due to the competition of resources and difficulty sharing spaces (Mukhacheva et al., 2015; Rupprecht, 2017). This problem, defined as human-wildlife conflict,

can lead to the intentional removal of wildlife from an area and or bringing harm to it. These conflicts arise from direct issues with wildlife and people, but also from preconceived notions about wildlife (Arnulphi et al., 2017). To ensure support of biodiversity and pro-environmental behaviors, public attitudes towards local wildlife need to be better understood as well as the factors that influence them (Hosaka, Sugimoto, & Numata, 2017). Two of these factors are an individual's affiliation for local wildlife and their willingness to live in close proximity to them. Even though individuals may have high affiliation scores for certain species, this does not always correlate to a willingness to live in close proximity to these animals. An example of this contradiction was found in a study by Eriksson (2015), where the majority of the study population stated high affiliation for bears and wolves, but their support for conservation programs and coexistence declined after encountering these animals around their homes. Due to this proposed gap between affiliation and willingness, a better understanding of the relationship between the two and what may influence these factors is needed to gain wider public support for local biodiversity conservation.

As found in a study by Hosaka (2017), effective public education is essential to bridge the gap between perceived problems of local wildlife and actual problems, which is based on attitude changes. A method of fostering attitude changes is through educational programming or engagement (Crudge, O'Connor, Hunt, Davis, & Browne-Nuñez, 2016; Barthel, Belton, Raymond, & Giusti, 2018; White, Eberstein, Scott, 2018). This programming can be implemented through various platforms, but studies find that interactive experiences have a greater impact on attitude and knowledge changes (Kalof, Zammit-Lucia, Bell, & Granter, 2014; Barthel et al 2018; Whitehouse, Waller, Chanvin, & Wallace, 2014; Kruse & Card, 2018; Pearson, Dorrian, & Litchfield, 2012). Another study describes how an interpretation program at

the Serra Malagueta Natural Park in Cape Verde found a gain in knowledge by all attendees, despite the short amount of time spent at the park (Burnett, Sills, & Peterson, 2016). Another example of a unique educational program is described in a study by Whitehouse (2014), where interactive games were used to promote guests' involvement in science in a zoo environment and increased science knowledge and understanding. Apart from greater scores of knowledge, interactive educational programs, like visual depictions of animals, also have the potential to alter people's perceptions on wildlife (Kalof et al., 2014). A study by Kalof (2014), reported that viewing animal portraits improved responses about kinship and positive perceptions of animals, therefore, altering attitudes and responses concerning animals. A form of an interactive educational experience utilized by zoos and nature centers is known as animal programming. Animal programming is a form of outreach that features live animal ambassadors, enabling individuals to perceive these animals in different settings. These animal ambassadors assist in bringing people closer to different local and foreign wildlife by seeing them up close or potentially touching the animals. The use of animal ambassadors has been demonstrated to increase knowledge, change attitudes, and spread messaging of conservation and environmental responsibility (Baird et al., 2016).

Childhood experiences in nature is another important component of establishing attitude changes, which is described by Hosaka (2017) as fostering positive attitudes that last into adulthood. This animal programming acts a form of nature experience that children can participate in. The role of these experiences is emphasized by Kellert and Wilson (1993) in their "biophilia hypothesis," which describes an innate interest of nature that is triggered in childhood-development (Muslim, Hosaka, Shinya, & Yahya, 2018; Born, 2018). The establishment of this interest in nature has a great importance for younger audiences, due to their future roles of

preserving natural resources for future generations (Kruse 2004). Unique experiences like hands-on animal husbandry and interactive media have been shown to have a great impact on knowledge and behavior of younger audiences (Kruse 2004). Through these unique experiences, younger audiences are exposed to wildlife in a more personable method. As depicted by Hosaka (2017), effective public education is needed to bridge the gap between perceived problems of local wildlife and actual problems. Through teaching about these preconceptions through animal programming, younger audiences can establish attitude changes of local wildlife that could persist into adulthood.

This study assessed the role of animal programming on changing children's attitudes towards local wildlife, within the realms of affiliation and willingness. The hypothesis of this study was ambassador animals in educational programming, or animal programs, improve children's affiliation for and willingness to live near local wildlife. Specifically, this study addressed the following questions, with the corresponding predictions:

1. Do animal programs increase the overall affiliation towards and willingness to live in close proximity to local species? It was predicted that if an individual observes ambassador animals within an educational program, their average Likert scores for affiliation and willingness will increase after witnessing the programs.
2. How are affiliation and willingness to coexist with native species influenced by each other? It was predicted that the increase in averages of affiliation scores for local wildlife promotes the increase of the willingness scores for individuals to live in close proximity to local wildlife.
3. Is there a preference between ambassador animals that have been seen in a program, or do programs promote a general increase for all species listed? It was predicted that

ambassador animals seen during the educational programs will have greater average affiliation and willingness scores than those not seen.

4. Do these scores of affiliation and willingness last over time? It was predicted that the scores of affiliation and willingness remain consistent from post responses to responses from the delayed survey taken approximately three months following the animal programs.
5. How do animal programs affect people's knowledge of helping local wildlife? It was predicted that scores in knowledge, concerning ways in which individuals can help local wildlife, will increase in the amount of relevancy to the eleven determined categories following animal programs.

**Methodology:**

***Site:***

The study was conducted at the Ohio Wildlife Center, which is a non-profit wildlife rehabilitation and education center located in Powell, Ohio. The Ohio Wildlife Center hosts on-site and off-site events and camps. The camps are year-round; however, the nine camps featured in this study occurred during the summer of 2019, during the months of May through August (Table 1).

***Animal Programming:***

During the summer camps, the campers participated in educational programs where ambassador animals were presented. These programs, hereafter referred to as animal programs, are when animals accompany a speaker for some time to discuss details about the species, individual animal, and different ways people can help local wildlife and the environment. These programs are interactive and could include being up close to the animal, touching the animal, and

asking or being asked questions. The Ohio Wildlife Center housed, at the time of the study, sixty-five ambassador animals which may make appearances during these programs. The animal programs were presented throughout the week-long camps on different days and varying periods of time, all with different varieties of animal ambassadors presented. The animal ambassadors presented are dependent on factors such as the training of the counselors, the timing of the programs, and the groups being presented to. Ten animal ambassadors that had the potential to make an appearance as ambassador animals during the animal programs were: striped skunk (*Mephitis mephitis)*, snapping turtle (*Chelydra serpentine*), woodchuck (*Marmota monax*), big brown bat (*Eptesicus fuscus)*, woodland box turtle (*Terrapene carolina carolina)*, Eastern foxsnake (*Pantherophis gloydi*), red-tailed hawk (*Buteo jamaicensis*), great horned owl (*Bubo virginianus*), Virginia opossum (*Didelphis virginiana*), and Eastern screech owl (*Megascops asio*) (Table 1).

| | Striped Skunk | Snapping Turtle | Wood Chuck | Big Brown Bat | Woodland Box Turtle | Eastern Fox Snake | Red-Tailed Hawk | Great Horned Owl | Virginia Opossum | Eastern Screech Owl |
|---|---|---|---|---|---|---|---|---|---|---|
| Camp 1 (n=21) | | X | | X | X | X | X | X | X | |
| Camp 2 (n=19) | | X | | | X | X | X | X | X | X |
| Camp 3 (n=27) | X | X | | | X | | X | X | X | X |
| Camp 4 (n=16) | | X | | | X | X | X | X | X | X |
| Camp 5 (n=15) | X | X | | | X | | X | X | X | |
| Camp 6 (n=16) | | X | | X | X | X | X | X | X | |
| Camp 7 (n=3) | | X | | | X | X | X | X | X | X |
| Camp 8 (n=14) | X | X | | | X | | X | X | X | X |
| Camp 9 (n=13) | | X | | X | X | | X | X | X | X |

Table 1. The animals seen during animal programs in the nine different summer 2019 camps.

***Survey:***

The survey was created using "Google Forms," and was distributed using a Windows Flex 10'' tablet, which was set to automatically prompt the survey to the user. The survey consisted of four separate parts: personal information, affiliation, willingness, and free response. There were three separate surveys: a "pre" for before the program, a "post" for directly after, and a "delayed" for approximately three months after witnessing the program. The "pre" survey was distributed to individuals at the beginning of the week-long camp, before participating in any animal programs. The "post" survey was then given to the individuals again following the final animal program seen during their camp, normally the last day of camp. A camp counselor was present during the "pre" and "post" surveys to explain any of the questions and assist as necessary. The first section of the survey, personal information, included asking for the participant's name and age. The name was then used to match the responses of the participants for their "pre," "post," and "delayed" responses, but was removed after being matched to keep answers anonymous.

*Affiliation and Willingness:*

The second part, affiliation, consisted of ranking how much participants liked the different program animals' species based on a Likert scale (Figure 1). The third part of the survey, willingness, asked participants to decide where they feel the most comfortable with the shown animals living in relation to them (Figure 2). The Likert scale ranking for both affiliation and willingness was based upon the scale used in the studies by Hosaka (2017) and Muslim (2018). The ambassador animals shown for the affiliation and willingness portions of the survey were: striped skunk, snapping turtle, woodchuck, big brown bat, woodland box turtle, Eastern

foxsnake, red-tailed hawk, great horned owl, Virginia opossum, and Eastern screech owl (Table 1).

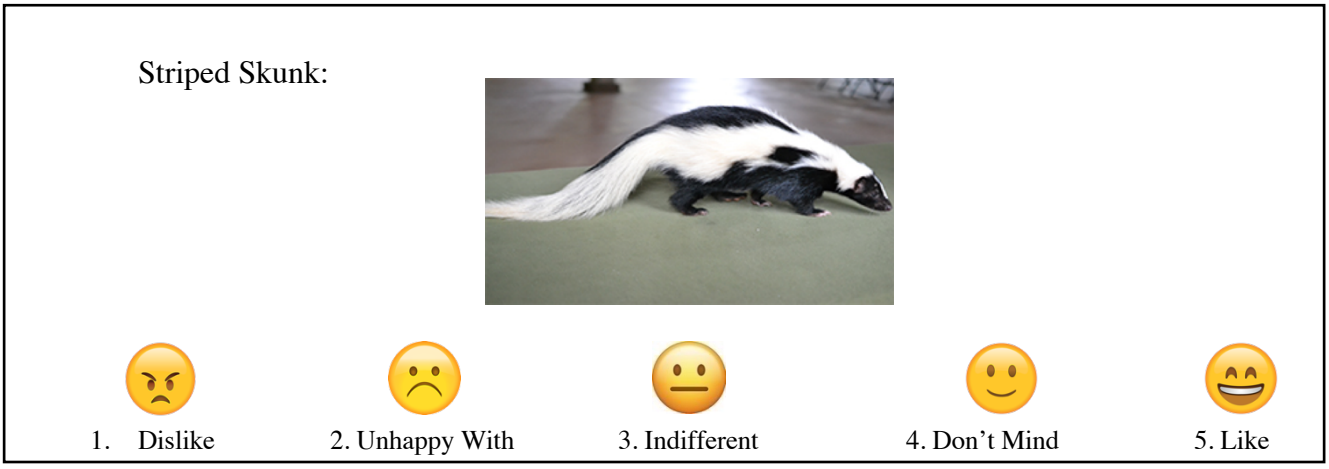


Figure 1. Example of the "affiliation" portion of the survey

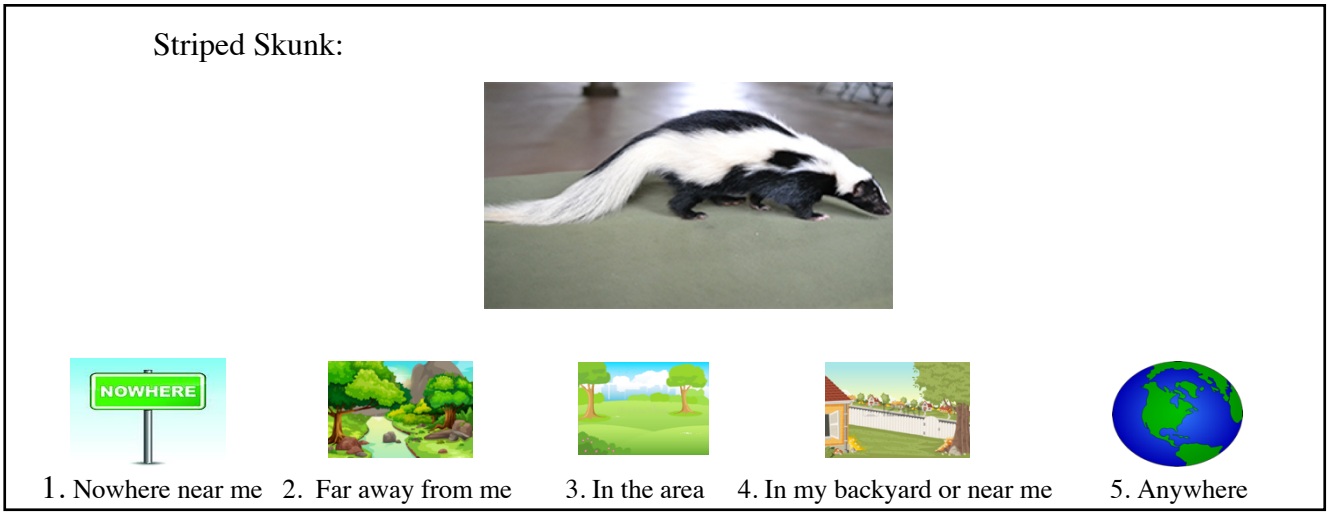


Figure 2. Example of the "willingness" portion of the survey.

*Self-Reported Knowledge Component:*

The fourth part of the survey included a free-response question where participants were asked, "What can you do to help local wildlife?" The answer to this question was scored according to eleven conservation behaviors selected from a national survey (Belden & Rusonello, 1996; Dierking et al., 2004):

- spending time in nature
- trying to cut down on the amount of trash
- looking for/purchasing products that are environmentally friendly
- trying to learn more about wildlife
- avoiding using chemicals in your yard/garden
- visiting zoos and nature centers
- helping create/improve habitats for fish and wildlife
- donating money to environmental organizations
- talking to others about the importance of wildlife
- using other types of transportation
- doing volunteer work for a group that helps the environment

Each mention of an activity related to these eleven categories would be scored as a "correct" response. There was also a category for responses that were "incorrect," which were responses that did not relate to the categories.

***Participants:***

Survey participants ranged from six to fifteen years of age, with majority aged six to eight years old. There was a total of 222 campers present at the summer 2019 camps (Table 1), with 144 completing the pre and post surveys. Of the 144 respondents, only eleven completed the delayed response. Participants who completed the delayed response were entered into a raffle for a $100 Amazon gift card.

***Ethics Statement:***

Consent from parents/guardians was asked for all participants before they took the survey. All participants were asked for verbal agreement by a camp counselor prior to

participating in the survey and prompted to confirm their agreement on the tablet. The survey took on average about three minutes to complete and was Institutional Review Board approved (HS #17/18-77) at the Otterbein University in Westerville, Ohio.

***Analysis:***

For the first prediction, the mean of the Likert responses was calculated for both the "pre" and "post" surveys. The statistical test used was a matched, paired, one tailed t-test and this was performed for both affiliation and willingness. A Hake gain was also calculated for both parts using the "Average of gains:" $g_{ave} = <(Post - Pre)/(100 - Pre)>$, to further analyze the measure of changes in responses (Coletta & Phillips, 2005). Analysis of Variance, ANOVA, was completed in accordance with the animals presented with the survey. A post hoc Tukey HSD was additionally performed when a significant difference was detected with an ANOVA.

For the second prediction, the mean of the Likert responses was calculated for both "pre" and "post" surveys, for both affiliation and willingness responses. The correlation between these mean scores was examined using Pearson correlation coefficients.

For the third prediction, the mean of the Likert responses was calculated for both the "pre" and "post" surveys. The statistical test was a paired t-test and an ANOVA was utilized to determine the variance of responses for animals seen and not seen for both affiliation and willingness. An additional post hoc Tukey HSD was completed when a significant difference was detected with an ANOVA.

For the fourth prediction, the mean of the Likert responses was calculated for the "pre," "post," and "delayed" surveys. The statistical test performed was a repeated measure ANOVA to analyze the timing, species, and the interaction between the two factors. An additional post hoc

Tukey HSD was completed when a significant difference was detected with an ANOVA. The program, SPSS, was utilized to run all statistical tests.

**Results:**

***(1) Assessing changes in affiliation and willingness scores***

Overall, mean affiliation and willingness scores both increased from "pre" to "post" surveys. Mean willingness scores were not as high as mean affiliation scores, and both started with initial higher scores. Analysis of the total mean of the data set revealed an initial score of $\overline{X}$ pre = 4.18 and a post score of $\overline{X}$ post = 4.34 for affiliation. The effect size of affiliation was determined to be small ($d$=.154). A larger increase in mean score occurred for willingness comparing the total mean score of $\overline{X}$ pre = 3.56 to $\overline{X}$ post = 3.85. Similar to affiliation, willingness had a small effect size ($d$= .243).

The changes in affiliation and willingness scores were analyzed by comparing the "pre" and "post" surveys, with a total of 144 responses for both. Figure 3 displays the average affiliation Likert scores for each of the 10 ambassador animals that were included in the survey. There was no decline in average response between "pre" and "post" for any of the animals, all average scores increased following the animal programs. A matched, paired one-tailed t-test was conducted and the following differences were determined as significant: Eastern foxsnake ($t(143)= 2.015$, $p= 0.023$), Eastern screech owl ($t(143)= 2.335$, $p= 0.0105$), great horned owl ($t(143)= 1.7$, $p= 0.046$), red-tailed hawk ($t(143)= 2.869$, $p= 0.0024$), striped skunk ($t(143)= 4.869$, $p= <.001$), and the Virginia opossum ($t(143)= 4.084$, $p= <.001$). The Virginia opossum had the greatest affiliation score after the program. The woodland box turtle had the greatest affiliation score from before the program. The striped skunk experienced the greatest increase in average affiliation score from "pre" to "post."

Figure 4 displays the average willingness Likert scores, and similar to affiliation scores, there was no decline in the average response from "pre" to "post" surveys, indicating that the scores increased following the programs. A matched, paired one-tailed t-test was also used to determine significance in the results. A significant difference was found for all except the woodchuck: big brown bat ($t(143)= 1.923$, $p= 0.0282$), Eastern foxsnake ($t(143)= 4.128$, $p= <.0001$), Eastern screech owl ($t(143)= 4.397$, $p= <.0001$), great horned owl ($t(143)= 2.787$, $p= 0.003$), red-tailed hawk ($t(143)= 4.47$, $p= <.0001$), snapping turtle ($t(143)= 3.014$, $p= 0.0015$), striped skunk ($t(143)= 2.338$, $p= 0.0104$), Virginia opossum ($t(143)= 3.639$, $p= 0.0002$), and woodland box turtle ($t(143)= 2.521$, $p= 0.0064$). The woodland box turtle had the highest average willingness score for both before and after the programs. The red-tailed hawk experienced the greatest increase in average willingness score from "pre" to "post."

A Hake gain, or normalized gain, was also calculated to analyze the effectiveness of the animal programs in increasing scores of affiliation and willingness in an audience with initial higher scores (Coletta & Phillips, 2005). Figure 5 depicts these Hake gain totals (g) for both affiliation and willingness on a scale of 0 to 0.7. Willingness had greater scores than affiliation for all ambassador animals except the striped skunk. The red-tailed hawk had the highest Hake gain score in both willingness and overall. The woodchuck had the lowest g value for both affiliation and overall. An ANOVA was performed to compare the g values between the ambassador animals for both affiliation and willingness. Affiliation was determined as significant ($F_{9,1430}= 1.916$, $p= 0.0460$) and an additional post hoc Tukey HSD determined that the score for the striped skunk was significantly different from the big brown bat's score. Willingness was not significant for Hake gain scores ($F_{9,1430}= 1.336$, $p= 0.2132$).

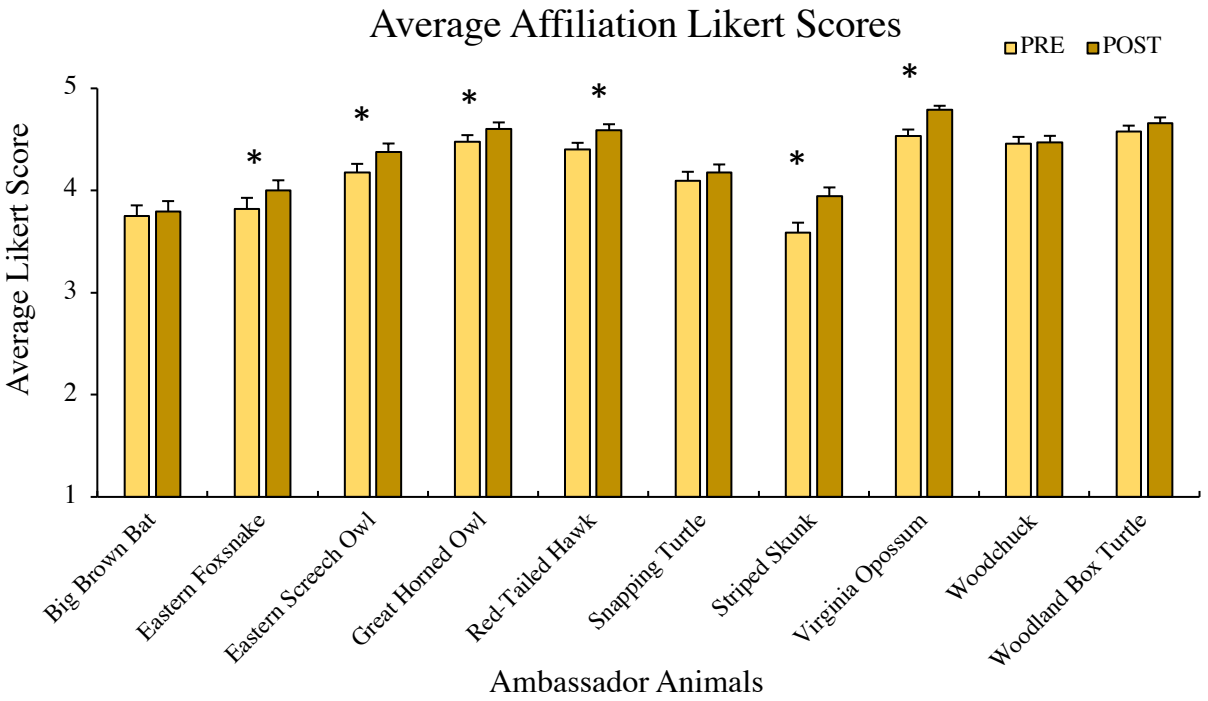


Figure 3. Average of Likert scores for the affiliation portion of the survey for both before and after the animal programs (n=144). Significant differences found for the Eastern foxsnake (p= 0.023), Eastern screech owl (p= 0.0105), great horned owl (p= 0.046), red-tailed hawk (p= 0.0024), striped skunk (p= <.001), and Virginia opossum (p= <.001).

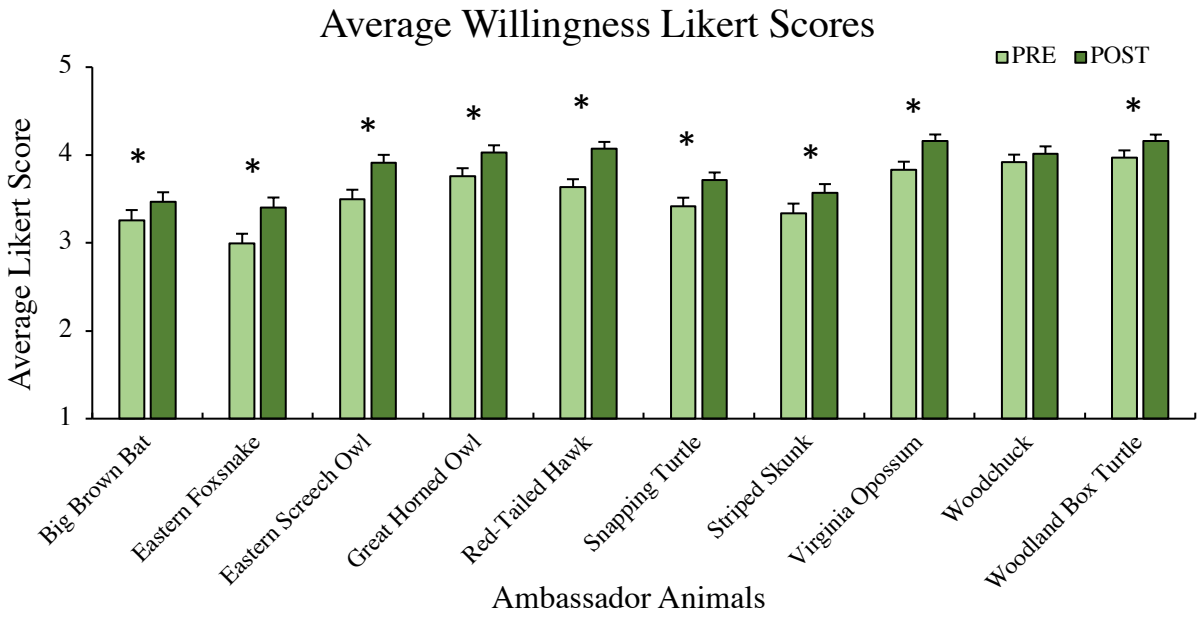


Figure 4. Average of Likert responses for the willingness portion of the survey for both before and after the animal programs (n=144). Significant differences found for the big brown bat (p= 0.0282), Eastern foxsnake (p= <.0001), Eastern screech owl (p= <.0001), great horned owl (p= 0.003), red-tailed hawk (p= <.0001), snapping turtle (p= 0.0015), striped skunk (p= 0.0104), Virginia opossum (p= 0.0002), and woodland box turtle (p= 0.0064).

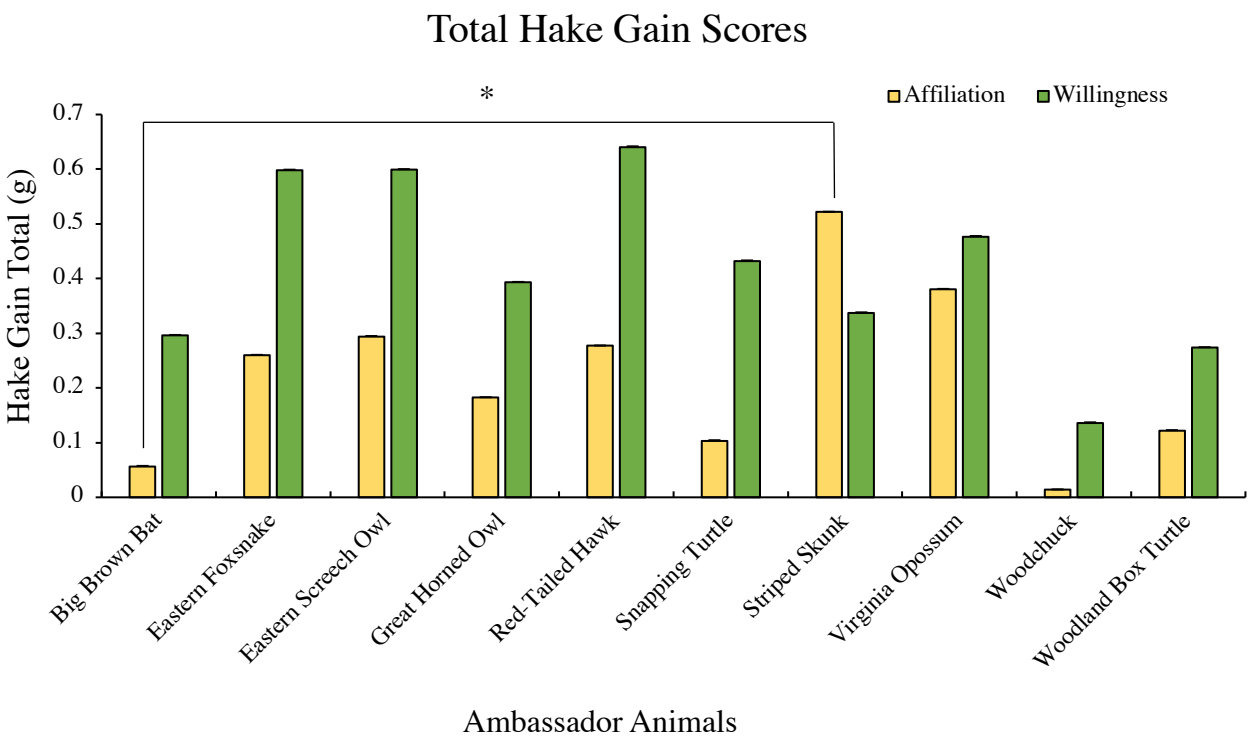


Figure 5. The total hake gain scores calculated for both affiliation and willingness portions of survey between the "pre" and "post responses." A significant difference was found between the big brown bat and striped skunk affiliation scores (p= 0.0460). Standard error bars present with small values.

***(2) Analysis of relation between affiliation and willingness***

To test the correlation between affiliation and willingness, a Pearson correlation coefficient was calculated. Correlation was tested between affiliation and willingness to determine the relationship of the two variables and the strength of their association. As depicted in Figure 6, there is a positive correlation between affiliation and willingness for both "pre" and "post." As shown in the figure, the higher the average score of affiliation for one of the animal ambassadors, the higher the average score for willingness. The averages of scores for affiliation and willingness for the "pre" survey were significant and had a strong correlation value: $r(1)= 0.89$, $p = 0.0006$. A linear regression was also calculated to determine how the variations in willingness are influenced by the variations of affiliation, which was determined to also be a strong value: $R^2= 0.793$. The averages of scores for the "post" survey were also determined to be significant

and had a strong correlation value: r(1)=0.9681, $p < 0.0001$. A linear regression was also performed for the "post," and a greater regression value was found: $R^2 = 0.938$. The larger $R^2$ in the "post" implies these variations in willingness were more heavily influenced by the variations in affiliation after the animal programs. The "post" values overall had a greater score than the averages of scores from the "pre" survey, which is consistent with the results depicted in Figures 3 and 4.

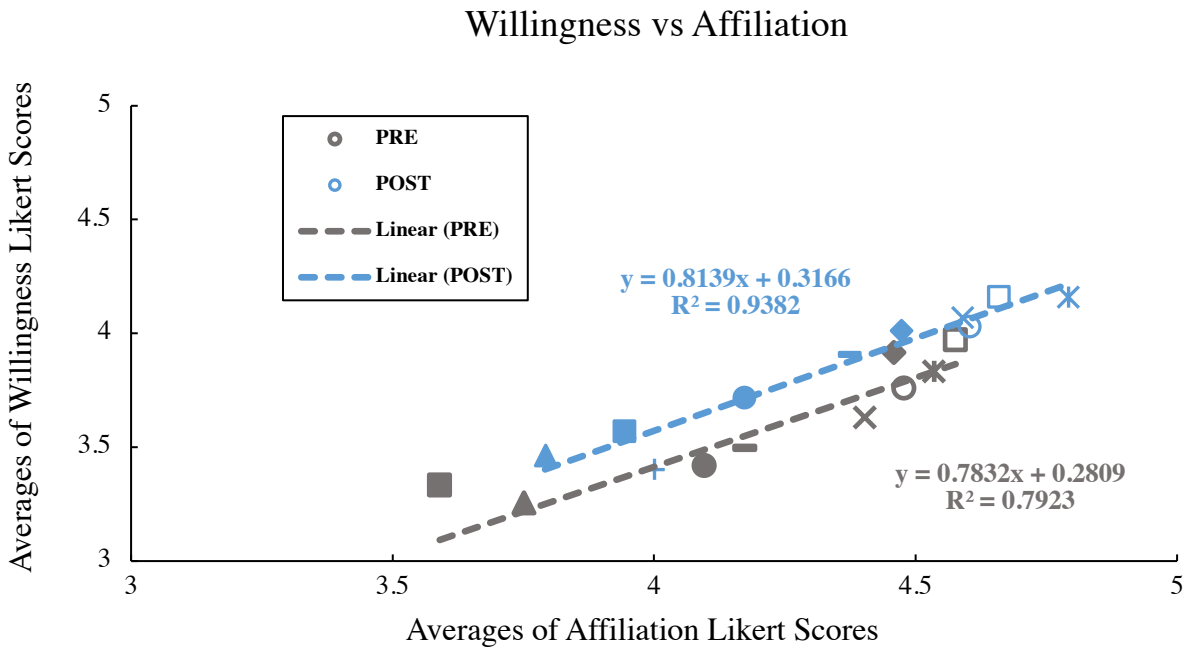


Figure 6. The average scores of Likert responses for both affiliation and willingness for all 10 ambassador animals: big brown bat (▲), Eastern foxsnake (+), Eastern screech owl (-), great horned owl (○), red-tailed hawk (X), snapping turtle (●), striped skunk (■), Virginia opossum (∗), woodchuck (◆), and woodland box turtle (□). The $R^2$ value for the "pre" data was 0.792 and the $R^2$ value for the "post" data was 0.938.

***(3) Evaluating scores of ambassador animals seen and not seen during animal programs***

To evaluate the differences in scores between the animals seen and not seen during the animal programs, an ANOVA was performed for two factors for both affiliation and willingness. The differences in scores between animals and the differences in scores between the results of the seen and not seen ambassador animals were analyzed.

The results for affiliation are depicted in Figure 7 as the mean differences from "pre" to "post" for all ten ambassador animals, including the factors of if they were seen or not seen. Only the big brown bat had a decrease in the mean score from "pre" to "post" surveys after being seen during an animal program. For all other animals, there was an insignificant increase in mean difference if the ambassador animal was seen and not seen ($F_1$= 0.4511, p= 0.5029). During the summer camps, all participants saw the great horned owl, red-tailed hawk, snapping turtle, Virginia opossum, and the woodland box turtle; whereas, no participants saw the woodchuck. It was also statistically analyzed to evaluate if there was a significant difference between all animals' scores. To determine this, an ANOVA was performed, and no significance was found ($F_9$= 1.8547, p= 0.0547).

The results for willingness, depicted in Figure 8, are also the mean differences from "post" to "pre." All ambassador animals had a greater mean difference when they were seen except for the Eastern screech owl. Consistent with Figure 8, all participants saw the great horned owl, red-tailed hawk, snapping turtle, Virginia opossum, and the woodland box turtle, and no participants saw the woodchuck. Similar to affiliation, an ANOVA was performed to determine if there was a significant difference between all animals' scores, and no significance was determined for willingness ($F_9$= 1.0376, p= 0.4073). Also, there was no significant difference between the willingness scores of ambassador animals seen and not seen, which was calculated using a two factor ANOVA ($F_1$= 1.1880, p=0.2758).

An additional t-test was performed to determine how scores in affiliation and willingness were influenced by the variables of the animals seen and not seen. For affiliation, no significant difference was found for the difference of scores based on if the ambassador animals were seen or not (t(1438)= 0.924, p=0.3556). For willingness, a significant difference was found for the

differences of scores based on if the ambassador animals were seen or not (t(1438)= 1.968, p= 0.0492).

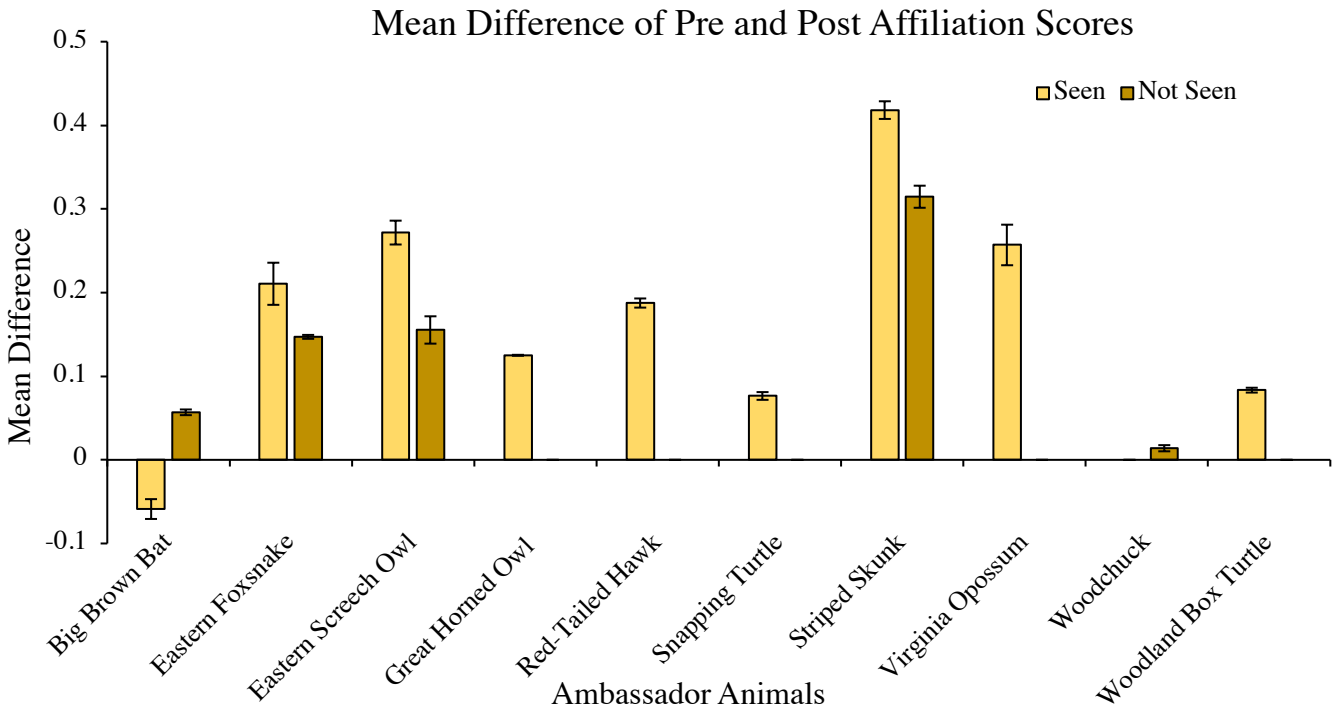


Figure 7. Mean difference of "pre" and "post" affiliation scores for both animals seen and not seen during the animal programs. An increase of mean score difference was determined for all animals seen during the programs, except for the big brown bat.

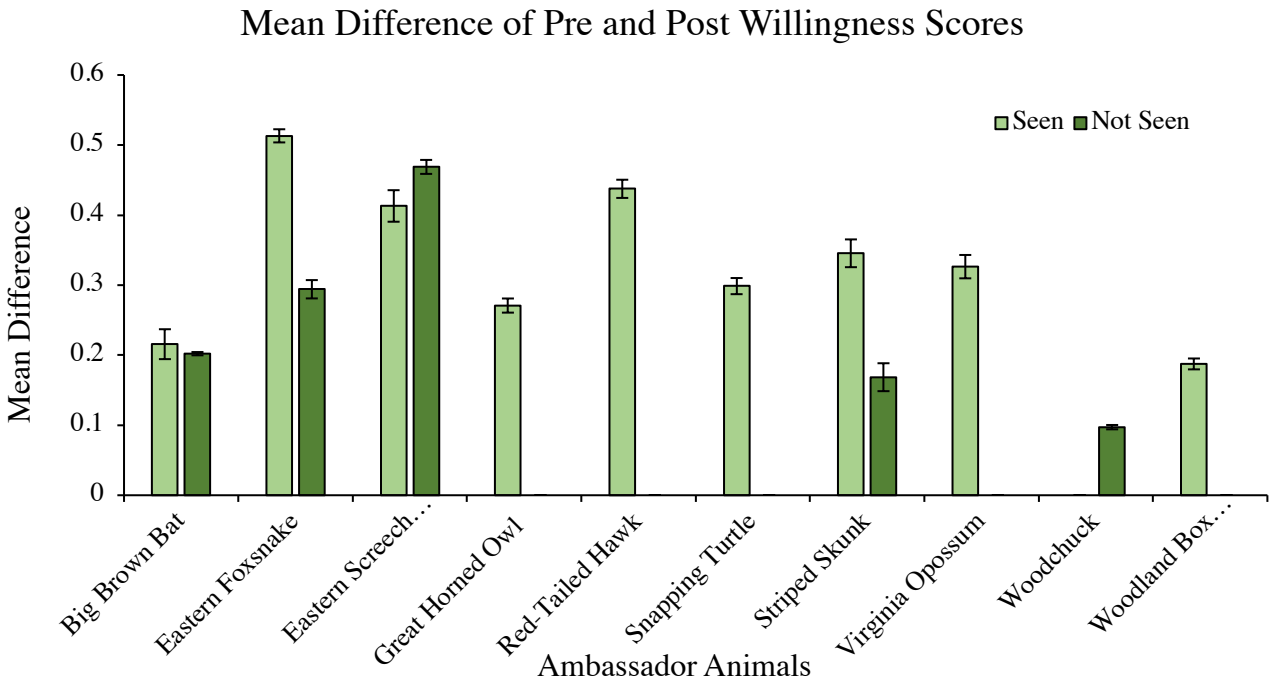


Figure 8. Mean differences of "pre" and "post" willingness scores for both animals seen and not seen during the animal programs. An increase of mean score difference was determined for all animals seen during the programs compared to not seen, except for the Eastern screech owl.

***(4) Analysis of responses over time***

A "delayed" survey was distributed approximately three months following the animal programs. Compared to the total of 144 participants in the "pre" and "post" surveys, only eleven completed the "delayed" response. Figures 9 and 10 display the average Likert scores for affiliation and willingness between the three different surveys for the eleven participants.

For Figure 9, the average affiliation scores remained consistent except for the Eastern foxsnake, great horned owl, red-tailed hawk, snapping turtle, striped skunk, and Virginia opossum, which were all examples where the average "delayed" score was lower than both the "pre" and "post" scores. An ANOVA repeated measure was calculated to determine the differences between the timing of the survey, the animal ambassadors, and the interaction between the timing and the animal ambassadors. The differences between the timing of the

survey was not significantly different for affiliation ($F_2$= 0.3009, p= 0.7475). However, the differences between the species of animal ambassadors was significant ($F_9$= 2.7141, p= 0.0072) and an additional post hoc Tukey HSD determined that the woodland box turtle's score was significantly different from the big brown bat, however, no other species was significant from another. The interaction between the time the survey was taken, and the differences of species was not significant ($F_{18}$= 1.0211, p= 0.4376).

Figure 10 displays the average willingness scores, where all animals except the Eastern foxsnake and the red-tailed hawk experienced lower average "delayed" responses compared to the "pre" responses. Similar to Figure 9, an ANOVA repeated measure was performed to determine the differences between the timing of the survey, the animal ambassadors, and the interaction between the timing and the animal ambassadors. Timing was determined to not be significantly different ($F_2$= 2.078, p= 0.1254). The differences between the scores for the animal ambassadors was also not significant ($F_9$= 1.1629, p= 0.3270). The interaction between the timing of the survey and the differences of the species was determined to not be significant ($F_{18}$= 0.4797, p= 0.9644).

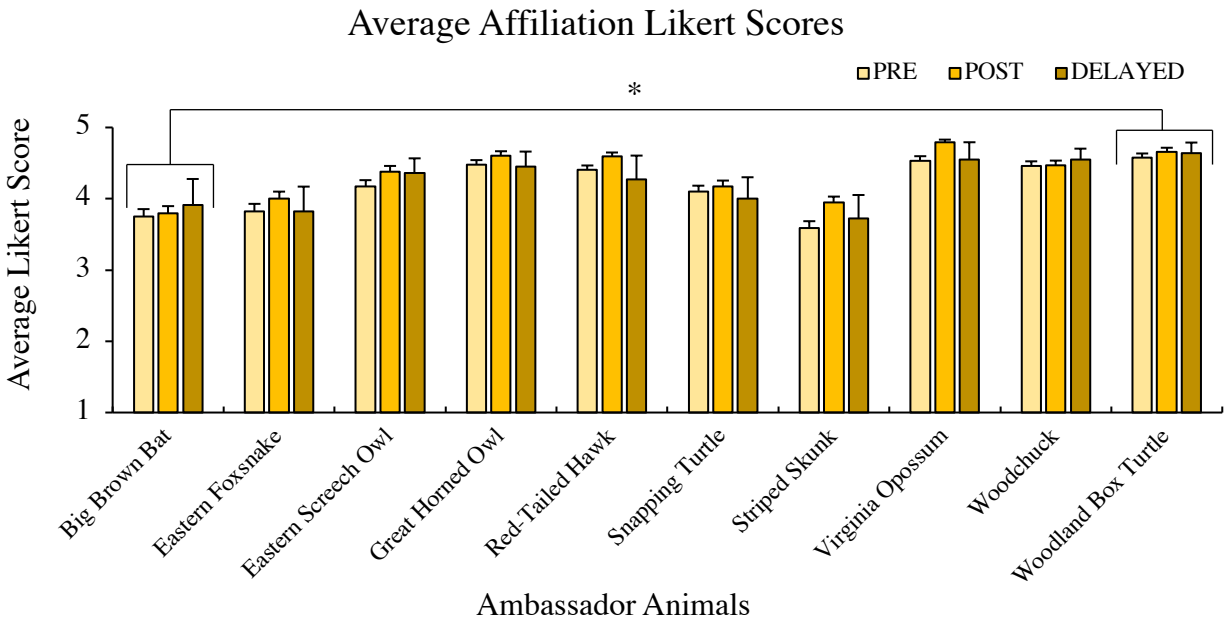


Figure 9. Averages of the Likert responses for the affiliation portion of the survey comparing "pre," "post," and "delayed" responses (n=11). The woodland box turtle's scores were determined to be significantly different from the scores of the big brown bat (p=.0072).

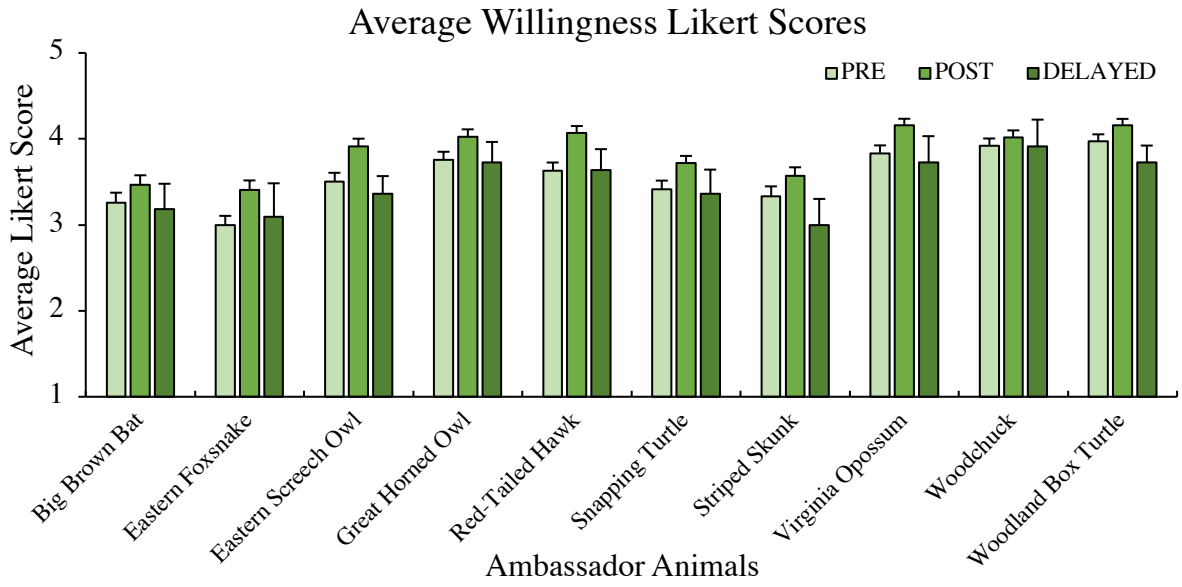


Figure 10. Averages of the Likert responses for the willingness portion of the survey comparing "pre," "post," and "delayed" responses (n=11).

***(5) Assessing knowledge scores***

Analysis of the knowledge component consisted of grouping correct responses into the eleven pre-determined categories (Belden & Russonello, 1996; Dierking, 2004). A percentage was calculated from the total number of responses per each category by the total sum of correct responses from the "pre," "post," and "delayed" surveys (Figures 11, 12, and 13). An example of correct "pre," "post," and "delayed" response was: "prevent littering," "recycle, reduce, reuse, and pick up litter," and "call the wildlife center about injured wildlife." There was a total of 135 correct responses in the "pre," 158 in the "post," and 13 in the "delayed" surveys. One response could have multiple correct answers, depending on how many actions the respondent recorded. There was a total of 57 incorrect responses in the "pre," 44 in the "post," and 2 in the delayed. An example of an incorrect response was "feeding wildlife." The category with the highest score in the "pre" survey was "trying to cut down on the amount of trash" with 37.78% of the total responses. In the "post," the highest was "helping create/improve habitats for fish and wildlife" with 42.41% of the total responses. For the "delayed" survey, the highest was also "trying to cut down on the amount of trash" with 46.51% of total responses.

The category, "spending time in nature," was not mentioned as a response in any of the three surveys; the other categories had at least one response in either the "pre" or "post" surveys. Two common answers were "don't litter/pick up litter" and topics directly related to the Ohio Wildlife Center (Table 2). Topics related directly to the wildlife center included: "bringing injured wildlife to the Ohio Wildlife Center's animal hospital," "donating to the Ohio Wildlife Center," and participating in specific Ohio Wildlife Center volunteer events. These responses were grouped into the main categories of "donating money to environmental organizations" and "doing volunteer work for a group that helps the environment." The responses for "don't litter /

pick up litter," were grouped into the categories of "trying to cut down on the amount of trash" and "helping create / improve habitats for fish and wildlife."

Figure 14 depicts the differences of the "post" and "delayed" percentages from the "pre" percentages per the eleven categories. Responses for the category, "trying to cut down on trash," had the greatest decrease of -9.29% from "pre" to "post," however, this category had an 8.38% increase from "pre" to "delayed," and was also the greatest increase for "delayed." The greatest increase for "post" responses was in the category, "helping create/improve habitats for fish and wildlife," with a 9.81% increase from "pre" scores. The differences for "delayed," declined in most of the categories due to the mention of only three of the eleven categories in the "delayed" survey, also depicted in Figure 13.

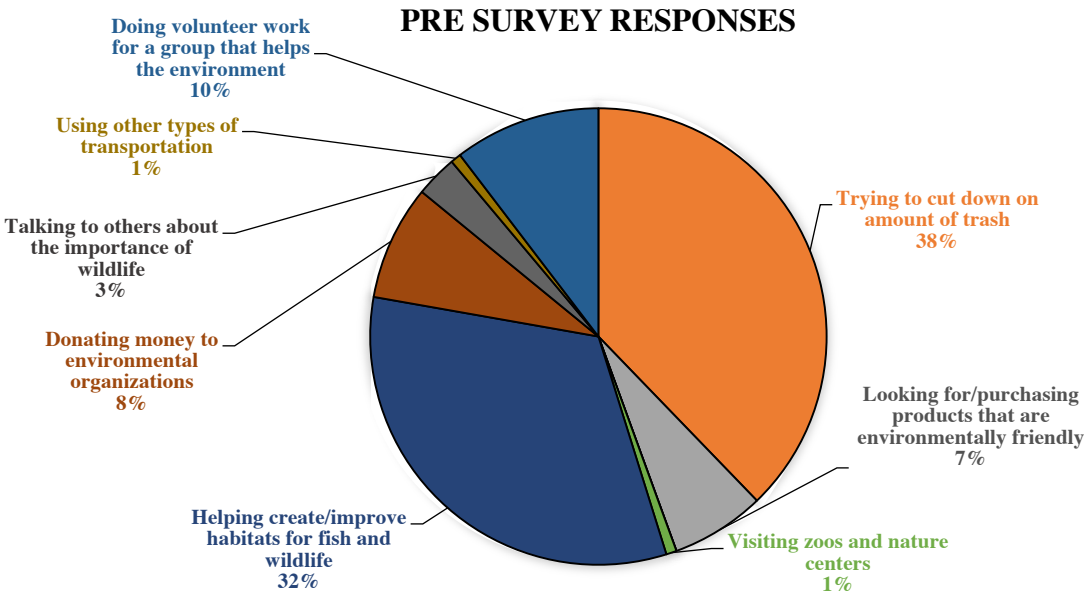


Figure 11. Percentages of the total amount of the correct responses related to the predetermined categories in the "pre" survey (n=135). No responses recorded for the categories: "trying to learn more about wildlife," "spending time in nature," and "avoiding using chemicals in your yard/garden."

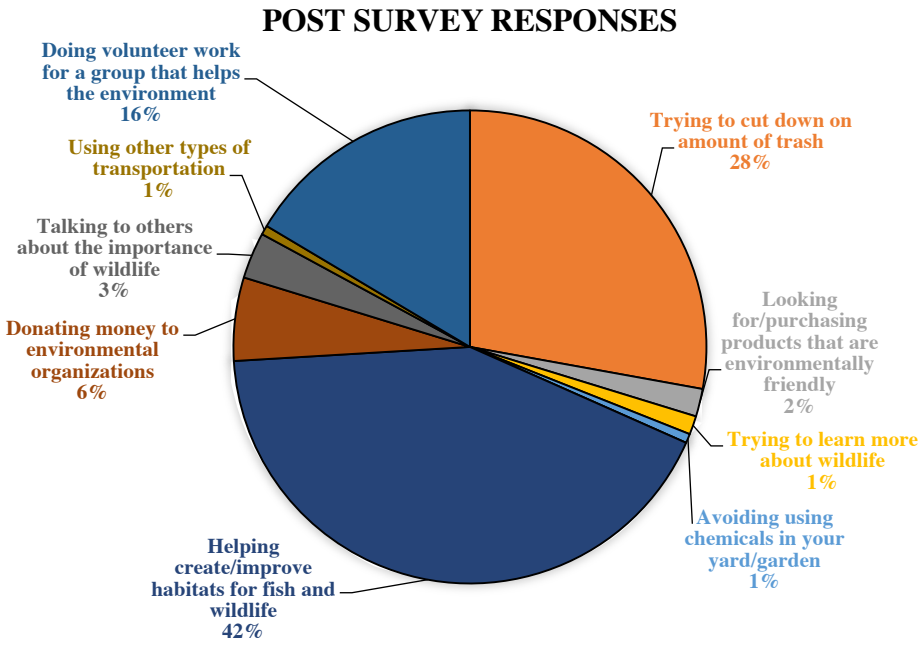


Figure 12. Percentages of the total amount of the correct responses related to the predetermined categories in the "post" survey (n=158). No responses recorded for the categories: "spending time in nature" and "visiting zoos and nature centers."

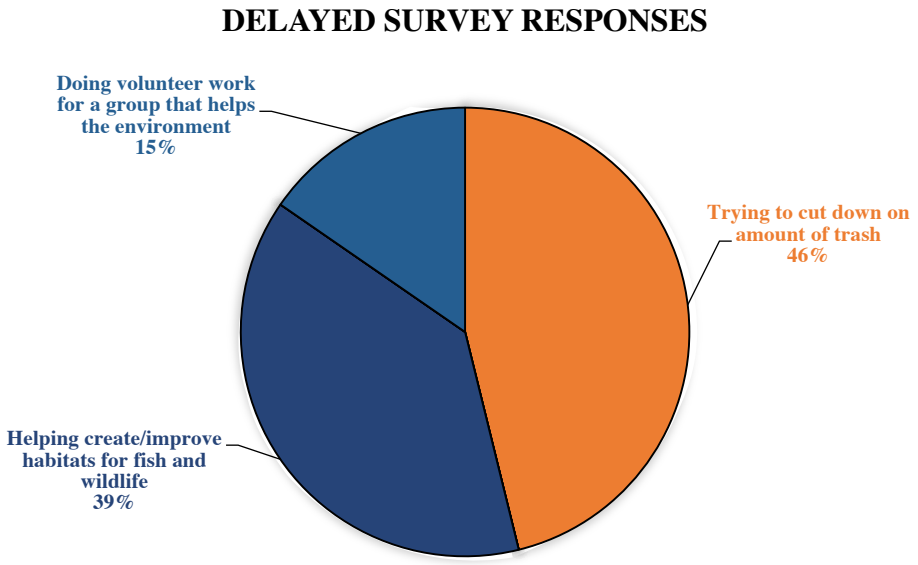


Figure 13. Percentages of the total amount of the correct responses related to the predetermined categories in the "delayed" survey (n=13).

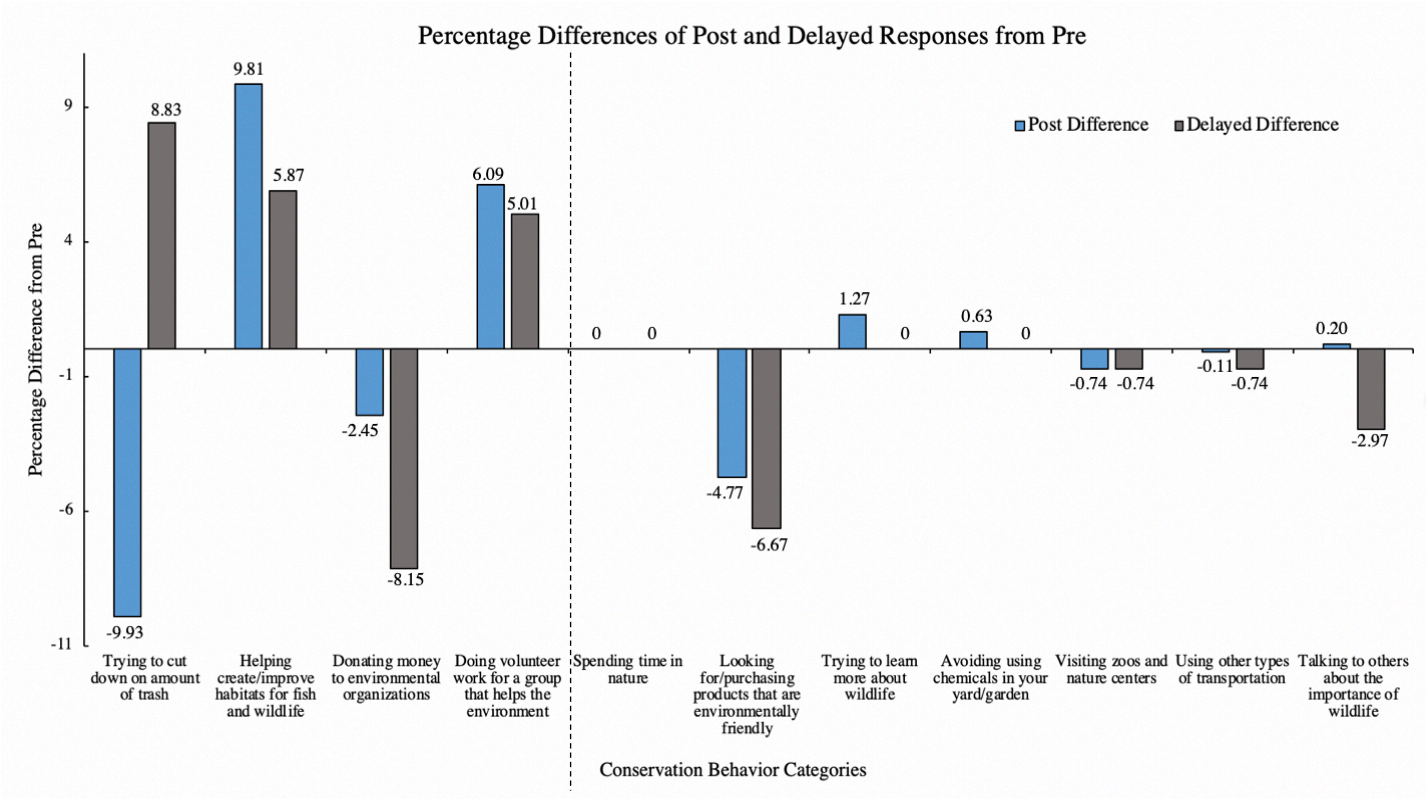


Figure 14. Percentage differences of "post" and "delayed" responses per category from the "pre" responses. The responses for "Don't Litter / Pick up Trash" were categorized in the first two categories (Table 2). The third and fourth categories listed are the ones in which Ohio Wildlife Center related responses were grouped into (Table 2).

| | **Ohio Wildlife Center Related Responses** | **Don't Litter / Pick up Trash** |
|---|---|---|
| **Pre (n=135)** | 18.52% (n=25) | 70.37% (n=95) |
| **Post (n=158)** | 22.15% (n=35) | 76.55% (n=111) |
| **Delayed (n=13)** | 15.38% (n=2) | 84.62% (n=11) |

Table 2. Percentages of the total responses involving specific Ohio Wildlife Center activities and not littering / picking up trash.

**Discussion:**

***Animal programs' influence on likeability and willingness to live near local wildlife***

The animal ambassadors presented in this study all had an increase in the average scores of both affiliation and willingness between the "pre" and "post" surveys. Despite the initial average high scores of affiliation and willingness for the ambassador animals, the results from this study suggest that there is an opportunity to continue to improve these scores. No average initial affiliation scores were beneath a score of three for all ambassador animals listed. For willingness, only the Eastern foxsnake had an initial score beneath an average of three, all other ambassador animals had an average score of above three for the "pre" survey. In the affiliation portion of the survey, the striped skunk had the greatest average increase from "pre" to "post." The respondents reported the greatest average affiliation change, scoring above an average of four, for the Eastern screech owl, great horned owl, red-tailed hawk, snapping turtle, Virginia opossum, woodchuck, and woodland box turtle. The interest in birds, and the aversion to snakes, is a common trend noted in this study, with an overall greater affiliation for bird species presented in the survey than the Eastern foxsnake (Zhang, Goodale, & Chen, 2014). Despite the interest in species of birds, the high initial affiliation scores translated to lower "pre" willingness scores for both the Eastern screech owl and the red-tailed hawk. However, the average "post" scores of these two animals were among the greatest changes between the "pre" and "post" scores for willingness, suggesting the role of animal programming in improving attitudes of species of local wildlife.

As predicted, a strong correlation and a high regression value between affiliation and willingness was found, indicating that the higher the scores in affiliation for a particular species, the more willing respondents were to live near the animal. Both the "pre" and "post" results had

strong, positive correlations between affiliation and willingness. The regression was also determined to be strengthened after witnessing animal programs, where the $R^2$ value was greater. This larger $R^2$ value found in the "post" results indicates that the changes in willingness were influenced by the changes in affiliation. The big brown bat and the striped skunk were the lowest scored in both the "pre" and "post" surveys, but both species had improvements in scores. Results suggest an individual is more willing and interested to have animals like owls, Virginia opossums, and woodland box turtles live near them. The lower scores for the striped skunk and big brown bat could be due to the fear of disease and danger associated with certain mammal species, as suggested by Hosaka (2017) and Soulsbury and White (2015). However, despite lower scores, the big brown bat and striped skunk both had significant difference in average willingness scores from "pre" to "post," and the striped skunk also experienced significant difference in the average affiliation scores.

The results imply that animal programs can have an impact on the scores of affiliation and willingness for local wildlife, however, it is yet to be determined if these scores persist over time. The sample size of the "delayed" response in this study did not accurately account for the original sample size of the respondents for the "pre" and "post" surveys. Despite the small sample size, the results from this portion of the study suggest that average affiliation and willingness scores may not persist over time. Average affiliation scores over the three surveys had more consistent results, but willingness had greater differences. For the average willingness Likert scores, the average "delayed" responses all decreased compared to the average "post" scores. All animal ambassadors, except the red-tailed hawk and Eastern foxsnake, average "delayed" willingness responses were lower than that of the "pre" scores. The decline in average scores could be due to the lack of reinforcing experiences concerning the topics and animal

ambassadors seen over the months following attending the summer camps, as a large component of attitudes concerns the current conditions (Dierking, 2004).

The results of this study concerning the correlation of affiliation and willingness support previous findings by Muslim (2018) and Hosaka (2017). Both studies also analyzed the role of nature experiences in fostering these changes in both affiliation and willingness, stressing that educational programs have the potential to change perspectives on different species of wildlife (Muslim, 2018; Hosaka, 2017). Close observation and educational opportunities have been documented to change overall attitudes of different species such as bobcats and snakes (Hudenko, Siemer, & Decker, 2010; Ballouard, Provost, Barre, & Bonnet, 2012). The increase in all average affiliation and willingness scores suggest the role of the animal programming in providing an interactive opportunity to change people's perspectives on local wildlife, supporting the hypothesis of the study.

***Roles of types of animals seen during animal programs***

The role of seeing particular ambassador animals during programs was not determined to be a significant factor in the changes of affiliation and willingness scores following animal programs. No significant differences were found between the differences of scores concerning animals seen and not seen; however, as a whole, the t-test for willingness results comparing overall seen and not seen values was determined as significant. In the case of willingness, it was determined that seeing ambassador animals had an impact on the change of overall average willingness scores, but not significantly for specific ambassador animals. In the affiliation and willingness sections, there was a general increase of mean difference for if the ambassador animals were seen, except in the case of the big brown bat and the Eastern screech owl. For the big brown bat, the mean difference score of affiliation decreased when it was seen during the

animal programs. For the Eastern screech owl, the mean difference willingness score was lower for the seen value as compared to the not seen value. The results of this suggest that the role of seeing ambassador animals in a program setting has the potential to increase the scores of affiliation and willingness, but could be specific to which animals are seen. Of the ten animal ambassadors, the big brown bat, Eastern screech owl, and woodchuck were considered outliers to the general trend of seen values being greater than not seen. These three animals all had scores that decreased when they were seen or had no score for seen values. It is worth noting that the woodchuck was also the only animal without a significant increase in average willingness scores found in Figure 5, and also did not have a significant increase in affiliation scores in Figure 4. Due to these variations based upon individual animal ambassadors, there is the potential that the aspect of an animal being seen during programs can have a role in increasing or decreasing its mean difference. In the case of decreasing this mean difference, additional messaging may need to be implemented to improve attitude scores for individual species. There were also increases of mean difference scores for ambassador animals that were not seen by the participants. This increase may suggest the potential that an animal ambassador may act as an ambassador for other species rather than just its own, or that messaging can be implemented to improve attitudes for multiple species.

***Animal programming as an educational platform***

Of the eleven pre-determined conservation behavior categories, all but one category was mentioned between the "pre" and "post" surveys. The one category not mentioned was "spending time in nature," and since this survey was taken over the course and following a nature summer camp, this category could have already been implied through attending the camp itself. It was predicted that there would be a greater diversity of responses to categories between

the “pre” and “post” surveys, however only one extra category was mentioned after the animal programs. Overall, there was an increase in total correct responses and a decrease of incorrect responses following the animal programs. Mentions of specific categories could have lower overall percentages due to the easy ability of children aged six to fifteen to perform the determined behavior categories, such as not using chemicals in a garden and purchasing environmentally friendly products. Categories including “trying to cut down on the amount of trash” and “helping create/improve habitats for fish and wildlife” are examples of behaviors easier for children to participate in, due to these being the categories that “not littering” and “picking up trash” were grouped into; these categories also had the greatest percentage of responses in all three of the surveys. These results align with the study by Smith (2010), which suggests that behaviors more commonly accepted are easy to do, have a clear reason on how it helps wildlife, and is an accessible option.

A common trend found in the responses following the animal programs were responses directly related to the Ohio Wildlife Center. The direct mention of Ohio Wildlife Center volunteer events and actions imply the educational ability of the animal programs. Since the respondents were participants in the Ohio Wildlife Center’s summer camps, much of the messaging during these programs related directly to the animal ambassador’s histories; all are rescued wildlife that had been brought to the Ohio Wildlife Center’s wildlife hospital. Animals treated, but deemed unable to rerelease, often become ambassador animals and help spread messaging and awareness in bringing sick or injured wildlife to the Ohio Wildlife Center’s hospital. The recollection of these responses in the surveys suggests the impact the specific ambassador animals and their stories had in the respondents.

***Implications and future studies***

Animal programming was determined to have an impact on human's attitudes of local wildlife, however with small effect size. This small effect size is predominately due to the initial high scores of affiliation and willingness for the ten ambassador species, which is due to the nonrandom audience that was surveyed in this study. The participants of this survey were also participants of a nature camp, which implies a pre-existing interest in wildlife. Despite the nonrandom audience, there was an overall increase in the average responses of affiliation and willingness, meaning that even with nonrandom audiences, there is room to influence and improve these attitudes towards local wildlife, particularly after experiencing animal programs.

Due to the strong correlation between affiliation and willingness, emphasis should be placed on stressing the coexistence with native species during animal programming and seeking to improve human attitudes of empathy and respect for local wildlife. Activities concerning emphasis on native species and focusing on specific animals and our attitudes towards them can drive overall willingness to coexist with species. As seen in the "delayed" results, the scores of affiliation have a greater potential to last over time than the scores of willingness. Due to this, messaging should emphasize these messages of coexistence to establish persisting willingness responses. More specific methods of helping local wildlife can also be stressed during these programs, specifically with real-world examples that are easy to follow or remember. Due to the majority of responses relating to the two categories of "helping create or improve habitats for fish and wildlife" and "trying to cut down on the amount of trash," behaviors relating to the other nine conservation behavior categories can be further implemented into messaging. These behavior categories can be related to the audiences seen in this study by emphasizing behaviors that children aged six to fifteen can efficiently and easily do. As depicted in the results from the

self-reported knowledge section, specific stories about the ambassador animals being rescued and brought to the Ohio Wildlife Center's animal hospital retained with participants three months following the animal programs. Storytelling and specific examples have the greatest potential to be remembered over time and therefore might be implemented as behavior change as well.

Future studies on this topic can be centered around analyzing the results of the survey taken by a random audience. This random audience can be found in outreach programs, where the ambassador animals are brought to schools, recreation centers, and more that are off-grounds of the Ohio Wildlife Center. These audiences consist of participants who are not directly choosing to come to the Ohio Wildlife Center and participate in week-long summer camps, rather they are an audience who had the animal programs brought to them in a unique setting. The results of the random audience compared to the results of this study could provide clearer results on the impact that animal programming can have on human attitudes. Another future study is taking into account what type of environment the participants are from or grew up in, particularly a rural, suburban, or city environment. This approach was attempted in this study; however, all but five participants of the 144 listed that they were from a suburban environment. Analyzing the responses of participants from these different environments could suggest different pre-conceived notions about the wildlife based on experiences, or lack of experiences, with the species of wildlife featured in the study.

Another dimension of future studies is concerning the types of animals seen and not seen during animal programs. Future studies should analyze the differences in results for animals seen and not seen in a controlled study to determine if the type of species shown during animal programs have an impact on the attitudes towards the species seen, meaning animal programs

may further tailor presentations for specific animals to be shown and or discussed. This approach can also provide more information on if animal ambassadors can act as ambassadors for only their specific species, or multiple different species as well. Another aspect to be analyzed in a control study are the "delayed" responses. Obtaining a larger sample size of "delayed" responses can further portray how these attitude changes from animal programs could persist over time.

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