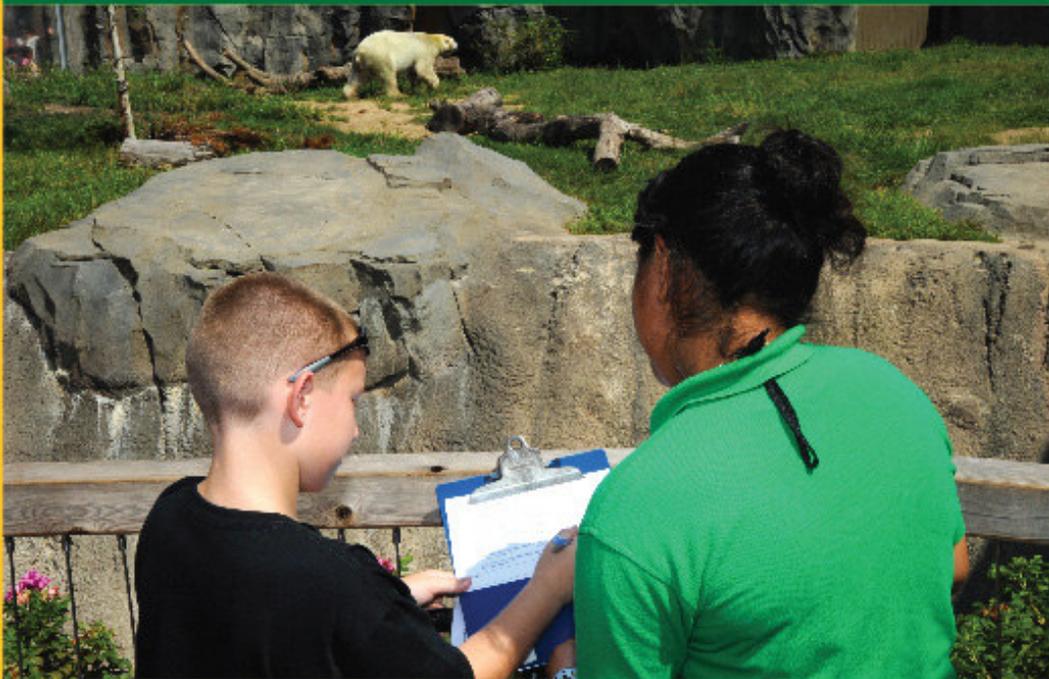


YOUTH VOLUNTEER INTERPRETERS AS FACILITATORS OF LEARNING ABOUT CLIMATE CHANGE IN ZOO SETTINGS

The Climate Literacy Zoo Education Network
July 2013

FINAL REPORT



Chicago Zoological Society
Inspiring Conservation Leadership



YOUTH VOLUNTEER INTERPRETERS AS FACILITATORS OF LEARNING ABOUT CLIMATE CHANGE IN ZOO SETTINGS

Jennifer Matiasek¹

Ricardo Stanoss¹

Debra Kutska¹

Kathryn Owen²

Kathy France²

Lisa-Anne D. Kelly¹

Alejandro Grajal¹

¹ Chicago Zoological Society

² Woodland Park Zoo

Acknowledgments

This material is based upon work supported by the National Science Foundation under Grant No. 1043284 and a grant from The Boeing Company. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation or Boeing. The Climate Literacy Zoo Education Network (CliZEN) principal investigator is Dr. Alejandro Grajal of the Chicago Zoological Society (CZS). He is joined by Dr. Ricardo Stanoss of CZS as co-principal investigator. The authors thank CliZEN co-principal investigators Dr. Susan Goldman of the University of Illinois at Chicago Learning Sciences Research Institute and Dr. Michael E. Mann of the Earth System Science Center at Penn State University. We also acknowledge the guidance of our advisors: Dr. Steven C. Amstrup of Polar Bears International, Dr. Philip Bell of the University of Washington, Dr. Paul Boyle of the Association of Zoos and Aquariums, Dr. Cynthia Hood of the Illinois Institute of Technology, Dr. Edward Maibach of George Mason University, and Dr. William Spitzer and John Anderson of the New England Aquarium. Finally, this project would not have been possible without the staff, youth volunteer interpreters, and visitors at Chicago Zoological Society / Brookfield Zoo and Woodland Park Zoo.

Suggested citation:

Matiasek, J., Stanoss, R., Kutska, D., Owen, K., France, K., Kelly, L.-A.D., & Grajal, A. (2013). *Youth volunteer interpreters as facilitators of learning about climate change in zoo settings*. Brookfield, IL: Chicago Zoological Society.

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EXECUTIVE SUMMARY

Development of human capacity to address global climate change may be supported by strengthening personal connections to nature and conservation outlook. Zoos and aquariums, with their living collections and interpretation facilitators, offer an unparalleled opportunity to contribute to the understanding of public engagement and further human potential to advance conservation efforts.

In this report we describe the impact of climate change education experiences facilitated by youth-volunteer interpreters. We measured the effects on both zoo visitors and the teen-aged facilitators. This project was developed by the Climate Literacy Zoo Education Network (CliZEN), a partnership of zoo educators, climate and learning scientists, and conservation psychologists. At Woodland Park Zoo and Brookfield Zoo teen volunteer interpreters facilitated three types of climate change learning opportunities for zoo visitors—an activity cart at a Sumatran tiger exhibit, and inquiry- and specimen-based learning resources at polar bear and Humboldt penguin exhibits.

The project was guided by five research questions:

1. Does participation in a youth facilitated inquiry-based learning opportunity affect zoo visitors' climate change knowledge, attitudes, and behaviors?
2. Does participation in a youth facilitated specimen-based learning opportunity affect zoo visitors' climate change knowledge, attitudes, and behaviors?
3. Does participation in youth facilitated “climate cart” activities affect zoo visitors' climate change knowledge, attitudes, and behaviors?
4. How do visitor outcomes compare across participation in inquiry-based and specimen-based learning opportunities?
5. How does participation as a youth interpreter of climate change learning opportunities affect the teen volunteer interpreters?

Our findings, based on surveys answered by visitors, indicate that:

1. Youth volunteer interpreters can be effective facilitators of learning about climate change in zoo settings.
2. Providing an inquiry activity focused on climate change may help visitors reflect on the issue of climate change and consider taking action.

Our findings regarding the impact of the program on youth interpreters indicate that:

1. Youth volunteer interpreters experienced gains in self perception, confidence, and knowledge.
2. Youth volunteer interpreters agree climate change is happening and over the summer increased in the strength of their convictions and the frequency of their conservation behaviors.

This pilot study has been very encouraging, and the results suggest new directions for climate change education research in zoos and aquariums. Such research designs may compare the impact of youth and adult volunteer interpretation on zoo visitors' climate change literacy.

OVERVIEW

As evidenced by increases in global air and ocean temperatures, rising sea levels, and decreased ice and snow cover, climate change is happening. These changes are negatively affecting the Earth's ecosystems, and human activities contributing to heat-trapping gas emissions are the dominant cause [10]. Humans have the potential and desire to address global climate change but perceive barriers to doing so, such as lack of knowledge about what behaviors will be effective [2, 7, 11].

Reaching 175 million visitors annually [3], institutions accredited by the Association of Zoos and Aquariums (AZA) are well positioned to play an important role in climate change education. Zoo and aquarium visits have been demonstrated to strengthen visitors' connections to nature, reinforce visitors' conservation outlook, and increase visitors' sense that they can be a part of the solution to environmental problems [8]. Research suggests, furthermore, zoos can provide positive emotional contexts for visitors [13], the zoo context supports a social identity related to concern for animals and the environment [5], it is possible to connect emotional affinity for animals to an interest in conservation issues [6], and emotional engagement supports learning about environmental issues [4].

Within zoos and aquariums, one potential strategy for engaging visitors in conversations about climate change is to have these interactions facilitated by youth volunteer interpreters. Many zoos and aquariums provide opportunities for high school age students to participate in volunteer programs. These programs focus on providing youth with first hand experiences in education or research and strive to promote participants' connection with nature, understanding of environmental issues, and capacity to take action on behalf of the environment, as well as their self confidence and social skills. The impact of the programs on the youth themselves has initially been documented [14], but there is further need to better understand the teens' experiences, as well as measure the impact of youth volunteers acting as educational interpreters for zoo and aquarium visitors.

The project described in this report was developed by the Climate Literacy Zoo Education Network (CliZEN) to pilot test climate change education resources featuring youth volunteer interpreters as facilitators for zoo visitors' experiences. CliZEN was formed based on the potential for zoos to be positive forces in climate change education. CliZEN brings together a partnership of zoo educators, learning science researchers, conservation psychologists, and climate scientists to explore strategies for effectively leveraging the unique opportunities of informal science education in zoos and aquariums toward increasing climate change literacy.

For this project, Woodland Park Zoo (Seattle, WA) and Brookfield Zoo (IL) focused on their strong youth volunteer interpreter programs to test some concepts on how to achieve visitor engagement through alternative ways to establish meaningful dialogue between youth interpreters and visitors. Rather than presenting information about climate change, the interpretive interventions were intended to generate conversations focused on the implications of climate change for humans and other species and what role we play as both consumers and citizens. Brookfield Zoo tested inquiry-based and specimen-based interpretation at the polar bear and Humboldt penguin exhibits, and Woodland Park Zoo tested a climate-change themed "activity cart" near their Sumatran tiger exhibit.

We wished to explore new frontiers in youth-facilitated interpretation, create a welcoming environment for visitors, and engage visitors in constructive conversation that develops their own sense of commitment to action. Therefore, we measured the effects of youth volunteer interpretation on the zoo visitors, as well as on the youth volunteer interpreters themselves. Furthermore, as recommended by Allen [1] we tested the effectiveness of inquiry-based exhibits in institutions with living collections; the research was designed to compare the effects of traditional specimen-based interpretation and inquiry-based interpretation.

This project was guided by five research questions:

1. Does participation in a youth facilitated inquiry-based learning opportunity affect zoo visitors' climate change knowledge, attitudes, and behaviors?
2. Does participation in a youth facilitated specimen-based learning opportunity affect zoo visitors' climate change knowledge, attitudes, and behaviors?
3. Does participation in youth facilitated "climate cart" activities affect zoo visitors' climate change knowledge, attitudes, and behaviors?
4. How do visitor outcomes compare across participation in inquiry-based and specimen-based, learning opportunities?
5. How does participation as a youth interpreter of climate change learning opportunities affect the teen volunteer interpreters?

To evaluate the impact of the youth-facilitated interpretation activities on zoo visitors, we conducted a survey of zoo visitors after interacting with the youth volunteer interpreters. To evaluate the impact of their experience, youth volunteer interpreters completed pre-summer and post-summer surveys.

Our findings regarding the impact of youth volunteer interpretation on zoo visitors indicate that:

1. Youth volunteer interpreters can be effective facilitators of learning about climate change in zoo settings.
2. Providing an inquiry activity focused on climate change may help visitors reflect on the issue of climate change and consider taking action.

Our findings regarding the impact of the program on youth interpreters indicate that:

1. Youth volunteer interpreters experienced gains in self perception, confidence, and knowledge.
2. Youth volunteer interpreters agree climate change is happening and over the summer increased in the strength of their convictions and the frequency of their conservation behaviors.

The next section of the report provides additional details about each of these four key findings. We then present the implications of our study and considerations for future research. Next, we present data tables pertinent to the key findings in Appendix A. Finally, an overview of our methodology is presented in Appendix B.

KEY FINDINGS

Impact of Youth Volunteer Interpretation on Zoo Visitors

About 200 visitors were surveyed following an interaction with youth volunteer interpreters at either Brookfield Zoo (n=147) or Woodland Park Zoo (n=54). At Brookfield Zoo these interactions were equally split between those at the penguin exhibit and those at the polar bear exhibit and those that involved an inquiry activity and those that involved a specimen interaction. At Woodland Park Zoo, these interactions followed an interpretive cart activity at the tiger exhibit.

1. Youth volunteers can be effective facilitators of learning about climate change in zoo settings.

The majority of zoo visitors at both Brookfield Zoo and Woodland Park Zoo reported they learned something new about climate change or about conservation actions that could help the animals being impacted by climate change.

- 94% of Woodland Park Zoo visitors agreed they learned about some of the impacts of climate change on animals and were able to cite at least one piece of new learning (Table A1).
- 83% of Woodland Park Zoo visitors agreed they learned something new about climate change (Table A1).
- 88% of Brookfield Zoo visitors reported they learned something new about the polar bear or penguin (Table A2).
- 77% of Brookfield Zoo visitors reported they learned about conservation actions that may help polar bears/penguins (Table A2).

2. Providing an inquiry activity focused on climate change may help visitors reflect on the issue of climate change and consider taking action.

Visitors who participated in inquiry activities and visitors who heard specimen interpretation at Brookfield Zoo did not have significantly different attitudes about climate change. There were, however, some promising trends when zoo member and non member visitors were compared. Non member visitors who participated in the inquiry activity seemed more likely than those who participated in the specimen interpretation to say they planned to talk to friends about the information they learned, experienced a feeling of connectedness, reflected on new ideas, and intended to take conservation action (Table A3).

After interacting with youth volunteers at Woodland Park Zoo, 61% of visitors agreed they planned to talk to their families and friends about the information they learned (Table A1).

Impact of Interpretation Programs on Youth Volunteers

In 2011, 98 high school students who participated in the Brookfield Zoo Youth Volunteer Corps and 31 students who participated in the Woodland Park Zoo Corps completed both a pre- and a post-summer survey. These surveys asked the students to report on their volunteer experience, climate change attitudes, conservation behaviors, and self perceptions.

1. Youth volunteer interpreters experienced gains in self perception, confidence, and knowledge.

- Over the course of the summer, Brookfield Zoo youth volunteer interpreters gained confidence in “speaking to large groups of people” (Table A8).
- Brookfield Zoo youth volunteer interpreters who facilitated inquiry activities also experienced confidence gains for “recognizing and using my strengths,” “recognizing and exploring my interests,” and “getting along with people who are different from me” (Table A9).
- Brookfield Zoo youth volunteer interpreters reported gains in their animal/conservation knowledge and understanding of threats to the environment (Table A10).
- Brookfield Zoo youth volunteer interpreters who facilitated inquiry activities were more likely than those who did not facilitate inquiry activities to report gains in their ability to see themselves as scientists, ability to conduct research, and conservation behaviors within the community (Table A11).
- Compared to their pre-surveys, Woodland Park Zoo youth volunteer interpreters were more likely to accurately identify greenhouse gases (Table A4), factors that impact climate (Table A5), sources of evidence of climate change (e.g., in tree rings and pollen) (Table A6), and current effects of climate change (Table A7) on their post-surveys.

2. Youth volunteer interpreters agreed climate change was happening and over the summer increased in the strength of their convictions and the frequency of their conservation behaviors.

- Compared with the beginning of the summer, more youth volunteer interpreters (at both Brookfield Zoo and Woodland Park Zoo) at the end of the summer reported thinking about climate change (Table A15), believing climate change will harm them personally (Table A16), and identifying climate change as an issue that should be a very high government priority (Table A17). Overall, almost all youth volunteer interpreters came into the program and left the program believing climate change is happening; however, there were changes in the strength of their convictions (Table A12).
- 66% of youth volunteer interpreters at Brookfield Zoo ended the summer being “extremely sure” climate change was happening (27% were “extremely sure” at the beginning of summer) (Table A12).
- 73% of youth volunteer interpreters at Woodland Park Zoo ended the summer being “extremely sure” climate change was happening (53% were “extremely sure” at the beginning of summer) (Table A12).
- Over the course of the summer, youth volunteer interpreters at Brookfield Zoo and Woodland Park Zoo increased the frequency with which they reported doing two conservation behaviors: encouraging their families to (1) change their thermostat to save energy and (2) swap out inefficient light bulbs (Table A13).
- Youth volunteer interpreters at Woodland Park Zoo also increased the frequency with which they reported talking to their family and/or friends about things they can do to help animals or the environment (Table A13).
- Youth volunteer interpreters at Brookfield Zoo who facilitated inquiry activities were also more likely to increase the frequency with which they wrote letters, sent emails, or signed petitions about issues affecting animals or the environment (Table A14).

IMPLICATIONS AND CONSIDERATIONS FOR FUTURE RESEARCH

We are highly encouraged by our findings. Interpretation activities performed by youth volunteers affect zoo visitors' climate literacy. Also, presenting these interpretation activities increases teens' scientific proficiency and confidence. These data suggest youth can effectively interpret climate change messages and engage zoo visitors in authentic dialog on climate change. At the same time, our study demonstrates these opportunities can be even more effective in increasing the teen interpreters' self-perception, confidence, knowledge, and frequency of their conservation behaviors.

The importance of providing teens with opportunities to explore and enhance their interest in and ability to use science is becoming more prominent as science and technology play an increasingly central role in society. For example, skills such as critical thinking and problem solving, creativity and innovation, communication and collaboration, scientific and numerical literacy, cross-disciplinary thinking, environmental literacy, and leadership and responsibility are among a list of "21st Century Skills" that have been defined as essential for students to succeed in school, work, and life [9, 15]. Cultivating these 21st Century Skills are, in most cases, the explicit intended outcomes of the youth volunteer interpreter programs offered at Brookfield Zoo, Woodland Park Zoo, and other informal learning settings. As a result, it should be a high priority for these organizations to embark on projects like those described in this report— projects that not only measure the impact of these programs on the general public, but also integrate additional research that measures the success in helping youth develop these skills.

For future iterations of this research, we recommend the following designs be considered:

- To assess whether visitors are more willing to talk with teen interpreters than adult interpreters about climate change, we recommend observing both teens and adults facilitating similar interactions and collecting data on how often climate change is discussed and how long visitors stay to talk about climate change with each volunteer.
- We recommend continuing to compare the impact of inquiry activities and specimen interpretation on visitors by tracking how long visitors stay for each type of encounter and what conversations are sparked following each type of interaction.
- We recommend creating additional comparison groups by surveying visitors who have not interacted with any volunteer interpreters, as compared with those who did and by surveying visitors who have conversed with youth interpreters, as compared to those who interacted with adult interpreters.

REFERENCES

1. Allen, S. (1997). Using scientific inquiry activities in exhibit explanations. *Science Education (Informal Science Education - Special Issue)* 81(6), 715-734. doi:10.1002/(SICI)1098-237X(199711)81:6<715::AID-SCE8>3.0.CO;2-L
2. American Psychological Association (APA) Task Force on the Interface between Psychology and Global Climate Change. Task force members: J. Swim (chair), S. Clayton, T. Doherty, R. Gifford, G. Howard, J. Reser, P. Stern, & E. Weber. (2010). *Psychology and global climate change: Addressing a multi-faceted phenomenon and set of challenges*. Washington, D.C.: American Psychological Association. Retrieved from <http://www.apa.org/science/about/publications/climate-change-booklet.pdf>
3. Association of Zoos and Aquariums (2013). *Zoo and aquarium statistics*. Retrieved from <http://www.aza.org/zoo-aquarium-statistics/>
4. Ballantyne, R., Fien, J., & Packer, J. (2001). School environmental education programme impacts upon student and family learning: A case study analysis. *Environmental Education Research*, 7(1), 23-37. doi:10.1080/13504620124123
5. Clayton, S., Fraser, J. & Burgess, C. (2011). The role of zoos in fostering environmental identity. *Ecopsychology*, 3(2), 87-96. doi:10.1089/eco.2010.0079
6. Clayton, S., Fraser, J., & Saunders, C.D. (2009). Zoo experiences: Conversations, connections, and concern for animals. *Zoo Biology*, 28(5), 377-397. doi:10.1002/zoo.20186
7. Dietz, T., Gardner, G., Gilligan, J., Stern, P., & Vandenberg, M. (2009). Household actions can create a behavioral wedge to rapidly reduce U.S. carbon emissions. *Proceedings of the National Academy of Sciences*, 106, 18452-18456. doi:10.1073/pnas.0908738106.
8. Falk, J.H., Reinhard, E.M., Vernon, C.L., Bronnenkant, K., Deans, N.L., & Heimlich, J.E. (2007). *Why zoos & aquariums matter: Assessing the impact of a visit*. Silver Spring, MD: Association of Zoos & Aquariums. Retrieved from http://www.aza.org/uploadedFiles/Education/why_zoos_matter.pdf
9. Institute of Museum and Library Services. (2009). *Museums, libraries, and 21st century skills*. Washington, DC: IMLS. Retrieved from http://www.imls.gov/assets/1/workflow_staging/AssetManager/293.PDF
10. Intergovernmental Panel on Climate Change (IPCC). (2007). *Contribution of working groups I, II and III to the fourth assessment report of the Intergovernmental Panel on Climate Change*. R.K. Pachauri & A. Reisinger, (Eds). Geneva, Switzerland: IPCC. Retrieved from http://www.ipcc.ch/publications_and_data/ar4/syr/en/contents.html
11. Luebke, J.F., Clayton, S., Saunders, C.D., Matiasek, J., Kelly, L.-A. D., & Grajal, A. (2012). *Global climate change as seen by zoo and aquarium visitors*. Brookfield, IL: Chicago Zoological Society. Retrieved from at <http://www.clizen.org/survey.html>

12. Maibach, E.W., Roser-Renouf, C., & Leiserowitz, A. (2009). *Global Warming's Six Americas 2009: An audience segmentation analysis*. New Haven, CT: Yale University and George Mason University. Yale Project on Climate Change Communication. Retrieved from <http://www.climatechangecommunication.org/images/files/GlobalWarmingsSixAmericas2009c.pdf>
13. Myers, O.E., Jr., Saunders, C.D., & Birjulin, A.A. (2004). Emotional dimensions of watching zoo animals: An experience sampling study building on insights from psychology. *Curator*, 47(3), 299-321. doi:10.1111/j.2151-6952.2004.tb00127.x
14. Owen, K., Murphy, D., & Parsons, C. (2009). ZATPAC: A model consortium evaluates teen programs. *Zoo Biology*, 28, 429-446. doi:10.1002/zoo.20203
15. Partnership for 21st Century Skills. *Framework for 21st century learning*. Washington, DC: Partnership for 21st Century Skills. Retrieved from <http://www.p21.org>

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Woodland Park Zoo Visitor Responses

Table A1. A majority of visitors who spoke with youth volunteer interpreters at the Climate Cart in front of the tiger exhibit agreed they learned something about climate change and will share what they learned.

Statement about learning	Percent agreeing (n=54)
I learned about some of the impacts of climate change on animals ¹	94%
I learned something new about climate change ²	83%
I plan to talk to my family & friends about the information I learned ³	61%

¹ Visitors provided open ended responses to this item, thus the percent represents visitors who were able to list one or more impacts of climate change on wildlife. Among visitors who agreed with this statement and noted something they had learned, the most frequent subject of new learning was the impact of climate on the gender of young turtles.

² Visitors rated their agreement with this statement as a 4 or 5 on a 5-point scale. Among visitors who described themselves as “very knowledgeable” about climate change, 13% indicated they had learned something new. Among those who described themselves as “somewhat knowledgeable,” 32% said they had learned something new about climate change.

³ Visitors rated their agreement with this statement as a 4 or 5 on a 5-point scale.

Brookfield Zoo Visitor Responses

Table A2. A majority of visitors who spoke with youth volunteer interpreters at the penguin or polar bear exhibits agreed they learned something about species being affected by climate change.

Statement about learning ¹	Percent agreeing (n=147)
I learned something new about the polar bear/penguin	88%
I learned about conservation actions that may help polar bears/penguins	77%

¹ Visitors rated their agreement with these statements as a 3, 4, or 5 (“somewhat” to “very much so”) on a 5-point scale.

Table A3. Among non-member visitors who spoke with youth volunteer interpreters at the penguin or polar bear exhibits, those who took part in an inquiry activity seemed more likely to reflect on new ideas and reported a stronger intent to talk to friends and participate in conservation actions.

Statement about learning ¹	Percent agreeing	
	Inquiry (n=37)	Specimen (n=37)
I found myself reflecting on new ideas about animals and their environment	86%	70%
I plan to talk to friends about information I learned at exhibit	89%	76%
I plan to participate in conservation actions that may help animals	91%	71%
I experienced a feeling of connectedness with the animals during my visit	86%	84%

¹ Visitors rated their agreement with these statements as a 3, 4, or 5 (“somewhat” to “very much so”) on a 5-point scale.

Woodland Park Zoo Youth Volunteer Interpreter Responses

Table A4. After their experience interpreting the Climate Cart, youth volunteer interpreters were more likely to correctly identify greenhouse gases.

Which of the following are greenhouse gases?	Percent selecting	
	Pre-survey (n=31)	Post-survey (n=31)
H ₂ O	7%	56% ¹
Methane	100%	94%
Hydrogen sulfide	33%	44%
Ozone	13%	50% ¹
CO ₂	100%	100%

¹ Statistically significant increase in the number of youth selecting this as a correct response.

Table A5. After their experience interpreting the Climate Cart, youth volunteer interpreters were more likely to correctly identify climate change impacts.

Which of the following affect climate?	Percent selecting	
	Pre-survey (n=31)	Post-survey (n=31)
Latitude	73%	81%
Elevation	87%	88%
Volcanic eruptions	87%	44% ¹
Seasonal precipitation	47%	19% ¹
“Freak” storm events	40%	13% ¹
Increasing CO ₂ levels	100%	88%

¹ Statistically significant decrease in the number of youth selecting this as a correct response.

Table A6. After their experience interpreting the Climate Cart, youth volunteer interpreters were more likely to correctly identify sources of climate change evidence.

Which of the following are natural evidence of climate change?	Percent selecting	
	Pre-survey (n=31)	Post-survey (n=31)
Tree rings	26.7%	66.7% ¹
Pollen	13.3%	53.3% ¹
Ocean & lake sediment layers	60.0%	73.3%
Volcanic sediments	26.7%	33.3%
Ice layers in glaciers	93.3%	100.0%

¹ Statistically significant increase in the number of youth selecting this as a correct response.

Table A7. After their experience interpreting the Climate Cart, youth volunteer interpreters did not show significant change in their identification of current effects of climate change.

What are some of the effects we currently see that have been attributed to climate change?	Percent selecting	
	Pre-survey (n=31)	Post-survey (n=31)
Decrease in mountain snowpack	100%	100%
Movement of new species into areas (where) they had not previously been able to survive	80%	100%
Reduction of species diversity in tropical areas as a result of loss of habitat	60%	60%
Increased runoff in urban areas	33%	40%
Increased drought in many parts of Africa	87%	93%

Brookfield Zoo Youth Volunteer Interpreter Responses

Table A8. After their volunteer experience, youth interpreters were more likely to strongly agree they were confident in their ability to speak to large groups of people.

I am confident in my ability to:	Percent responding “strongly agree”	
	Pre-survey (n=98)	Post-survey (n=98)
Speak to or in front of large groups of people.	27%	47%

Table A9. Over the course of their volunteer experience, youth interpreters who took part in inquiry activities were more likely than youth participating in specimen interpretation to report increased confidence in recognizing their strengths and interests and getting along with others.

I am confident in my ability to:	Percent responding “strongly agree”			
	Facilitated inquiry activities (n=40)		Facilitated specimen activities (n=58)	
	Pre-survey	Post-survey	Pre-survey	Post-survey
Recognize what I’m good at & find ways to use my strengths.	38%	58%	38%	45%
Recognize what I’m interested in & find ways to explore my interests.	60%	78%	68%	62%
Get along with people who are different from me.	50%	70%	49%	52%

Table A10. Almost all youth volunteer interpreters reported gains in their animal knowledge and understanding of environmental threats after their summer experience.

Over the summer, do you feel like you gained understanding or ability in the following areas?	Percent responding “very much” or “much” gain (n=98)
My animal/conservation knowledge	90%
My understanding of threats to the environment	81%

Table A11. After their volunteer experience, youth interpreters who facilitated inquiry activities seemed to have more confidence in their scientific abilities and their abilities to do research than youth who only facilitated specimen activities.

Over the summer, do you feel like you gained understanding or ability in the following areas?	Percent responding “very much” or “much” gain	
	Facilitated inquiry activities (n=40)	Facilitated specimen activities (n=58)
My self esteem and confidence	64%	62%
My understanding of threats to the environment	82%	81%
My ability to see myself as a scientist	80%	64%
My ability to conduct research	71%	57%
My conservation behaviors at home	67%	64%
My conservation behaviors in my community (school, neighborhood)	64%	51%
My animal/conservation knowledge	87%	91%

Brookfield Zoo and Woodland Park Zoo Youth Volunteer Interpreter Responses

Table A12. Almost all youth volunteer interpreters began the summer agreeing climate change was occurring. Following their summer experience, many increased the strength of their agreement.

What do you think? Do you think that climate change is happening? ¹	Percent selecting each response			
	Brookfield Zoo (n=98)		Woodland Park Zoo (n=31)	
	Pre-survey	Post-survey	Pre-survey	Post-survey
Yes, Extremely sure	27%	66%	53%	73%
Yes, Very sure	44%	22%	20%	20%
Yes, Somewhat sure	25%	6%	13%	-
Yes, Not sure	-	1%	7%	-
Don't Know	3%	2%	-	-
No, Not sure	-	-	-	-
No, Somewhat sure	-	1%	7%	-
No, Very sure	2%	1%	-	7%
No, Extremely sure	-	-	-	-

¹ You may have noticed that global warming has been getting some attention in the news. Global warming, or climate change more generally, refers to the idea that the world's average temperature has been increasing over the past 150 years, may be increasing more in the future, and that the world's climate may change as a result. What do you think? Do you think that climate change is happening?

Table A13. Following their summer experience, youth volunteer interpreters reported an increase in encouraging their families to adjust their thermostats and swap out regular light bulbs for CFLs.

	Percent selecting "all of the time" and "most of the time"			
	Brookfield Zoo (n=98)		Woodland Park Zoo (n=31)	
	Pre-survey	Post-survey	Pre-survey	Post-survey
I recycle at home (cans, bottles, etc.).	82%	85%	100%	100%
I encourage my family to turn our thermostat to 65 degrees or lower in winter and up to 78 degrees in the summer.	30%	44%	33%	44%
I encourage my family to swap out all incandescent (regular) light bulbs for compact fluorescents (CFLs) home.	52%	70%	47%	63%
I choose to eat at least one "meatless" meal a week.	45%	51%	53%	63%
I save energy by doing things like turning off lights when I leave the room.	91%	92%	100%	94% ¹
I take the bus, carpool, walk or bike instead of driving when I have the chance.	65%	66%	67%	56% ²
I talk to my family and/or friends about things they can do to help animals or the environment.	59%	66%	27%	50%
I write letters, send emails, or sign petitions about issues affecting animals or the environment.	10%	14%	27%	31%
I look for information about animals or the environment outside of school (watch TV nature shows, read about animals online, etc).	77%	71%	67%	56%
I help restore wildlife habitat (planting trees, cleaning beaches, removing invasive species, etc.).	41%	44%	27%	27%

¹ The percentage who said they did this "all the time" increased from 46.7% on the pre- to 68.8% on the post-survey.

² The percentage who said they did this "all the time" increased from 33.3% on the pre- to 43.8% on the post-survey.

Table A14. After their experience, Brookfield Zoo youth volunteer interpreters who facilitated inquiry activities indicated they more frequently wrote letters and emails on issues affecting animals or the environment than youth who facilitated specimen activities.

	Percent selecting “all of the time” and “most of the time”			
	Facilitated inquiry activities (n=40)		Facilitated specimen activities (n=58)	
	Pre-survey	Post-survey	Pre-survey	Post-survey
I write letters, send emails, or sign petitions about issues affecting animals or the environment.	5%	18%	14%	12%

Table A15. Brookfield Zoo and Woodland Park Zoo youth volunteer interpreters indicated thinking more about climate change following their summer experience.

How much had you thought about climate change before today?	Percent selecting each response			
	Brookfield Zoo (n=98)		Woodland Park Zoo (n=31)	
	Pre	Post	Pre	Post
A lot	34%	46%	13%	25%
Some	44%	36%	33%	31%
A little	21%	17%	53%	44%
Not at all	1%	1%	-	-

Table A16. Compared with their responses prior to the summer, following their summer experience, Brookfield Zoo and Woodland Park Zoo youth volunteer interpreters indicated a stronger belief that climate change would harm them personally.

How much do you think climate change will harm you personally?	Percent selecting each response			
	Brookfield Zoo (n=98)		Woodland Park Zoo (n=31)	
	Pre	Post	Pre	Post
A lot	38%	57%	20%	38%
Some	36%	27%	60%	56%
A little	15%	10%	7%	-
Not at all	1%	1%	7%	6%
Don't know	10%	4%	-	-

Table A17. Compared with their responses prior to the summer, following their summer experience, Brookfield Zoo and Woodland Park Zoo youth volunteer interpreters responded that climate change should be higher priority for the President and Congress.

Do you think climate change should be a low, medium, high or very high priority for the President and Congress?	Percent selecting each response			
	Brookfield Zoo (n=98)		Woodland Park Zoo (n=31)	
	Pre	Post	Pre	Post
Very high	27%	40%	20%	50%
High	47%	42%	67%	44%
Medium	19%	14%	7%	-
Low	7%	4%	7%	6%

APPENDIX B: METHODS

During summer 2011, members of the Brookfield Zoo Youth Volunteer Corps and the Woodland Park Zoo Corps participated in a preliminary evaluation to measure the effects of youth-led interpretation on zoo visitors and the youth themselves. Youth volunteer interpreters are high school students who receive training in educational interpretation and interact with zoo visitors, provide information, answer questions, interpret exhibits and specimens, and facilitate activities. The interpretation models in this evaluation included: (1) specimen-based interpretation and (2) inquiry-based interpretation at Brookfield Zoo, and (3) activity cart-based interpretation at Woodland Park Zoo. All three models were designed to accommodate each zoo's settings, program strengths, popular species, and institutional priorities.

Brookfield Zoo's Youth Volunteer Corps

Youth volunteer interpreters were stationed at the zoo's polar bear or Humboldt penguin exhibits and facilitated either an inquiry activity or a conversation about an animal specimen with zoo guests. As part of their volunteer training, all youth had received instruction on educational interpretation, scientific inquiry, and climate change processes and impacts. In addition, for the first two weeks of the summer returning youth volunteer interpreters mentored new youth volunteer interpreters in zoo navigation and interpretation skills. Youth volunteer interpreters were trained and coached on how to engage in conversations related to four basic climate change topics: (1) What is climate change, (2) What causes climate change, (3) How does climate change affect this particular animal, and (4) What can we do to help the animals?

Specimen-based interpretation: Youth volunteer interpreters were stationed at the penguin or polar bear exhibits in either pairs or triplets and encouraged to engage visitors in conversations about the animals' natural history and the impact of climate change on their ecology. Following traditional zoo interpretation styles, visitors were able to look at and touch specimens (penguin skull and feathers for penguin station; polar bear skull for polar bear station), ask questions, and talk with the youth volunteer interpreters. Upon completion of a conversation regarding climate change, youth volunteer interpreters were encouraged to ask visitors to "make a pledge" to reduce their carbon footprints by promoting the "Polar Pledge" on the Brookfield Zoo website. All 121 teens in the Youth Volunteer Corps Interpretive Track program were trained on this method of interpretation and scheduled at this station throughout the summer.

Inquiry-based interpretation: Separate inquiry activities were developed for the polar bear and penguin exhibits. With the guidance of youth volunteer interpreters, visitors collected and reflected upon on data as a lead in to conversations about how to make sense of scientific data and use it to inform decisions affecting consumer choices and daily life. The inquiry for polar bears asked, "How do activities vary between an older adult male polar bear and a younger male adult polar bear at Brookfield Zoo?" The penguin exhibit inquiry asked, "How does behavior vary between male and female Humboldt penguins at Brookfield Zoo?" Youth volunteer interpreters were stationed in pairs or triplets at each inquiry station and encouraged to ask visitors if they would like to take part in "polar bear" or "penguin" research as appropriate. Once the visitors agreed, they were invited by the youth volunteer interpreter to select an animal for observation. The zoo visitors were then provided with an observation sheet on a clipboard and the youth volunteer interpreter described the animal behavior observation guidelines. Simple behavior and observation worksheets were created for both polar bears and penguins. A randomly selected subset of the Youth Volunteer Corps (32 for penguins, 31 for polar bear) was trained to facilitate these two inquiry activities.

Utilizing a stopwatch that beeped every 20 seconds, youth volunteer interpreters guided the visitors in recording behavioral observations for a two minute period. During this time, the youth volunteers offered interpretation about the animals and related climate change messages. Upon completion of the two minute observation period, youth volunteer interpreters led the visitors to a data board to add the observation data to existing data from that day. The youth volunteer interpreters then facilitated a discussion that encouraged the visitors to reflect on observed behavior patterns. The youth volunteer interpreters also related the observed behavior patterns to additional climate change messages. As a thank you and recognition for participation, the visitor was given a sticker indicating participation in research that day.

Woodland Park Zoo's Zoo Corps

Youth volunteer interpreters were stationed at the zoo's Sumatran tiger exhibit and used an activity cart designed to engage visitors in conversations about climate change. All Zoo Corps teens received training in interpretive skills; additional sessions on climate change interpretation focused on the causes of climate change, and the impacts on wildlife and habitats around the world, and the actions that individuals can take to lower their own carbon footprint.

Activity cart-based interpretation: Woodland Park Zoo initially pilot-tested an activity cart at the zoo's Humboldt penguin exhibit. Formative evaluation of this activity identified a number of challenges to effective implementation. The pilot activity was revised substantially based on these results, and then set up as an activity cart at the zoo's Sumatran tiger exhibit. The revised version of the activity cart included a "tipping point" game focused on climate change and sea level rise. Youth volunteer interpreters approached visitors as they arrived at the Sumatran tiger exhibit and invited them to take part in the game, which engaged visitors in an activity aimed at increasing awareness of the impact of sea level rise on this tiger species and its habitat in the wild.

Visitor surveys

Staff members at each zoo developed visitor surveys to evaluate the impact of the different youth interpreter-facilitated activities on participating zoo visitors. Visitors were approached by zoo evaluators after they completed an activity and were exiting the exhibit area. These visitors were asked to complete a survey about their environmental predispositions, exhibit experiences, climate change attitudes, and conservation behaviors.

At Brookfield Zoo, the visitor survey included six types of question. The survey first asked visitors about their predisposition towards nature and environmental attitudes. A series of questions then asked visitors what they did at the exhibit and what they felt, thought, and learned at the exhibit. Five questions asked about visitors' climate change attitudes; these were taken from a national study of the general public conducted by the Yale Project on Climate Change Communications and the George Mason University Center for Climate Change Communication [12]. Nine behavioral items were included to assess visitors' current actions in addressing climate change. These items concerned various consumer behaviors and other conservation support behaviors. Most of these items came from a visitor survey used in 2009 at three Northwest Zoo & Aquarium Alliance institutions (Oregon Coast Aquarium, Oregon Zoo, and Woodland Park Zoo). Finally, two demographic items asked visitors their age and whether or not they were zoo members.

At Woodland Park Zoo, the visitor survey included questions on climate change attitudes (again, taken from the aforementioned study conducted by Yale and George Mason

Universities). In addition, five open-ended questions were included to assess the extent to which visitors were coming away with new and/or reinforced learning about climate change and its impacts. Finally, the survey contained two questions aimed at adults visiting with children, to explore whether caregivers felt the information presented was (a) an appropriate topic for their child to learn about, and (b) presented in a manner that their child could understand.

Youth volunteer interpreter surveys

Youth volunteer interpreters at both Brookfield Zoo and Woodland Park Zoo were asked a series of questions about climate change both before and after their summer experience. Teens completed the “pre” survey as part of their volunteer training at the beginning of the summer and completed the “post” survey on one of their last days of volunteer service for the summer.

Survey items were selected from the aforementioned Yale and George Mason University study. Youth volunteer interpreters were asked if they thought climate change was happening, if they were worried about climate change, how much they thought about climate change, how much climate change would harm them, and how high a priority climate change should be for the U.S. government. Youth volunteer interpreters were also asked how often they engaged in a series of actions to address climate change, including both consumer behaviors and conservation support behaviors.

At Brookfield Zoo, youth volunteer interpreters were also asked to respond to items about their motivation for becoming a volunteer, their self and social confidence, and their confidence in taking part in science and research. At Woodland Park Zoo, youth volunteer interpreters were also asked to respond to several items to capture their knowledge about climate change processes.