# Why Zoos & Aquariums Matter: Assessing the Impact of a Visit to a Zoo or Aquarium

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# Assessing the Impact of a Visit to a Zoo or Aquarium

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**Executive Summary**

To find out if zoos and aquariums successfully promote conservation, the Association of Zoos and Aquariums (AZA) formed strategic partnerships and undertook a three-year, nationwide study of the impacts of a visit to a zoo or aquarium. We found that going to AZA-accredited zoos and aquariums in North America does have a measurable impact on the conservation attitudes and understanding of adult visitors.

The AZA is using the study results, funded by the National Science Foundation (NSF) and developed through partnerships with the Institute of Learning Innovation (ILI) and the Monterey Bay Aquarium, to better understand and predict our member institutions' contributions to public understanding of animals and conservation. All zoos and aquariums accredited by the AZA must have a commitment to educating their visitors, and this study will help strengthen their ability to provide meaningful and effective conservation education programming.

The findings contribute insights into the overall impact of a zoo or aquarium visit — both immediately and in the months after the visit. They also provide us with an analysis of how seeing wildlife at these institutions affects the way people think about conservation and their own role in helping protect the environment.

Key results include:

• Visits to accredited zoos and aquariums prompt individuals to reconsider their role in environmental problems and conservation action, and to see themselves as part of the solution.

• Visitors believe zoos and aquariums play an important role in conservation education and animal care.

• Visitors believe they experience a stronger connection to nature as a result of their visit.

• Visitors bring with them a higher-than-expected knowledge about basic ecological concepts. Zoos and aquariums support and reinforce the values and attitudes of the visitor.

• Visitors arrive at zoos and aquariums with specific identity-related motivations and these motivations directly impact how they conduct their visit and what meaning they derive from the experience.

Our visitor impact study shows that zoos and aquariums are enhancing public understanding of wildlife and the conservation of the places animals live. We believe these results will help institutions develop even more effective exhibitions and educational programs that help connect people with nature and encourage attitude and behavioral changes that help conservation.

The study began with a comprehensive review of existing literature about the impact of zoo and aquarium visits. The literature supported the conclusion that zoos and aquariums make a difference, but much of the earlier research had been limited in scope and in ways that did not allow the results to be applied generally across all leading zoos and aquariums.

To address this gap, we held a series of public forums with zoo and aquarium professionals. Drawing on feedback from these meetings, researchers from the Institute for Learning Innovation developed a series of studies to investigate specific factors that directly relate to visitor learning and behavior, and to analyze how this information can be used to further enhance visitors' attitudes toward wildlife and nature.

Over a three-year period, more than 5,500 visitors and twelve AZA-accredited institutions participated in the studies. We drew on various quantitative and qualitative methods, including written questionnaires, interviews, tracking studies, and Personal Meaning Mapping (PMM), which identified individual changes in visitors' thinking by allowing them to respond to a series of questions prior to and after their visit.

Fifty-four percent of the individuals surveyed offered comments about the elevated awareness of their role in conservation as a direct consequence of their visit. Forty-two percent commented on the important role that zoos and aquariums play in education.

We called a subset of the participants seven to eleven months after their visit to determine the impact of the visit over time. Sixty-one percent of visitors were able to talk about what they learned from their previous visit, and 35% reported that the visit reinforced their existing beliefs about conservation, stewardship and
love of animals.

## Overview of the multi-institutional research program

*For the first time, we have reliable data validating the positive impact zoos and aquariums have in changing visitors' feelings and attitudes about conservation. This study clearly shows that visitors believe that accredited zoos and aquariums are deeply committed to animal care and education, and that we play an important role in species conservation. These findings enhance our goal to build America's largest wildlife conservation movement.*

Jim Maddy, President and CEO, Association of Zoos and Aquariums.

Zoos and aquariums all over this country are making a difference for wildlife and wild places by sharing their passion for conservation with more than 143 million visitors a year. By creating interactive exhibits, interpretive tours and educational programs that bring people face-to-face with living animals, zoos and aquariums profoundly influence their visitors in significant ways.

But exactly how do zoos and aquariums inspire visitors to care about and care for the natural world, and take meaningful conservation action? What are the changes in conservation knowledge, understanding and attitudes of adults who visit a zoo or aquarium? How does what visitors see and do during their visits contribute to these outcomes? And how are zoos and aquariums measuring the impact?

Over the years, visitor research showed how people relate to the natural world, but gave an incomplete picture about the impact zoos and aquariums have on conservation-related knowledge, attitudes and behavior. To address this deficit of information, the AZA Conservation Education Committee assembled a national advisory group to launch a research program involving multiple AZA institutions. Initially called the Multi-Institutional Research Project (MIRP), the acronym is now used as an umbrella term to encompass studies being conducted by many institutions on various aspects of zoo and aquarium visitor impact.

MIRP's initial study summarized what is already known about the impact of a zoo or aquarium visit in a thorough literature search, Visitor Learning in Zoos and Aquariums: A Literature Review (Dierking et al, 2002).

The literature review revealed that, although zoos and aquariums promote the importance of inspiring conservation action, we have done little to assess our impact in this area. While there is some evidence of zoo experiences resulting in changes in visitors' intention to act, there are few studies demonstrating actual changes in behavior.

The more we learned, the more we realized how much we didn't know. It became abundantly clear that we faced a knowledge gap.

- How do aquariums and zoos contribute to people's **understanding and perceptions** of animals and their conservation?

- How do aquariums and zoos contribute to people's **personal and emotional connections** to animals and their conservation?

- How do zoos and aquariums contribute to the **ways people act and behave** toward animals?

- How do we **increase** these impacts? What do we do that is successful?

- **Who** are our visitors?

After holding public forums with zoo and aquarium professionals across the country to discuss these questions, and delving further into social research about how people learn, we concluded that knowledge, affect and behavior are inextricably linked.

That led AZA, together with the Institute for Learning Innovation (ILI), a non-profit leader in research on learning in free-choice learning settings, and the Monterey Bay Aquarium, to undertake a major research initiative and seek funding from the National Science Foundation (NSF). The research was designed to assess the impact of a zoo and aquarium visit on adults, as well as develop a set of tools that every institution could use for assessing their conservation impact on visitors.

Twelve AZA-accredited institutions and over 5,500 visitors participated in the studies over a three-year period. Institutions varied in size and geographic location to ensure a representative sample, and included:

- Arizona-Sonora Desert Museum in Tucson, Arizona
- Binder Park Zoo in Battle Creek, Michigan
- Brandywine Zoo in Wilmington, Delaware
- Bronx Zoo in Bronx, New York
- Florida Aquarium in Tampa, Florida
- Monterey Bay Aquarium in Monterey, California
- National Aquarium in Baltimore, Maryland
- New York Aquarium in Brooklyn, New York
- North Carolina Aquarium at Roanoke Island in Manteo, North Carolina
- Oregon Coast Aquarium in Newport, Oregon
- Philadelphia Zoo in Philadelphia, Pennsylvania
- Salisbury Zoo in Salisbury, Maryland

## Section One: Assessing the Impact of a Visit to a Zoo or Aquarium

Visitors do not arrive at a zoo or aquarium *tabula rasa*; they arrive with prior knowledge, experience, interest and motivations for their visit, what John Falk and Lynn Dierking (2000) refer to as the "Personal Context." Recent research investigations confirm the important influence these factors have on visitor learning. Unlike demographic variables, Personal Context variables have the potential to predict changes in visitor knowledge and conservation attitudes.

Testing this latter assumption represented a major part of this investigation. To understand the complexity of adult learning in zoos and aquariums, we needed to capture the essence of what motivates visitors so we could better predict what they might gain from their visit. Only then might we develop an understanding of how time spent at a zoo or aquarium impacts visitors.

Our study set out to make a fundamental contribution towards a nationally shared comprehension of the role and impact of zoos and aquariums in facilitating enhanced public understanding of animals and their conservation. To achieve that, we sought to answer the following research questions:

1. How can we best capture the pre-existing conservation knowledge, attitudes/affect, behaviors and visit motivations of entering zoo and aquarium visitors, and how do these entering characteristics contribute to changes in public understanding of animals and their conservation?

2. What development, elaboration and/or extension of a visitor's knowledge of and attitudes towards animals and their conservation result from a zoo or aquarium visit?

To create a generalizable model and measure of zoo and aquarium cognitive and affective learning, we set up the study in two phases. The first focused on understanding something about the nature of the visitors who come to zoos and aquariums; in particular their motivations for visiting. The second phase focused on measuring changes in visitor's short and long-term conservation-related knowledge and attitudes. We believe that these two studies represent seminal research that will have long-lasting and large-scale benefits for the zoo and aquarium community as well as for the broader free-choice learning community.

**Phase I Methodogy**

We've learned that visitor demographics by themselves are not that helpful in telling us what knowledge and attitudes visitors bring with them during a visit, and how they might change afterwards. Previous free-choice learning research by Falk and Storksdieck (2005) found that the motivations individuals have for visiting free-choice learning institutions appear to be identity-related. Although, in theory, visitors to such institutions could possess an infinite number of identity-related visit motivations, the motivations of the vast majority of visitors appeared to cluster around just a few identity-related reasons. Based upon these findings, Falk (2006) proposed clustering these identity-related motivations into five distinct categories:

"**Explorers**" are curiosity-driven and seek to learn more about whatever they might encounter at the institution;

"**Facilitators**" are focused primarily on enabling the experience and learning of others in their accompanying social group;

"**Professional/Hobbyists**" feel a close tie between the institution's content and their professional or hobbyist passions;

"**Experience Seekers**" primarily derive satisfaction from the fact of visiting this important site; and

"**Spiritual Pilgrims**" are primarily seeking a contemplative and/or restorative experience.

Falk further postulated that these identity-related motivations were multi-dimensional and effectively encapsulated many previously identified important entering-visitor variables such as prior knowledge, prior interest, visitor agenda, social group and prior experience. In Phase I of this investigation we set out to test this hypothesis within the context of zoos and aquariums. To do this, we designed an instrument to measure zoo and aquarium visitors' identity-related motivations. We began by generating 125 items representing the five different identity-related motivational factors. We tested these items and formats at four zoos and four aquariums using traditional methods and statistical techniques of instrument development. At the end of Phase I, we identified several items for clarification and retesting.

The final product from Phase I yielded a simple-to-use, refined instrument that we believe validly and reliably measures why people come to zoos and aquariums. In addition to forming a key measure in our Phase II study, we believe these measures can be used as a robust way to capture this important independent variable in a wide variety of future research. (The complete methodological approach is included in the Appendix.)

**Phase II Methodology**

We collected data in Phase II of the study to answer a range of research questions related to conservation learning resulting from a general adult visitor's experiences at a zoo or aquarium. The four sites utilized in the study – two zoos and two aquariums – represented the broader zoo and aquarium community. We wanted to capture the most generalizable picture possible of the conservation knowledge of zoo and aquarium visitors as they enter and as they exit, as well as the responses, purposes, and general outcomes of their visit.

A random sample of 1,862 adults across all four sites completed pre- and post-visit instruments. The research instruments used in the study were designed to measure visitors' identity-related visit motivations as well as a range of conservation-related cognitive and affective variables identified as key to the study. In addition, two other data sets were collected; a series of one-on-one interviews to determine where in the zoo or aquarium visitors went and why (n=356) and long-term follow-up data (n=83) conducted through either telephone interviews or an email on-line survey.

*Identity-Related Visit Motivation*

The psychometric instrument constructed in Phase I became the identity-related visit motivation instrument in Phase II. It listed 20 statements representing four examples from each of the five key identity-related motivations common to zoo and aquarium visitors. Visitors selected the five statements that best explained why they chose to visit the zoo or aquarium on that particular day; and then ranked each of the selected five statements in importance on a seven-point Likert-type scale.

*Cognitive Measure Development*

Collaborating with senior professionals from the zoo and aquarium community, we developed 10 broad-knowledge messages and 10 outcome messages that professionals believed their zoo or aquarium strives to communicate to the public. Synthesizing these responses into three constructs of biodiversity, habitat, and ecosystems, we then developed test items and pilot-tested them. The final instrument consisted of 10 multiple-choice questions.

*Affective Response Measure*

We determined the affective response to the visit by asking visitors to respond to a series of 13 items on an exit survey; each of the exit-only questions required visitors to indicate, on a seven-point Likert-type scale, their level of agreement with statements that related to their attitudes towards 1) conservation; 2) their ability to effect change; and 3) the role played by zoos and aquariums in promoting conservation. We also asked visitors to reflect on how they perceived they would have answered the same items before their visit to the zoo or aquarium (retrospective-pre). This type of post-only, retrospective-pre measure has been shown to be more reliable than traditional pre/post measures for assessing attitudes (Rockwell & Kohn, 1989; Stevens & Lodl, 1999).

*Personal Meaning Mapping*

To better understand visitors' prior knowledge of and interest in zoos and aquariums as well as to understand the individual's perception of the relationship between zoos and aquariums and conservation, we used a methodology called Personal Meaning Mapping (PPM) (Falk, Moussouri & Coulson, 1998).

Approximately 20 visitors at each of the four sites (n=86) participated in a paired PMM interview. Just prior to entering the zoo or aquarium, we asked visitors to share their thoughts about a specific prompt: the words "Zoo – Conservation" or "Aquarium – Conservation." Upon exiting the zoo or aquarium, these visitors were asked to add to, subtract from, or otherwise modify any thoughts they had shared previously on the subject. Subsequent to the visitor writing down his/her responses, an investigator interviewed them in depth, utilizing the words they wrote down as prompts.

*Reflective Tracking Study*

We wanted to see if visitors' entering identity-related motivations affected the ways they behaved during their visit. We could not conduct a true tracking study as part of this investigation because of both the extensive visit times and large numbers of the subjects. Instead, we created a reflective tracking approach that built upon the free-choice nature of the zoo and aquarium visits. A random sample of visitors was intercepted by researchers as they entered the zoo or aquarium and invited to participate in this part of the investigation. Comparable to our standard protocol, one adult within each social group who agreed to participate completed the pre-visit instruments (knowledge and motivations). Upon leaving the zoo or aquarium, the visitors identified themselves to the researcher and were given a map of the zoo or aquarium. Individuals then described where they went and what they did. We followed up visitor responses by asking additional questions designed to help us understand what motivated them to make the visit decisions they made.

*Long-Term Impact Study*

We asked all individuals who completed pre/post measures if they would be willing to provide phone and/or e-mail contact information so that they could be re-contacted later, as part of a follow-up study. We conducted the long-term impact study through both telephone and e-mail interviews of a random sample of individuals providing contact information (n=83). We also designed parallel instruments for use either by telephone or e-mail consisting of a series of open-ended questions. The questions were designed to assess visitors' recall of the particular visit seven to eleven months subsequent to the visit. Visitors were asked to recall: salient events if any from the day; motivations for the visit; if those motivations changed for any reason during the visit; and how they perceived the visit affected their knowledge and attitudes.

**Results and Findings**

Our three-year visitor impact study found that a visit to an accredited zoo or aquarium in North America has a measurable impact on the conservation attitudes and understanding of adult visitors. Overall, we found that:

> Visitors arrive at zoos and aquariums with specific identity-related motivations and these motivations directly impact how they conduct their visit and what meaning they make from the experience.
>
> Overall, visitors bring with them a higher-than-expected knowledge about basic ecological concepts. A small percentage group of visitors (approximately 10%)
> did show significant changes in their conservation-related knowledge. However because of the higher than expected entering knowledge of most visitors, there were no statistically significant changes in overall knowledge.
>
> Most visitors (61%) found that their zoo and aquarium experience supported and reinforced their values and attitudes towards conservation.

Visits to accredited zoos and aquariums prompted many individuals (54%) to reconsider their role in environmental problems and conservation action, and
to see themselves as part of the solution.

Roughly half (42%) of all visitors believed that zoos and aquariums play an important role in conservation education and animal care.

A majority (57%) of visitors said that their visit experience strengthened their connection to nature.

*Identity-Related Motivations*

We had hypothesized that it should be possible to segment visitors as a function of their identity-related entering motivations. The results suggest that it was indeed possible to segment visitors using this framework. Half of visitors (48%) began their zoo or aquarium visit with a single, dominant identity-related motivation; the rest possessed multiple motivations for visiting. Explorers and Facilitators were the two most common dominant motivations, each representing about 16% of visitors. However, all five of the major identity-related motivations were well represented in the sample.

A different profile of motivations was found at each of the four institutions with the two zoos having fairly similar profiles. The profile of the two aquariums differed, but these differences may have been due to the fact that data were collected in different seasons rather than representing a real difference in the profiles of aquarium visitors. Unfortunately, we cannot know from this study.

The study strongly supported the hypothesis that visitor's identity-related motivations subsumed a variety of entering Personal Context variables. Individuals with differing degrees of prior knowledge, interest, beliefs and attitudes tended to cluster into different identity-related motivational groups.

An interesting result of the study was that grouping visitors by identity-related motivations did appear to provide significant insights into in-institution behaviors and both short and long-term post-visit outcomes. In fact, segmenting visitors by identity-related motivations (Explorers, Facilitators, et al) provided the best way to understand both what visitors did in the institution as well as the short and long-term meaning they made from the experience. This finding has important ramifications for both future research and educational practice.

*Gains in Knowledge*

Overall, zoo and aquarium visitors have a broad range of knowledge and know more about major ecological concepts before they visit than we thought; consequently there was no overall statistically significant change in understanding seen. However, a few visitors (in particular Experience Seekers) showed significant changes in the conceptual understanding we chose to measure over the course of their visit ($F = 1.906$, $p = .026$). This is not to say that the other visitors do not learn from their visit. For example, we knew from previous studies that after a visit, people who visit a zoo or aquarium often know more about specific animals or exhibits. Because we were striving in this study for changes in visitors' general conservation knowledge, we did not measure the specific knowledge that visitors might have acquired from an individual zoo or aquarium. If we had sought to measure this kind of knowledge, we very likely would have found significant visitor gains.

*Changes in Attitudes*

We were not surprised to find that visitors are predisposed towards animals and have a strong, positive orientation towards zoos and aquariums. We were pleased to discover that their zoo and aquarium visits supported and reinforced these values and attitudes ($t = 320.834$, $p<.001$). Importantly, the data showed that most visitors leave the zoo or aquarium thinking differently about their role in environmental problems. A major finding was that individual action messages, such as "There is a lot I can to do conserve," and "I am part of the solution to nature's problems," significantly increased as a consequence of the visit (61% and 54% increases, respectively).

We also found that the vast majority of visitors perceived aquariums and zoos as places that care about animals (42% increase), and that play an important role in conservation (64% increase). Facilitators ($F=13.097$, $p=.000$), Professional/Hobbyists ($F=3.898$, $p=.009$) and Experience Seekers ($F = 1.908$, $p = .026$) were the visitor groups most likely to show significant positive change in their attitudes towards conservation and the role of zoos and aquariums.

Data from the Personal Meaning Mapping exercise strongly reinforced the affective findings described above. Nearly half (46%) of the individuals interviewed with this method offered unprompted comments related to personal actions they planned on taking as a consequence of their visit. More than a third of visitors (39%) volunteered comments related to the important educational role zoos and aquariums play in supporting conservation. Also, about half of visitors (41%) made comments related to the role of zoos and aquariums in preserving and protecting animals.

**Long-term Learning and Attitudes**

We know that a visit to a zoo or aquarium does result in changes in visitor learning, attitudes and behaviors. Yet, these changes can only be partially understood by collecting data immediately after the experience, while the visitor is still at the zoo or aquarium.

A much more complete picture comes to light weeks and months later, after individuals have had a chance to make sense of their experience, integrate their learning into their lives, and act upon any new interests or motivations inspired by their visit (see review by Anderson, Storksdieck & Spock, 2007).

Nearly a year after their zoo or aquarium visit, virtually all participants could talk about their visit and remember a number of details about the experience. Roughly half (42%) of all visitors we interviewed mentioned a particular animal or species as the highlight of their visit, while for one in five visitors (21%), the physical layout and aesthetics of the surroundings were important and memorable. Importantly, given our earlier findings related to changes in knowledge, over half of visitors (61%) talked to us about what they learned (either reinforced prior understandings or new knowledge gained) from their zoo or aquarium visit.

When asked what the zoo or aquarium hoped visitors would take away from their visit, 40% of visitors mentioned conservation-oriented themes. A large majority of visitors (76%) indicated that they believed that zoos and aquariums are invested in conservation and education. Once again reinforcing our earlier findings, a large number of visitors (66%) said that zoos and aquariums play an important role in species preservation and in increasing their visitors' awareness of conservation issues.

## Section Two: Implications for Zoos and Aquariums

Zoos and aquariums do make a difference in the conservation knowledge and attitudes of visitors. How do we build on that knowledge to enhance zoo and aquarium conservation goals and connect those goals

to the visitor experience? We have thoroughly reviewed the research findings and compiled the following take-home messages and recommendations for improving institutional practice:

**What do visitors learn?**
*Finding*: Visitors already know a lot about basic biological concepts.
*Implication*: Zoos and aquariums should spend more time on specific conservation and natural history messages. Most visitors are ready to be more engaged in advocacy efforts.

**How do visitors feel about conservation?**
*Finding*: A visit increases visitors' feelings that they are part of conservation. They leave with a stronger idea of their role in environmental problems: "I'm the solution." The largest gains in the questionnaire items related to individual action: "There's a lot I can do for conservation."
*Implications*: We should continue to emphasize conservation action in educational programming and exhibitions at our zoos and aquariums. Visitors want to be involved in conservation and look to us to find out how.

*Finding*: We convey that we care about animals.
*Implication*: We should continue to explain our animal welfare standards and demonstrate how we care for animals in our care and in the wild.

*Finding*: Visitors may see their visit as a nature experience; we can successfully encourage them to explore and value nature.
*Implication*: Other research has shown that spending time in nature is critical for the development of an environmental ethic and in promoting healthy children. For urban dwellers, we may be their best "nature experience" – a strong marketing point.

**Why do visitors visit?**
*Finding*: Most visitors come for multiple reasons, but the majority of visitors have a single dominant identity-related motivation.
*Implications*: Aquariums and zoos should offer multiple layers of experiences to appeal to the broad array of visitor motivations, goals, and learning outcomes. They should design experiences for each dominant group in order to better match their desired outcomes:

***Facilitators***
*Finding*: Facilitators are one of the two major groups with a dominant motivation.
*Implications*: First and foremost, Facilitators desire a social experience aimed at the satisfaction of someone else. Zoos and aquariums need to offer them opportunities for social interaction at exhibits and during programs, such as opportunities to talk with staff, and to provide places for regrouping and processing of their visit. Zoos and aquariums also need to ensure that parents, in particular, have the tools to support their children's learning.

***Explorers***
*Finding*: Explorers, who visit for personal interests, are also one of the two major groups with a dominant motivation. Explorers were one of the two groups who showed neither significant changes in cognition or affect.
*Implications*: An Explorer's visit satisfaction is tied to the quality of the learning experience, including the ability to see animals and the interpretation. Ironically, zoos and aquariums often tend to design for this group because they are so much

like zoo and aquarium professionals, but the data suggests institutions are not necessarily being successful with this approach. Zoos and aquariums need to provide Explorers with new or surprising offerings, such as temporary exhibits or in-depth programs and create more challenging experiences than currently seem to exist in some zoos and aquariums.

***Experience Seekers***
*Finding*: Experience Seekers visit as tourists or they value the zoo or aquarium as part of the community.
*Implications*: A unique program or offering that surpasses other local attractions will draw these kinds of visitors. Experience Seekers possess the least knowledge and the lowest expectations for their visit; they also represented a small number of visitors in our sample (7.8%). However, this was the one group that showed significant positive change in both cognition and affect.

***Professional/Hobbyist***
*Finding*: A small (roughly 10%) group but important group for zoos and aquariums, Professional/Hobbyists are tuned into institutional goals and activities.
*Implications*: Professional/Hobbyists are likely interested in premium programs, for example, photo tours, dive trips, how-to workshops, and theme nights. They are also a great source of volunteers, members and donors.

***Spiritual Pilgrim***
*Finding*: Spiritual Pilgrims are the smallest group overall (4%), with very different needs, and tend to be more common in aquariums.
*Implications*: Aquariums and zoos need to balance the needs of Spiritual Pilgrims with those of other visitors (e.g., the very social Facilitators). Zoos and aquariums could create areas for reflection, and offer programs at quieter times of day or year. Like Professional/Hobbyists, Spiritual Pilgrims represent a great source of volunteers, members and donors.

## Section Three: Visitor Impact Toolbox

One of the major goals in this study was to produce a series of evaluation tools that would assist zoos and aquariums in better understanding their visitors; why they come, what they do and what they take away from the experience. The following toolbox items, some of which are direct products of this study, will be available for all AZA-accredited zoos and aquariums.

**Conservation Affective Instrument**
A major goal of all AZA-accredited zoos and aquariums is communicating the importance of conservation, the role that individuals can play in supporting conservation and the vital role that zoos and aquariums are playing in promoting and supporting conservation. In direct consultation with the AZA Conservation Education Committee and with input from this project's national advisors and participants at the AZA's schools for professional development, the Institute for Learning Innovation developed an affective assessment tool that validly and reliably measures changes in visitors' attitudes towards these key conservation topics.

The toolbox provides a guide to implementing and utilizing this instrument within any institution. It helps aquariums and zoos measure their effectiveness in supporting visitor conservation attitude change; it also enables institutions to contribute to the development of a national AZA database, which helps all AZA-accredited zoos and aquariums better substantiate the contribution they are making to public conservation education.

**Identity–Related Motivational Categories of Visitors**
We know that many different types of people come to zoos and aquariums. We also know that people visit for multiple reasons. These differences influence how individuals use these institutions and what benefits they derive. Historically, zoos and aquariums have used demographic categories like age, social group, race/ethnicity, level of education and visit frequency/infrequency as a means for segmenting audiences. Recent research, including research conducted as part of this study, is revealing powerful new and more robust ways to understand and segment zoo and aquarium visitors.

This new strategy utilizes a series of identity-related motivations for distinguishing among visitors. Every visitor enters with a set of expectations that can be categorized as falling within one or some combination of five major identity-based categories: Experience Seeker, Professional/ Hobbyist, Spiritual Pilgrim, Facilitator, or Explorer. Research shows that individuals not only choose to visit or not visit zoos and aquariums based upon these identity-based motivations, but it also shows that these motivations largely determine how visitors conduct their visit and strongly influences long-term learning and sense of satisfaction with a visit.

The toolbox includes tips on how to identify and think about these five identity-based motivational categories, as well as suggestions on how to use them to facilitate and improve interpretation, marketing, evaluation and even fund-raising.

**Personal Meaning Mapping**
Personal Meaning Mapping (PMM) is based upon current cognitive and neural science research that shows learning is a relative and constructive process. PMM is designed to quantifiably measure how an educational experience uniquely affects each individual's conceptual and attitudinal understanding. PMM takes into account each visitor's unique, personal construction of knowledge and experience. PMM also facilitates the identification of individual visitor's prior knowledge, concepts, attitudes and vocabulary (baseline) about a particular subject, such as zoos, aquariums and conservation, and provides a mechanism for meaningfully assessing how these change as a function of a zoo/aquarium experience. By comparing the relative and unique impact of a single educational experience across many different people, PMM allows for an overall assessment of the impact of that experience on the public.

The toolbox includes a guide to literature about PMM as well as a "how to" manual for implementation and analysis of Personal Meaning Mapping.

**Reflective Tracking Study**
Tracking, a tried-and-true technique for understanding visitor behavior and learning, involves following visitors throughout the course of their visit to know where they went and what they did. However, true visitor tracking for a zoo or aquarium visit can be enormously challenging and costly because of both the extensive visit times and large number of subjects. We certainly encountered that in this study, a reality that was compounded by the large numbers of the subjects with which we were dealing. To get around this problem and deal with the unique realities of zoos and aquariums, we created a new technique we call "reflective tracking."

We approached visitors as they entered the zoo or aquarium and asked if they would be willing to participate in an in-depth inquiry into their visit. In exchange, we offered them the opportunity to discover "how many steps they will take today" using a pedometer. Amazingly, as we found with similar interventions, virtually everyone sought us out at the end of their visit, returned their pedometers and consented to being interviewed about their visit. Using a map of the facility, individuals or families

were encouraged to show where they walked and where they stopped. The visitors could either mark their journey through the facility on the map or use the map to point where they had gone and have the researcher place the mark on the map. We used open-ended questioning to illicit information on who made the suggestions/decisions on where to go within the group and how the group determined time allocation within and across the visit.

The toolbox includes a "how to" manual for conducting and adapting this reflective tracking instrument for use in any zoo or aquarium.

## Appendix One: Study Methodology

**Phase I**

Phase I of this two-part research study aimed to create a meaningful categorization of visitors based on their knowledge, interests, beliefs, attitudes, behaviors, and motivations; characteristics that directly affect the core educational outcomes of a zoo and aquarium visit. Phase I research was built upon previous investigations by the Institute for Learning Innovation researchers that suggested that many of these multiple "entry" variables could be successfully subsumed into a single, multi-dimensional variable related to visitor's identity-related motivations.

Hence, Phase I research began with a confirmatory study to verify the validity, within a zoo and aquarium context, of using an identity-related motivational classification developed as part of a multi-year research investigation of visitors to science centers. The pilot research was complemented by an extensive literature review. These two investigations – the confirmatory study and the literature review – reinforced the validity of this approach and provided the necessary insights to move toward the creation of a research tool for measuring the identity-based motivations of zoo and aquarium visitors.

The five identity-related motivations are:

- Experience Seeker
- Professional/Hobbyist
- Spiritual Pilgrim
- Facilitator
- Explorer

Designing a single measure for validly and reliably capturing zoo and aquarium visitors' identity-related motivations required an intensive instrument development process. The full report details the process, and includes the statistical analysis and modifications. The remainder of this summary outlines the steps used in the process.

First, using language derived from interviews in the confirmatory study, an "item bank" was generated by selecting statements that clearly related to each of the five unique zoo and aquarium visitor identity-related motivations. According to Falk (2006), Explorers visit to satisfy their own curiosity and desire to learn. By contrast, the Facilitator is someone who is visiting to satisfy the needs of others. The Professional/Hobbyist visits because of a specific interest, knowledge or training in an area related to the zoo or aquarium and is looking to specifically extend that interest, knowledge and or training. The Experience Seeker is someone who is visiting, often from out-of-town, who wants to have the experience of visiting a zoo or aquarium; often because this is what someone from out-of-town does when visiting this city. Finally, the Spiritual Pilgrim goes to the zoo or aquarium for reflective purposes; to get away from the noise and hubbub of the city or to enjoy the peacefulness of the setting.

Construct validation was assured by asking a panel of experts from the AZA-NSF Advisory Board[1] to confirm that the factors and items were complete. The items were placed into five scales, one for each factor. A differential scale comparing descriptions of each of the factors in a paired comparison (rotation) was also developed and tested for usability and reliability. This differential scale was constructed to serve as a constant to determine weight response patterns on the items, or as a dependent variable for analysis.

At the first four sites (Sonoran Desert Museum, Monterey Bay Aquarium, Aquarium of the Pacific, and Binder Park Zoo), a total of 1,585 individuals completed the differential scale and one of the factor scales. After a series of statistical analysis, a weighted (dampened) scoring system was used to select the strongest indicator items for each of the scales. The three dominant weighted items and the three most negative (indicating selectivity) were identified and, with some modifications, selected as the items for the second round of instrument testing. Twenty-five items were selected and two different formats (Likert-type and equal appearing) were created. On the Likert-type scale, items were clustered by factor then randomly placed. For the equal appearing scale, factors and items were randomly ordered.

After gathering data at sites five and six (Bronx Zoo and North Carolina Aquarium-Roanoke Island; N=800), scales were analyzed using a series of statistical processes; principal component factor analysis proved to be the most descriptive. For the Likert-type scale, the three dominant loading items were selected—and in some cases modified—to create a scale with 15 items that represented the five unique zoo and aquarium visitor's identity- related motivations. In order to maximize score range, only one item from each motivational category was removed from the equal appearing scale. Due to analysis differences between the scales, the items selected for each scale were not necessarily the same.

The final two sites (Florida Aquarium and Brandywine Zoo; N=654) were used to compare the scales. At these sites, the differential scale was eliminated because it caused frustration among some participants who did not understand how to complete it. The two scales—the Likert-type and equal appearing—were then completed by all respondents, providing a strong base for correlational analysis.

The process to design an instrument to measure zoo and aquarium visitor's identity- related motivations began with the confirmatory study and literature review, which informed the creation of items. More than 100 items representing the five different motivational factors were generated initially. These items and formats were tested using traditional methods and statistical techniques of instrument development. At the end of Phase I, several items had been identified for clarification and retesting. The final product from Phase I was a simple-to-use refined instrument that validly and reliably measures why people come to zoos and aquariums and can be used as a robust independent variable in a wide variety of future research; in particular in Phase II of Assessing the Impact of a Visit to a Zoo or Aquarium: A Multi-Institutional Research Project.

## Study Methodology: Phase II

Data was collected during the Phase II study in order to answer the study's research questions related to the conservation learning resulting from a general adult visitor's experiences at a zoo or aquarium.

The questions guiding this component of the study were:

[1] Project National Advisory Board: Eugene Matusov, Rachel Kaplan, Scott Paris, Cheryl Asa, Nancy Falasco, Bill Mott, Jackie Ogden, Jeff Hayward, Kathy Wagner, Carol Saunders, and Eric Reinhard.

What conservation messages do zoos and aquariums consistently strive to communicate to the public?

What is visitors' entering knowledge of these conservation messages?

What is visitors' exiting knowledge of these conservation messages?

How does exiting knowledge relate to visitors' entering conditions such as their identity-related motivations for the visit?

What are visitors' affective outcomes from a visit to zoo or aquarium and how do these outcomes relate to changes in visitor knowledge?

Does a zoo or aquarium visit change an individual's ability to discuss conservation and the role of zoos or aquariums in supporting conservation?

What are some of the longer-term impacts of a visit to a zoo or aquarium and are these impacts influenced by the individual's pre-visit identity-related visit motivations?

The four sites utilized in this part of the study–Philadelphia Zoo, Salisbury Zoo, New York Aquarium and National Aquarium in Baltimore—were selected to be as broadly representative of the zoo and aquarium community as was possible within the financially- imposed constraint of selecting only institutions in the Mid-Atlantic area. Our goal was to have a mix of institutions that would enable us have as generalizable a picture as possible of the entering and exiting conservation knowledge of typical adult zoo and aquarium visitors as well as the responses, purposes, and general outcomes of a visit to a typical zoo or aquarium.

*Cognitive Measure Development*

A multi-step process involving a representative sampling of zoo and aquarium professionals was utilized to identify the "common messages" that most zoos and aquariums strive to communicate to the public. The first step involved asking a nationally prominent group of twelve zoo and aquarium educators and researchers during a half-day workshop to generate as complete a list as possible of the cognitive messages they believed were communicated by zoos and aquariums nationally.

In addition to knowledge-related messages, the group also identified several affective outcome messages (perceptual knowledge, awareness). This list was then discussed and clarified to reduce duplications and to insure broad consensus. The resulting messages were then organized and refined and submitted to a second national group of zoo and aquarium educators who engaged in a process of reviewing all the messages, adding or removing messages, and then voting on the 10 knowledge messages that their own zoo/aquarium strives to communicate to the public and the 10 affective messages that their own zoo/aquarium desires as an outcome of a visit.

The top items were explored for themes and four clear categories of conservation knowledge messages emerged: biodiversity; endangered species; habitat; and ecosystem. From the various statements written by zoo and aquarium educators, test items were developed in each of the four categories. A third panel of experts including both ecologists and educators, reviewed the test items for validity and identified those that were the best "indicators" within each category.

These test items were then constructed into multiple-choice questions. Detractors were developed for each item using the standard that all choices should look probable to the uninformed; two should look equally probable to the somewhat informed; only one is clearly correct. The resulting set of questions was tested first at the National Aquarium in Baltimore (n=65) and item analysis were run. The questions were revised and again 3tested at the Columbus Zoo and Aquarium (n=90) and item analysis again run. A final revision and reliability test at the Columbus Zoo and Aquarium (n=75) provided the distribution of response consistency expected between tests and suggested that eight of the ten items had the intended distribution for classical test analysis. For nine of the ten items, the correct answer received the plurality or majority (on two items) of responses and had the lowest deviation. On all items, two of the detractor items were closely aligned statistically.

Overall, analysis showed that for all questions the correct response was identified clearly by those who knew the correct response, the two "middle items" were equally confusing to those who did not know the correct response but were making an educated guess, and there was one item for each question which respondents would pick if they were purely "guessing". For the final instrument, the sequence of detractors was randomly assigned for each question and several forms of the instrument were created to randomly order test questions. For the post, the order of items was again randomly altered. The final instrument was made up of ten, multiple-choice questions.

*Identity-Related Visit Motivation*

Previous research (cf., Falk & Storksdieck, 2006) has shown that a visitor's entering conditions, for example prior knowledge, interest, motivation and social group, strongly influence the zoo and aquarium visit experience. Subsequent research, including research conducted during Phase I of this project (Falk, 2006; Heimlich, et al., 2004) demonstrated that a single, composite variable defined as a visitor's identity-related visit motivations could be used to subsume many of these categories. As described in detail in Phase I reports (cf., Heimlich, et al., 2004) and above, investigators developed, through a psychometric procedure, an instrument that reliably and validly measured visitors' identity-related motivations. The instrument listed 20 statements. Visitors selected the five statements that best explained why they chose to visit the zoo or aquarium on that particular day. Then each of the five statements was selected, and ranked in order of importance on a seven-point Likert-type scale.

*Affective Response Measure*

Affective change was captured by asking visitors to respond to an exit survey. The exit-only affective instrument was comprised of 13 items, each of which required visitors to indicate on a 7-point Likert-type scale their level of agreement with the statements that related to their attitudes towards conservation and the role played by zoos and aquariums in promoting conservation. Visitors were also asked to reflect on how they believed they would have answered before their visit to the zoo or aquarium. The use of a post with retrospective pre-measure, as opposed to a more common pre- and post-test, was selected for this study because studies (see for example: Rockwell & Kohn, 1989; Stevens & Lodl, 1999) have shown that this approach yields greater reliability. Traditional pre/post measures suffer from ceiling effects because individuals tend to over-report their attitudes on the pre-measure. The scale used in this study had reliability co-efficient of .842. A confirmatory factor analysis revealed all items loading onto one component and explained 41.5% of the variance.

*Personal Meaning Mapping*

To better understand visitors' prior knowledge of and interest in zoos and aquariums and the relationship individuals perceived between zoos and aquariums and conservation, as well as assessing how the zoo and aquarium visit contributed to visitors' thinking about these topics, investigators used a methodology

called Personal Meaning Mapping (PMM) (Adams, Falk & Dierking, 2003; Falk, Moussourri & Coulson, 1998; Falk, 2003).

PMM, developed by John Falk and his colleagues at the Institute for Learning Innovation, is based upon current cognitive and neural science research that shows learning is a relative and constructive process. PMM is designed to quantifiably measure how an educational experience uniquely affects each individual's conceptual and attitudinal understanding. The power of PMM as a methodology is three-fold:

> PMM yields reliable quantitative results from a qualitative method of data collection which takes into account unique, personal constructions of knowledge and experiences;
>
> PMM facilitates the identification of an individual's prior knowledge, concepts, attitudes and vocabulary (baseline) about a particular subject, such as zoos, aquariums and conservation;
>
> PMM provides a mechanism for meaningfully assessing and comparing the relative and unique impact of a single educational experience across many different people.

Approximately 20 visitors from each of the four sites participated in a paired PMM interview. Just prior to entering the zoo or aquarium, visitors were asked to share their thoughts about a specific prompt, the words "Zoo – Conservation" or "Aquarium – Conservation." Upon exiting the zoo or aquarium, these visitors were asked to add to, subtract from, or otherwise modify any thoughts they had shared previously on the subject. Paired data provided a rigorous mechanism for comparing individual change in a visitor's experiences, knowledge, and attitudes. Entry PMMs established "baseline" information, which could then be compared to visitors' understandings and attitudes after their visits. During the interviews, researchers recorded visitors' responses.

For each visitor, learning was assessed along two semi-independent learning parameters: 1) extent of knowledge and 2) depth of understanding. The first parameter focuses on an individual's vocabulary. This parameter attempts to document the extent of a visitor's awareness and understanding of the terms zoo or aquarium and conservation by looking at the vocabulary and ideas the individual used to discuss this concept. The second parameter assesses the depth of a visitor's understanding in order to capture how deeply and richly he/she understands a particular concept.

*Reflective Tracking Study*

There was a desire to see if visitors' entering identity-related motivations affected the ways in which they behaved during their visit. It was not possible to conduct a true tracking study as part of this investigation because of both the extensive visit times and large numbers of the subjects. Instead, a reflective tracking approach was created that built upon the free-choice nature of the zoo and aquarium visits. A random sample of visitors was intercepted by researchers as they entered the zoo or aquarium and provided an incentive to participate in the study by being offered an opportunity to borrow a pedometer and "find out how many steps you take today." One adult within each social group who agreed to participate completed the pre-visit instruments (knowledge and motivations) and one of the group members was given a pedometer to wear. Groups were instructed to find the researcher upon exiting in order to find out how many steps they took and return the pedometer. Upon exiting, the number of steps recorded by the pedometer were written down (but not analyzed as the pedometers were not of a quality to ensure consistent readings) and the individual, and often the entire group, engaged in describing their visit. Using a map of the facility, individuals or families were encouraged to show where they walked and where they stopped. The visitors could either mark their journey through the

facility on the map or use the map to point where they had gone and have the researcher mark on the map. The researchers used open-ended questioning to illicit information on: 1) Who made the suggestions/decisions on where to go within the group? 2) How did the group determine time allocation within and across the visit?; and 3) To what extent were identity-related dimensions driving decisions and what were the interest and cognitive dimensions that intersected with these identity-related decisions? A total of 356 visit interviews were conducted at the four sites.

*Long-Term Impact Study*
Individuals who completed pre/post measures were asked if they would provide phone and/or e-mail contact information to participate in a follow-up study. The long-term impact study was conducted through both telephone and e-mail interviews. An initial attempt was made to randomly select a representative number of individuals from each reported identity-related motivation category, but due to low response rates, solicitations were ultimately sent out to all remaining individuals for whom we had contact information (n=592). The final sample of 84 completed interviews was the result of approximately 488 contact attempts through telephone calls and e-mails. Several individuals were contacted more than once, thus a valid response rate may not be generated from this figure.

Both phone interviews and e-mail questionnaires were parallel. A series of open-ended questions were developed that focused on: 1) recall of the particular visit; 2) salient events if any from the day; 3) recall of motivations for the visit and determination if those motivations changed for any reason during the visit; and 4) self-reported knowledge and attitudinal outcomes from the visit.

*Conditions of Study*
One large zoo and one large aquarium and one small zoo and one small aquarium were selected by AZA for the study. Data was collected during peak summer visitation periods. Researchers were on site at each facility for 14 days during summer 2005. In addition, each institution dedicated staff and/or volunteers (trained by the researchers) who gathered additional pre/post knowledge measures; entering identity-related motivation measures; and post affect measures. The project set a goal of a minimum of 800 matched pre-post items; over 1,000 matched pre-post measures were obtained (N = 1,861). In addition, there were 250 pre and 250 post only instruments completed. To minimize bias in the sample, a "continual ask" method was employed (i.e., the first available visitor group would be intercepted, followed by the next available group, and so forth.). A refusal log was maintained.

*Data Analysis*
Data were entered into SPSS+ for analysis. Central tendencies were reported for all items; summated scores were used for individual scores on knowledge. Pearson product-moment correlations were used with conditions of entry (15 potential categories of entry conditions). Paired t-tests were used for the matched pre/post measures. For many of
the descriptive items in this study, a Kendall's Tau b was used. To determine the differences in scales and subscales, analysis of variance (ANOVA) was used.

Correlations were determined with Spearman's Rho. Finally, COANOVA was used to explore the relationship between entering identity-related motivations and change in knowledge and affect at each site.

## Appendix Two: References


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## Appendix Three: Study Sites

**Phase I**
Association of Zoos and Aquariums, Silver Spring, Maryland
Institute for Learning Innovation Incorporated, Annapolis, Maryland
Monterey Bay Aquarium in Monterey, California
Arizona-Sonora Desert Museum in Tucson, Arizona
Binder Park Zoo in Battle Creek, Michigan
Brandywine Zoo in Wilmington, Delaware
Bronx Zoo in Bronx, New York
Monterey Bay Aquarium in Monterey, California
North Carolina Aquarium at Roanoke Island in Manteo, North Carolina
The Florida Aquarium in Tampa, Florida
Oregon Coast Aquarium in Newport, Oregon

**Phase II**
Association of Zoos and Aquariums, Silver Spring, Maryland
Institute for Learning Innovation Incorporated, Annapolis, Maryland
Monterey Bay Aquarium in Monterey, California
National Aquarium in Baltimore, Maryland
New York Aquarium in Brooklyn, New York
Philadelphia Zoo in Philadelphia, Pennsylvania
Salisbury Zoo in Salisbury, Maryland

**Project Advisory Board**
Cheryl Asa, Ph.D., Saint Louis Zoo
Nancy Falasco, Brandywine Zoo
Jeff Hayward, Ph.D., People, Places & Design Research
Rachel Kaplan, Ph.D., University of Michigan
Eugene Matusov, Ph.D., University of Delaware
Bill Mott, The Ocean Project
Jackie Ogden, Ph.D., Disney's Animal Kingdom
Scott Paris, Ph.D., University of Michigan
Carol Saunders, Ph.D., Brookfield Zoo
Kathy Wagner, Philadelphia Zoo

## Appendix Four: AZA Conservation Messages

All life on Earth exists within an ecosystem.

a. Ecosystems are made of interdependent relationships between groups of living things (biodiversity) and their physical environment.

b. An impact on any element of an ecosystem has ramifications throughout the ecosystem.

Human beings are an integral part of all ecosystems.

a. Human activities within ecosystems affect these systems

Healthy ecosystems provide many essential services and benefits that sustain and improve human lives.

a. Natural systems maintain a habitable planet by regulating climate and by cycling water, oxygen and carbon dioxide and soil nutrients.

b. Natural systems provide human beings with essential services (ecosystem services) that sustain life on Earth: fresh air, clean water, soil and oceans that can produce food.

c. People depend on thousands of plants and animals to live their daily lives.

d. Biological diversity provides a multitude of natural resources used commercially for food, shelter, fiber, and other products.

e. Nature is the primary source for many common medicines upon which so many of us depend, and is also the likely source for promising new pharmaceuticals that may hold the secret for combating cancers, AIDS, and other threatening diseases.

f. Healthy ecosystems underpin healthy human economics and sustainable nature systems support sustainable human communities. Many jobs depend directly on protecting natural ecosystems (fishing, farming, etc.).

The human experience requires a connection to nature. These experiences in wild places in our community enrich our lives and inspire our choices for future generations.

a. For all human beings, nature is a place to renew the human spirit and refresh our emotional and mental health. For people of faith, nature is the work of and a connection to a higher power.

b. Nature provides wondrous places to play and recreate, to explore, to be creative, to learn and enjoy both as individuals and with our friends and families.

c. The beauty and resources of the natural world are national treasures. They help define America's national heritage and character, and provide the nation with valuable and irreplaceable natural resources.

d. The variety of life on Earth, its biodiversity, is both essential and inspirational for human existence.

Human beings are responsible for dramatic changes to ecosystems at a rate unprecedented in Earth's history.

a. The growth of the human population coupled with the increased consumption

of resources by individuals will increasingly impact the planet's finite resources.

b. The primary human threats to the environment are global warming, habitat destruction, invasive species, and overuse of individual species.

We have the responsibility to care for the Earth, to leave healthy ecosystems for our families and future generations.

a. Due to the unprecedented changes the human species is causing on the planet, we must often intervene to save wildlife.

b. Many decisions involved with caring for the Earth are extremely complex, and must take into account both human and animal needs.

Through informed actions, we can positively impact ecosystems. These actions include:

a. Making appropriate lifestyle decisions.

b. Actively participating in public decisions.

c. Sharing our knowledge and feelings about wildlife and wild places.

d. Supporting conservation organizations, including AZA zoos and aquariums.

e. Being "informed" means considering multiple points of view.

Responsible zoos and aquariums strive to conserve ecosystems and promote care and positive action for the natural world.

a. Responsible zoos and aquariums share knowledge, ideas and projects that empower people to take conservation action.

b. Responsible zoos and aquariums are active partners in the conservation community and help further conservation efforts worldwide by seeking workable and realistic solutions to conservation problems.

c. Responsible zoos and aquariums provide animal and nature experiences that engender a sense of wonder.

d. Responsible zoos and aquariums disseminate valuable information about animals and the ecosystems they inhabit.

e. Responsible zoos and aquariums model caring by being leaders in animal care.

f. Responsible zoos and aquariums commit to serving diverse segments of human society and provide a forum for exploring and communicating different perspectives concerning the natural world