

Museum Visitor Studies, Evaluation & Audience Research

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**Summative Evaluation of the
Madagascar! Exhibition**

Prepared for
**Wildlife Conservation Society
Bronx, NY**

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EXECUTIVE SUMMARY

INTRODUCTION

Findings from the summative evaluation of The Wildlife Conservation Society's (WCS) *Madagascar!* exhibition demonstrates that it is extremely successful at achieving its goals. The exhibition effectively utilizes simple low-tech interactive exhibits, large-scale video walls, live interpretation, and intimate, close-up looks at animals to connect visitors to the environments and wildlife of Madagascar. A rigorous research design that used rubrics to compare the achievement of eight objectives by visitors who have not seen the exhibition to visitors who have seen the exhibition yielded highly statistically significant findings.

These findings demonstrate that as a result of experiencing the exhibition, visitors' perceptions and knowledge about Madagascar, its animals, and conservation science *shifted* along a continuum from knowing nothing or having vague ideas to developing new ideas and understandings about these subjects. These newly-developed understandings varied, with some visitors just beginning to understand Madagascar and its animals and others able to identify specific and concrete information and ideas. Despite the variation in degree to which visitors gained new knowledge, findings show with no uncertainty that *there was growth* in understanding. This finding is extraordinary and indicates that *Madagascar!* provided visitors with the information, evidence, and thinking tools necessary to make the leap from limited, vague ideas about Madagascar and conservation science to more sophisticated understandings.

Succinctly put, statistically significant findings showed that many visitors who experienced the exhibition gained the following *new* knowledge, ideas, and beliefs:

- ◆ Enhanced interest in the animals of Madagascar based on knowledge of their habits, environment, and endangered status (versus interest based solely on novelty);
- ◆ Knowledge that Madagascar's environment and animals are threatened, especially by the loss of trees; and,
- ◆ An understanding of why conservation scientists (including those from WCS) are in Madagascar: to study the animals and environment so that they can implement appropriate conservation strategies toward its protection.

**Selected highlights of the study are included in this summary.
Please consult the body of the report for a detailed account of the findings.**

SUMMARY: ACHIEVEMENT OF EXHIBITION OBJECTIVES

Statistical tests were run to compare the scores of interviewees *before seeing* the exhibition to interviewees *after seeing* the exhibition to determine if differences in their level of accomplishment of the eight objectives (as outlined in the rubrics on the following pages) were statistically significant. **Notably, for *all* objectives except one, people who had seen the exhibition had statistically**

higher ratings than people who had not seen the exhibition. (One objective was not applicable to interviewees who had not seen the exhibition, so no comparison was made.)

Findings for all eight objectives are summarized below. For simplicity's sake, the two higher levels "developing" and "accomplished" are combined for making comparisons below. These findings clearly demonstrate increased knowledge and understanding when comparing visitors who had and visitors who had not seen the exhibition.

Nevertheless, it is important to note that these gains were not as cut and dried as presented below—for instance visitors' gains varied with some understanding the objectives to a greater extent than others, which is to be expected (this variation is apparent in the Principal Findings).

Objective 1: Visitors will develop emotional attachment and wonder for Madagascar's animals and environments.

Before seeing the *Madagascar!* exhibition, 49 percent of visitors scored "developing" or "accomplished;" *after* seeing the exhibition, 78 percent of visitors scored "developing" or "accomplished," meaning they accurately identified at least one animal from Madagascar and provided some description.

Objective 2: Visitors will know that Madagascar's unique species are threatened by deforestation due to slash-and-burn agriculture and over-harvesting of timber but understand that there is hope for their survival.

Before seeing the *Madagascar!* exhibition, 33 percent of visitors scored "developing" or "accomplished;" whereas, *after* seeing the exhibition, 66 percent of visitors scored "developing" or "accomplished," meaning they knew that Madagascar is threatened by a loss of trees, with some able to identify deforestation specifically.

Objective 3: Visitors will personally engage in the scientific process [through inquiry-based approaches] and explore the work of individual scientists.

This objective was applicable only to interviewees who had seen the exhibition since it was directly related to the exhibition experience. A majority of visitors (75 percent) who had seen *Madagascar!* scored "developing" or "accomplished," meaning that they accurately named a way he/she did science in the exhibition.

Objective 4: Visitors will understand how and why conservation science is important to protecting places like Madagascar.

Before seeing the exhibition, 30 percent of visitors scored "developing" or "accomplished;" *after* seeing the exhibition, 63 percent of visitors scored "developing" or "accomplished," meaning they could accurately identify the work of scientists in the protection of Madagascar, either generally or specifically.

Objective 5: Visitors will know what conservation scientists are doing to preserve Madagascar's animals/habitats (e.g., captive breeding of endangered animals, reintroduction, habitat conservation, studying indigenous species in captivity, setting up reserves, etc.).

Before seeing the exhibition, 32 percent of visitors scored “developing” or “accomplished;” *after* seeing the exhibition, 67 percent of visitors scored “developing” or “accomplished,” meaning they could name accurate conservation activities scientists are doing in Madagascar, either generally or specifically.

Objective 6: Visitors will know this is an exemplary case of collaborative work done by WCS zoos and international conservation programs to save wildlife.

Before seeing the exhibition, 32 percent of visitors scored “developing” or “accomplished;” *after* seeing the exhibition, 61 percent of visitors scored “developing” or “accomplished,” meaning they could provide accurate explanations for what WCS is doing in Madagascar, either generally or specifically.

Objective 7: Visitors will want to take conservation action or support conservation work because of an increased value for wildlife and wild places.

Before seeing the exhibition, 20 percent of visitors scored “developing” or “accomplished;” *after* seeing the exhibition, 44 percent of visitors scored “developing” or “accomplished,” meaning they strongly believe Madagascar is in need of protection, with a small portion of those also citing concrete ways he/she can take action.

Objective 8: Visitors will understand that Madagascar is an isolated island and as a result is home to a great number of animals found nowhere else in the world.

This was the only objective for which there was no statistically significant difference between visitors who had and had not seen the exhibition; 62 percent and 61 percent, respectively, scored “below beginning,” meaning they did not know that animals living in Madagascar are different from animals in other places because they live on an island.

SUMMARY: VISITORS' RATINGS OF SPECIFIC EXHIBITION COMPONENTS

Visitors who had seen the exhibition were asked to rate three specific exhibition components—look of the exhibits, videos, and live interpretation—on a scale of 1 to 7. Findings show that:

- Visitors rated the **look of the exhibits** 6.44, indicating extreme satisfaction.
- Visitors rated the **videos** highly (5.76).
- 37 percent of exit interviewees reported interacting with a live interpreter, and these visitors rated the **live interpretation** highly (5.80).

CONCLUSION

Visitors to the exhibition most definitely demonstrated an increased knowledge-base that enhanced their overall interest in Madagascar and its wildlife. These achievements cannot be understated. The *Madagascar!* exhibition has shown that zoos can be appropriate environments for moving visitors beyond the novelty of seeing wild animals to developing an understanding of where the animals come from, why they are important, and how conservation efforts can protect them.

INTRODUCTION

This report presents the findings from a summative evaluation of the National Science Foundation-funded *Madagascar!* exhibition conducted by Randi Korn & Associates, Inc. (RK&A) for the Wildlife Conservation Society (WCS). RK&A conducted this evaluation to examine the extent to which the exhibition achieved its intended objectives. Data for this study were collected in August and September 2008.

Specifically, the summative evaluation explores the extent to which:

- ◆ Visitors develop emotional attachment and wonder for Madagascar's animals and environments;
- ◆ Visitors know that Madagascar's unique species are threatened by deforestation due to slash-and-burn agriculture and over-harvesting of timber but understand that there is hope for their survival;
- ◆ Visitors personally engage in the scientific process [through inquiry-based approaches] and explore the work of individual scientists;
- ◆ Visitors understand how and why conservation science is important to protecting places like Madagascar;
- ◆ Visitors know what conservation scientists are doing to preserve Madagascar's animals/habitats (e.g., captive breeding of endangered animals, reintroduction, habitat conservation, studying indigenous species in captivity, setting up reserves, etc.);
- ◆ Visitors know this is an exemplary case of collaborative work done by WCS zoos and international conservation programs to save wildlife;
- ◆ Visitors want to take conservation action or support conservation work because of an increased value for wildlife and wild places; and,
- ◆ Visitors understand that Madagascar is an isolated island and as a result is home to a great number of animals found nowhere else in the world.

EVALUATION APPROACH

It is important to explain the design and methodology used in this study. The purpose of any summative evaluation is to assess, or measure, the extent to which a program or exhibition achieves its intended goals and objectives. Goals and objectives are often written in terms of what visitors will learn, understand, believe, or take action on. Yet, measuring learning, attitudes, and behaviors that result from an experience in informal settings is extremely challenging. We know from research and evaluation that visitors create new meaning by assimilating new ideas and perceptions with their pre-existing ideas and perceptions. The impact of an exhibition or program on visitors is extremely variable. These often subtle differences in impact are difficult to detect through conventional evaluation strategies.

To address this challenge, RK&A devised a rigorous research design using rubrics to blend qualitative and quantitative research methods to compare visitors just before they entered

Madagascar! to visitors who had just exited the exhibition, thus measuring the impact of the *Madagascar!* exhibition¹. A rubric is a set of criteria, linked to learning objectives that is used to assess a performance of knowledge, skills, etc. For each objective, rubrics include a continuum of understandings (or skills, attitudes, or behaviors) on a scale from 1, “below beginning,” to 4, “accomplished.”

To capture the nuances in visitors’ experiences and to guide the design of instruments and the analysis of data, RK&A developed a scoring rubric that describes, on a continuum, visitors’ understanding of ideas presented in *Madagascar!* For each visitor outcome, the rubric includes a continuum of understandings on a scale from 1 to 4 (see Appendix C for the Interview Scoring Rubric). To develop the rubric, RK&A used information gathered from the *Madagascar!* exhibition development team, the exhibition itself, as well as early analysis of data from in-depth interviews (the actual language used by visitors to talk about the exhibition).

This study utilizes rubrics to *quantify* large samples of *qualitative* data. In this way, rubrics assess learning in a way that remains authentic to visitors’ complicated, nuanced informal learning experience *while at the same time* rigorously responds to the need to measure and quantify impact. For this evaluation, RK&A conducted a total of 133 in-depth interviews with family groups (represented as adult-child pairs); 68 pairs were interviewed immediately prior to visiting the exhibition (entrance interviews), and a different sample of 65 pairs were interviewed immediately after visiting the exhibition (exit interviews). Data collection took place in September and October of 2008, soon after *Madagascar!* opened to the public. Following the qualitative tradition, the interviews were open-ended and in-depth, giving visitors the freedom to discuss what they felt was meaningful and thereby produced data rich in personal meaning and experience (all the interviews were audio-recorded and transcribed verbatim).

To quantify the data, RK&A developed rubrics that describe, on a continuum, visitors’ understanding of ideas presented in *Madagascar!* RK&A developed a rubric for each of the eight exhibition objectives. As an example, Objective 5 is shown in the following figure (for a complete list of all eight rubrics, see Appendix C). RK&A used these rubrics to score the interview data and then compared results from entrance and exit interviews to assess the degree to which visitors developed an understanding of the exhibition objectives.

¹ The visitors interviewed *before* visiting the exhibition and the visitors interviewed *after* seeing the exhibition were two separate samples; however, an analysis of demographic data demonstrates that the two groups were statistically similar, thus making it a fair comparison.

Example

RUBRIC SCORE AND CRITERIA FOR OBJECTIVE 5

SCORE	CRITERIA FOR OBJECTIVE 5
Below beginning (1)	The visitor does not know what scientists are doing to preserve animals/habitats in Madagascar (may not know there are scientists there).
Beginning (2)	The visitor makes random, far-fetched guesses about the work that scientist are doing in Madagascar (i.e., “cleaning up oil spills”).
Developing (3)	The visitor provides only general explanations of what scientists are doing to preserve animals/habitats in Madagascar (i.e., “raising awareness”).
Accomplished (4)	The visitor names at least one concrete example of the strategies scientists are using to preserve animals/habitats in Madagascar (captive breeding of endangered animals, reintroduction, habitat conservation, studying indigenous species in captivity).

METHODOLOGY

RK&A used in-depth interviews to assess visitors’ experiences in the exhibition. In-depth interviews encourage and motivate interviewees to describe their experiences, express their opinions and feelings, and share with the interviewer the meaning they constructed from an experience. By means of open-ended questions, in-depth interviews give interviewees the freedom to discuss what they feel is meaningful and thereby produce data rich in personal meaning and experience. For the *Madagascar!* exhibition evaluation, RK&A conducted both entrance and exit interviews. All interviews were audio-recorded with participants’ permission and transcribed to facilitate analysis.

ENTRANCE INTERVIEWS

RK&A conducted entrance interviews with visitor pairs who were about to enter the exhibition, consisting of one adult 18 years and older and one child between the ages of 6 and 10. The interviewer asked several open-ended questions about pre-existing ideas and prior experiences regarding issues of Madagascar and conservation science (see Appendix A for the entrance interview guide).

EXIT INTERVIEWS

RK&A conducted exit interviews with visitor pairs who were exiting the exhibition, consisting of one adult 18 years and older and one child between the ages of 6 and 10. The interviewer asked several open-ended questions about ideas and experiences regarding issues of Madagascar and conservation science (see Appendix B for the exit interview guide).

DATA COLLECTION PROCEDURE

Both the entrance and exit interview samples were obtained using a continuous random sampling method, the only difference being that visitor pairs selected for entrance interviews were intercepted as they were entering the exhibition and visitor pairs selected for exit interviews were intercepted as they were leaving the exhibition. In accordance with a continuous random sampling method, the interviewer positioned him/herself at the exhibition’s entrance/exit and intercepted the first family or multi-generational group that appeared to include at least one adult 18 years and older and one child between the ages of 6 and 10. The data collector described the reason for the interview and determined the eligibility of one adult and one child (the interview pair) from the group. If the pair declined to participate, the interviewer thanked the pair and recorded their genders and ages as well as the reason for refusal. If the pair agreed to participate, the interviewer proceeded with the

interview. After completing the interview and thanking the participants, the interviewer returned to the entrance/exit, and intercepted the very next family or multi-generational group that appeared to be eligible (see the entrance and exit interview guides in Appendix A and Appendix B for a more detailed description of the selection procedure and intercept script).

DATA ANALYSIS

Visitors' rubric scores, demographic characteristics, and Bronx Zoo visit patterns were analyzed with SPSS 12.0.1 for Windows, a statistical package for personal computers.

Descriptive statistical analyses included frequency distributions for all variables plus summary statistics for the rubric rating-scale variables and age. Summary statistics included the mean (average), median (50th percentile), and standard deviation (spread of scores: “±” in tables).

Inferential statistical analyses, including chi-square analysis and analysis of variance (ANOVA), were used to compare the entrance and exit groups. To compare the composition of the entrance and exit groups according to a categorical variable, the categorical variable and the entrance/exit interview group variable were cross-tabulated and the chi-square statistic (X^2) tested the significance of the joint frequency distribution of the two variables. For example, “gender” was tested against “entrance or exit interview group” to determine if the two interview groups were statistically similar (or different) with respect to gender.

To compare the means of two or more groups, analysis of variance (ANOVA) tested the group means and the F-statistic indicated if the means were significantly different. For example, the “mean rating scores” for each of the rubric rating-scale variables were compared according to “entrance or exit interview group” to determine if the means of the two groups were significantly different.

All statistical tests employed a two-tailed 0.05 level of significance to preclude findings of little practical significance.² See Appendix C for a list of all statistics run.

REPORTING METHOD

RK&A presents quantitative data in tables. Percentages within tables may not always equal 100 owing to rounding. Findings within each topic are presented in descending order, starting with the most frequently occurring.

² When the level of significance is set to $p = 0.05$, any finding that exists at a probability (p -value) ≤ 0.05 is “significant.” When a finding (such as a relationship between two variables or a difference in rating scores) has a p -value of 0.05, there is a 95 percent probability that the finding exists; that is, in 95 out of 100 cases, the finding is correct. Conversely, there is a 5 percent probability that the finding would not exist; in other words, in 5 out of 100 cases, the finding appears by chance.

PRINCIPAL FINDINGS: RUBRIC-SCORED INTERVIEWS

INTRODUCTION

RK&A conducted a total of 133 interviews with family groups; 68 groups were interviewed immediately prior to visiting the exhibition (entrance) and 65 groups were interviewed immediately after visiting the exhibition (exit) (see Table 1). The interview was conducted with a pair consisting of one adult and one child from the family group.

TABLE 1

INTERVIEW TYPE

INTERVIEW TYPE	<i>n</i>
Entrance Interview	68
Exit Interview	65

DEMOGRAPHIC CHARACTERISTICS

This section presents the basic demographic characteristics of the interview participants and compares the entrance and exit interview groups to determine if they are similar in make-up.

INTERVIEW PAIRS

Most often, the interview was conducted with a female adult and male child (33 percent) or a female adult and female child (32 percent) (see Table 2). Less often, the interview was conducted with a male adult and male child (18 percent) or male adult and female child (17 percent).

Although there are differences between entrance and exit interview pairs in regard to their gender composition, these differences are not statistically significant and can therefore be attributed to chance variation.

TABLE 2

DESCRIPTION OF ADULT-CHILD INTERVIEW PAIRS

ADULT-CHILD INTERVIEW PAIRS' (<i>n</i> = 122)	INTERVIEW GROUP		
	ENTRANCE	EXIT	TOTAL
	%	%	%
Female adult – Male child	25	40	33
Female adult – Female child	37	27	32
Male adult – Male child	18	18	18
Male adult – Female child	20	15	17

¹The child's gender was not recorded in 8 entrance interview pairs and 3 exit interview pairs.

ADULT PARTICIPANTS

Among adult participants, females outnumber males (64 percent vs. 36 percent) (see Table 3). Most participants are middle-aged, between 35 and 54 years of age (80 percent). The median age is 41 years. Both gender and age of entrance and exit adult participants are statistically similar, so differences in the characteristics of the two groups can be attributed to chance variation.

TABLE 3
DEMOGRAPHIC CHARACTERISTICS OF ADULT PARTICIPANTS

DEMOGRAPHIC CHARACTERISTICS	INTERVIEW GROUP		
	ENTRANCE	EXIT	TOTAL
GENDER (n = 132)	%	%	%
Male	39	32	36
Female	61	68	64
AGE GROUP (n = 131)	%	%	%
< 35 years	14	9	12
35 – 54 years	76	85	80
55+ years	11	6	8
SUMMARY STATISTICS FOR AGE (n = 131)	AGE IN YEARS	AGE IN YEARS	AGE IN YEARS
Range	21 - 78	19 - 65	19 - 78
Median age	41.0	41.0	41.0
Mean age	42.9	41.3	42.1
± Standard Deviation	± 10.1	± 8.1	± 9.2

CHILD PARTICIPANTS

Among child participants, there are roughly equal numbers of males and females (51 percent vs. 49 percent) (see Table 4). In all, 43 percent are 6 – 7 years of age, 39 percent are 8 – 9 years of age, and 18 percent are 10 – 11 years of age. The median age is 8 years. Both gender and age of entrance and exit child participants are statistically similar, so differences in the characteristics of the two groups can be attributed to chance variation.

TABLE 4

DEMOGRAPHIC CHARACTERISTICS OF CHILD PARTICIPANTS

DEMOGRAPHIC CHARACTERISTICS	INTERVIEW GROUP		TOTAL
	ENTRANCE	EXIT	
GENDER (n =122)	%	%	%
Male	43	58	51
Female	57	42	49
AGE GROUP (n =124)	%	%	%
6 – 7 years	35	50	43
8 – 9 years	44	35	39
10 – 11 years	21	15	18
SUMMARY STATISTICS FOR AGE (n =124)	AGE IN YEARS	AGE IN YEARS	AGE IN YEARS
Range	6 - 11	6 - 11	6 - 11
Median age	8.0	7.5	8.0
Mean age	8.2	7.7	7.9
± Standard Deviation	± 1.5	± 1.6	± 1.6

VISIT AND MEMBERSHIP CHARACTERISTICS

This section presents visit and membership characteristics of the interview participants and compares the entrance and exit interview groups to determine if they are similar.

Most interview pairs were repeat visitors to the Bronx Zoo (88 percent) (see Table 5). Almost all pairs said they traveled less than three hours to reach the Zoo (97 percent). Over one-half of the interview pairs said they were members of the Bronx Zoo (58 percent). Over one-half of the interview pairs had visited the Bronx Zoo Web site (58 percent), but only 28 percent had looked at *Madagascar!* exhibition content on the Web Site. The Bronx Zoo visit and membership characteristics of the entrance and exit interview groups are statistically similar.

TABLE 5
VISIT AND MEMBERSHIP CHARACTERISTICS

VISIT AND MEMBERSHIP CHARACTERISTICS	INTERVIEW GROUP		
	ENTRANCE	EXIT	TOTAL
VISIT TO BRONX ZOO (n = 132)	%	%	%
First	13	11	12
Repeat	87	89	88
TRAVEL TIME TO BRONX ZOO (n = 131)	%	%	%
Less than 3 hours	94	100	97
More than 3 hours	6	0	3
MEMBER OF BRONX ZOO (n = 132)	%	%	%
No	39	46	42
Yes	61	54	58
VISITED BRONX ZOO WEB SITE (n = 132)	%	%	%
No	37	46	42
Yes	63	54	58
VISITED <i>MADAGASCAR!</i> SECTION OF BRONX ZOO WEB SITE (n = 132)	%	%	%
No	78	66	72
Yes	22	34	28

All of the entrance interview pairs were visiting the *Madagascar!* exhibition for the first time, in accordance with the interview selection criteria (see methodology). Most of the exit interview pairs were also visiting the *Madagascar!* exhibition for the first time (94 percent) (see Table 6).

TABLE 6
PREVIOUS *MADAGASCAR!* EXHIBITION VISITS
(EXIT INTERVIEW GROUP ONLY)

NUMBER OF OTHER VISITS TO <i>MADAGASCAR!</i> EXHIBITION (n = 65)	%
None (first time today)	94
1 visit	2
3 visits	3
6 visits	1

MADAGASCAR! EXHIBITION EXPERIENCES

This section presents information about exit interview participants’ experiences in the exhibition as well as their ratings of specific aspects of the exhibition.

INTERACTION WITH BRONX ZOO STAFF

Of the exit interview pairs, 37 percent interacted with Bronx Zoo Staff during their visit to the exhibition (see Table 7).

TABLE 7
INTERACTION WITH BRONX ZOO STAFF

INTERACTION WITH BRONX ZOO STAFF WHILE IN EXHIBITION (n = 65)	%
No	63
Yes	37

MADAGASCAR EXHIBITION RATINGS

The interviewer asked exit adult participants to rate exhibits, videos, and live interpretation if they had used them in the exhibition. Participants rated the exhibits, videos, and live interpretation on a 7-point scale from 1, “Not at all satisfied,” to 7, “Very Satisfied” (see Table 8). Visitors were most satisfied with the look of the exhibits (mean = 6.44), but the ratings of live interpretation and videos were also very good (means = 5.80 and 5.76, respectively).

TABLE 8

MADAGASCAR/ EXHIBITION RATINGS

7-POINT RATING SCALE: NOT AT ALL SATISFIED (1) / VERY SATISFIED (7)	<i>n</i>	MEAN	±
Look of the exhibits	55	6.44	0.86
Live interpretation	35	5.80	1.13
Videos	38	5.76	1.28

EXHIBITION OBJECTIVES

This section explores respondents’ accomplishment of eight exhibition objectives and compares the results based on interview group (entrance and exit). RK&A reviewed data from each respondent’s interview and rated the respondent’s accomplishment of the exhibition objectives according to specific criteria. Based on the criteria for each objective, RK&A classified respondents’ accomplishments of each objective into one of four categories: 1) Below Beginning, 2) Beginning, 3) Developing, or 4) Accomplished. (See Appendix E for Verbatim Examples of Indicators for Below Beginning, Beginning, Developing, and Accomplished responses for each exhibition objective.)

Results in this section are presented in graphs; more descriptive results are presented in tables in Appendix F.

OBJECTIVE 1:

VISITORS WILL DEVELOP EMOTIONAL ATTACHMENT AND WONDER FOR MADAGASCAR'S ANIMALS AND ENVIRONMENTS.

The rubric for Objective 1 describes the continuum for interviewees' achievement (see Figure 1 below). Representative verbatim quotations are available in Appendix E.

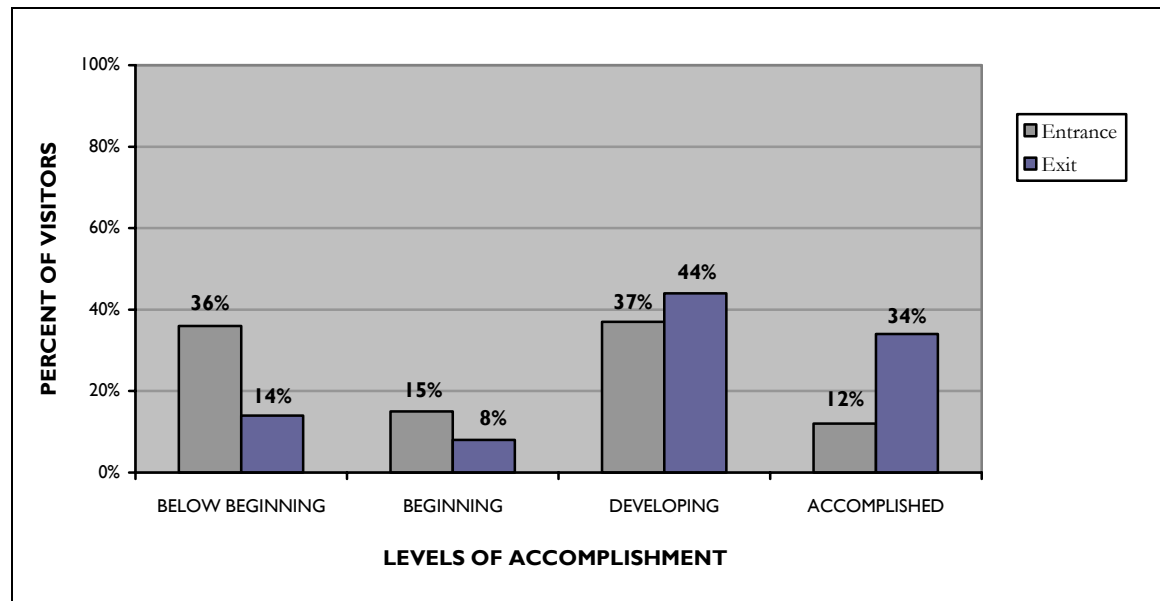
FIGURE 1
RUBRIC SCORE AND CRITERIA FOR OBJECTIVE 1

SCORE	CRITERIA FOR OBJECTIVE 1
Below beginning (1)	The visitor is unable to name one animal that lives on Madagascar (may or may not refer to characters from the movie.)
Beginning (2)	The visitor accurately identifies an animal of Madagascar but also believes animals from the movie, <i>Madagascar</i> , live on the island.
Developing (3)	The visitor accurately identifies at least one animal that lives on Madagascar but provides a cursory description.
Accomplished (4)	The visitor accurately identifies at least one animal that lives on Madagascar and expresses affection for or awe of the animal by providing a rich description.

For Objective 1, *exit* interview pairs have higher ratings than *entrance* interview pairs (see Figure 1a). This finding is statistically significant.

- ♦ Of *entrance* interview pairs, 51 percent have a “Beginning” or “Below Beginning” rating. Of *exit* interview pairs, 22 percent have a “Beginning” or “Below Beginning” rating.
- ♦ Of *entrance* interview pairs, 37 percent have a “Developing” rating, and 12 percent have an “Accomplished” rating. Of *exit* interview pairs, 44 percent have a “Developing” rating, and 34 percent have an “Accomplished” rating.

FIGURE 1a
VISITORS' DEVELOPMENT OF EMOTIONAL ATTACHMENT AND WONDER FOR MADAGASCAR'S ANIMALS AND ENVIRONMENTS



$\chi^2 = 15.127; df = 3; p = .002$

OBJECTIVE 2:

VISITORS WILL KNOW THAT MADAGASCAR'S UNIQUE SPECIES ARE THREATENED BY DEFORESTATION DUE TO SLASH-AND-BURN AGRICULTURE AND OVER-HARVESTING OF TIMBER BUT UNDERSTAND THAT THERE IS HOPE FOR THEIR SURVIVAL.

The rubric for Objective 2 describes the continuum for interviewees' achievement (Figure 2 below). Representative verbatim quotations are available in Appendix E.

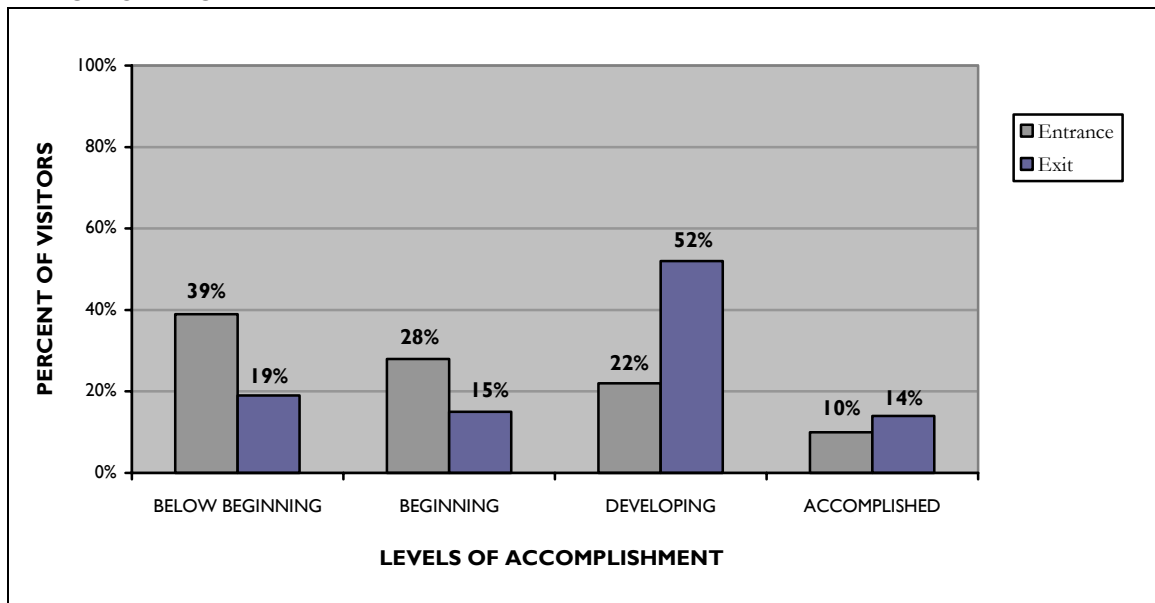
FIGURE 2
RUBRIC SCORE AND CRITERIA FOR OBJECTIVE 2

SCORE	CRITERIA FOR OBJECTIVE 2
Below beginning (1)	The visitor does not realize that Madagascar is a threatened environment. Or the visitor identifies inaccurate threats of Madagascar and its animals are (i.e., being eaten by other animals).
Beginning (2)	The visitor says that Madagascar and its animals are threatened by broad environmental issues (such as global warming or pollution).
Developing (3)	The visitor says that Madagascar and its animals are threatened by the loss of trees, but does not use specific terminology.
Accomplished (4)	The visitor <i>specifically</i> says that Madagascar and its animals are threatened by deforestation.

For Objective 2, *exit* interview pairs have higher ratings than *entrance* interview pairs (see Figure 2a). The finding is statistically significant.

- ◆ Of *entrance* interview pairs, 67 percent have a “Beginning” or “Below Beginning” rating. Of *exit* interview pairs, 34 percent have a “Beginning” or “Below Beginning” rating.
- ◆ Of *entrance* interview pairs, 22 percent have a “Developing” rating, and 10 percent have an “Accomplished” rating. Of *exit* interview pairs, 52 percent have a “Developing” rating, and 14 percent have an “Accomplished” rating.

FIGURE 2a
VISITORS' KNOWLEDGE THAT MADAGASCAR'S UNIQUE SPECIES ARE THREATENED BY DEFORESTATION



$\chi^2 = 14.890; df = 3; p = .002$

OBJECTIVE 3:

VISITORS WILL BE PERSONALLY ENGAGED IN THE SCIENTIFIC PROCESS THROUGH INQUIRY-BASED APPROACHES] AND EXPLORE THE WORK OF INDIVIDUAL SCIENTISTS (APPLICABLE TO EXIT INTERVIEWS ONLY).

The rubric for Objective 3 describes the continuum for interviewees’ achievement (see Figure 3 below). Representative verbatim quotations are available in Appendix E.

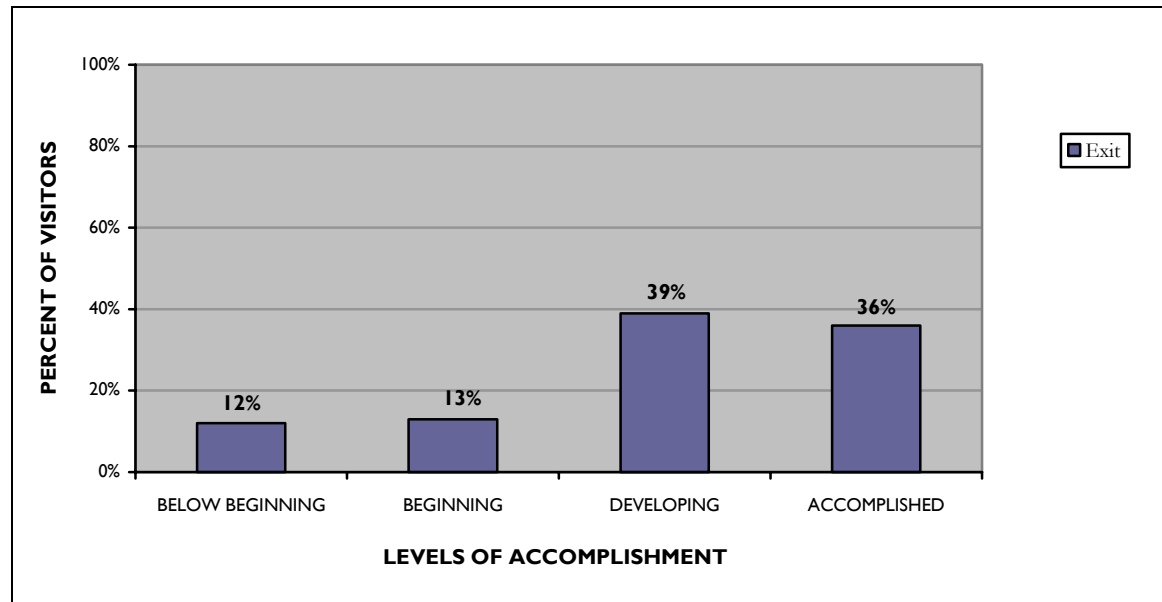
FIGURE 3
RUBRIC SCORE AND CRITERIA FOR OBJECTIVE 3

SCORE	CRITERIA FOR OBJECTIVE 3
Below beginning (1)	The visitor says he/she did not do science in the <i>Madagascar</i> exhibition.
Beginning (2)	The visitor says he/she did science in the <i>Madagascar</i> exhibition but is unable to name any specific examples.
Developing (3)	The visitor names at least one <i>accurate but general</i> example of a way he/she did science in the <i>Madagascar</i> exhibition (e.g., “looking” or “watching.”)
Accomplished (4)	The visitor names at least one <i>accurate and specific</i> example of a way he/she did science in the exhibition (e.g., observing, counting, compare/contrasting, making guesses).

For Objective 3, *exit* interview pairs have good ratings overall (see Figure 3a).

- ♦ Of *exit* interview pairs, the majority have either a “Developing” rating (39 percent) or an “Accomplished” rating (36 percent).

FIGURE 3a
VISITORS’ ENGAGEMENT IN THE SCIENTIFIC PROCESS



OBJECTIVE 4:

VISITORS WILL UNDERSTAND HOW AND WHY CONSERVATION SCIENCE IS IMPORTANT TO PROTECTING PLACES LIKE MADAGASCAR.

The rubric for Objective 4 describes the continuum for interviewees’ achievement (see Figure 4 below). Representative verbatim quotations are available in Appendix E.

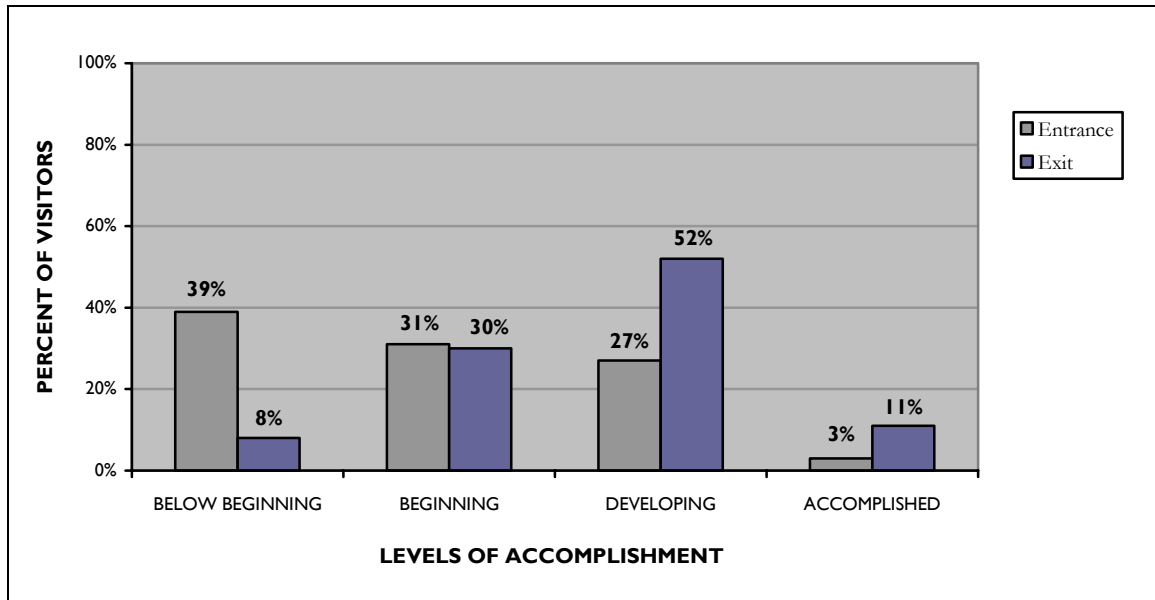
FIGURE 4
RUBRIC SCORE AND CRITERIA FOR OBJECTIVE 4

SCORE	CRITERIA FOR OBJECTIVE 4
Below beginning (1)	The visitor says he/she does not know there are scientists working in Madagascar or makes far-fetched guesses to explain what they are doing there.
Beginning (2)	The visitor says that scientists are in Madagascar but <i>does not</i> realize they are there to protect it. He/she provides only general explanations and does not connect the work that scientists do with protection of the place and animals.
Developing (3)	The visitor says that scientists are in Madagascar to <i>protect</i> it, but he/she provides only general explanation for what they are doing.
Accomplished (4)	The visitor says that scientists are in Madagascar to <i>protect</i> it and provides at least one concrete example of the work of scientists (i.e., studying environmental clues)

For Objective 4, *exit* interview pairs have higher ratings than *entrance* interview pairs (see Figure 4a). The finding is statistically significant.

- ◆ Of *entrance* interview pairs, 70 percent have a “Beginning” or “Below Beginning” rating. Of *exit* interview pairs, 38 percent have a “Beginning” or “Below Beginning” rating.
- ◆ Of *entrance* interview pairs, 27 percent have a “Developing” rating, and 3 percent have an “Accomplished” rating. Of *exit* interview pairs, 52 percent have a “Developing” rating, and 11 percent have an “Accomplished” rating.

FIGURE 4a
VISITORS’ UNDERSTANDING OF HOW AND WHY CONSERVATION SCIENCE IS IMPORTANT TO MADAGASCAR



$\chi^2 = 21.458; df = 3; p = .000$

OBJECTIVE 5:

VISITORS WILL KNOW WHAT CONSERVATION SCIENTISTS ARE DOING TO PRESERVE MADAGASCAR'S ANIMALS/HABITATS.

The rubric for Objective 5 describes the continuum for interviewees' achievement (see Figure 5 below). Representative verbatim quotations are available in Appendix E.

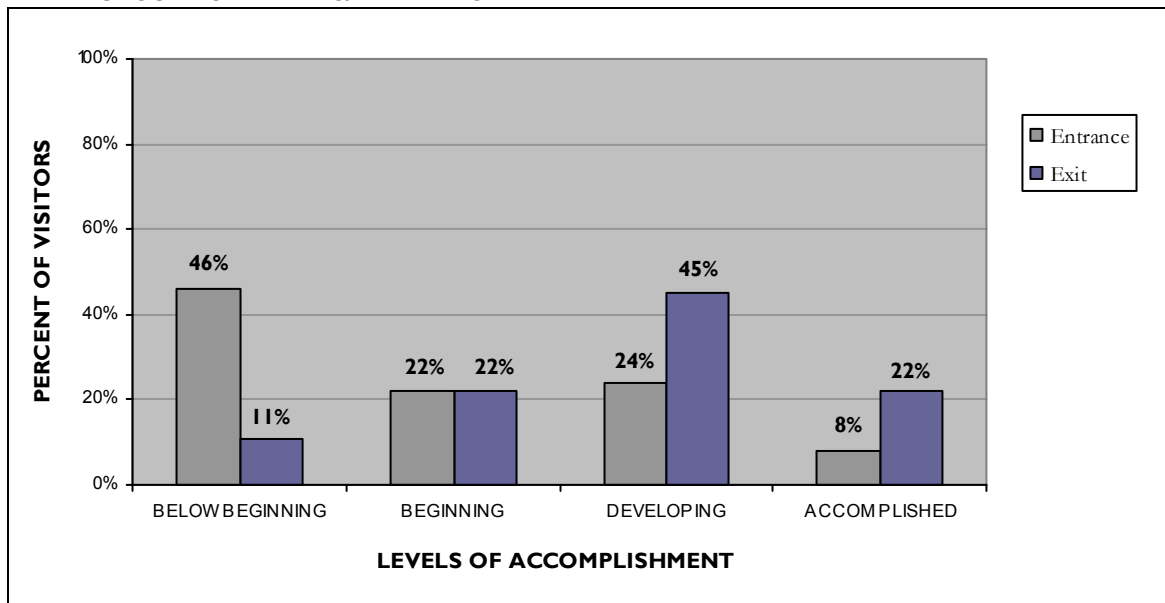
FIGURE 5
RUBRIC SCORE AND CRITERIA FOR OBJECTIVE 5

SCORE	CRITERIA FOR OBJECTIVE 5
Below beginning (1)	The visitor does not know what scientists are doing to preserve animals/habitats in Madagascar (may not know there are scientists there).
Beginning (2)	The visitor makes random, far-fetched guesses about the work that scientist are doing in Madagascar (i.e., "cleaning up oil spills").
Developing (3)	The visitor provides only general explanations of what scientists are doing to preserve animals/habitats in Madagascar (i.e., "raising awareness").
Accomplished (4)	The visitor names at least one concrete example of the strategies scientists are using to preserve animals/habitats in Madagascar (captive breeding of endangered animals, reintroduction, habitat conservation, studying indigenous species in captivity).

For Objective 5, *exit* interview pairs have higher ratings than *entrance* interview pairs (see Figure 5a). The finding is statistically significant.

- ◆ Of *entrance* interview pairs, 68 percent have a "Beginning" or "Below Beginning" rating. Of *exit* interview pairs, 33 percent have a "Beginning" or "Below Beginning" rating.
- ◆ Of *entrance* interview pairs, 24 percent have a "Developing" rating, and 8 percent have an "Accomplished" rating. Of *exit* interview pairs, 45 percent have a "Developing" rating, and 22 percent have an "Accomplished" rating.

FIGURE 5a
VISITORS' KNOWLEDGE OF WHAT CONSERVATION SCIENTISTS DO TO PRESERVE MADAGASCAR'S ANIMALS/HABITATS



$\chi^2 = 23.155; df = 3; p = .000$

OBJECTIVE 6:

VISITORS WILL KNOW THIS IS AN EXEMPLARY CASE OF COLLABORATIVE WORK DONE BY WCS ZOOS AND INTERNATIONAL CONSERVATION PROGRAMS TO SAVE WILDLIFE.

The rubric for Objective 6 describes the continuum for interviewees' achievement (see Figure 6 below). Representative verbatim quotations are available in Appendix E.

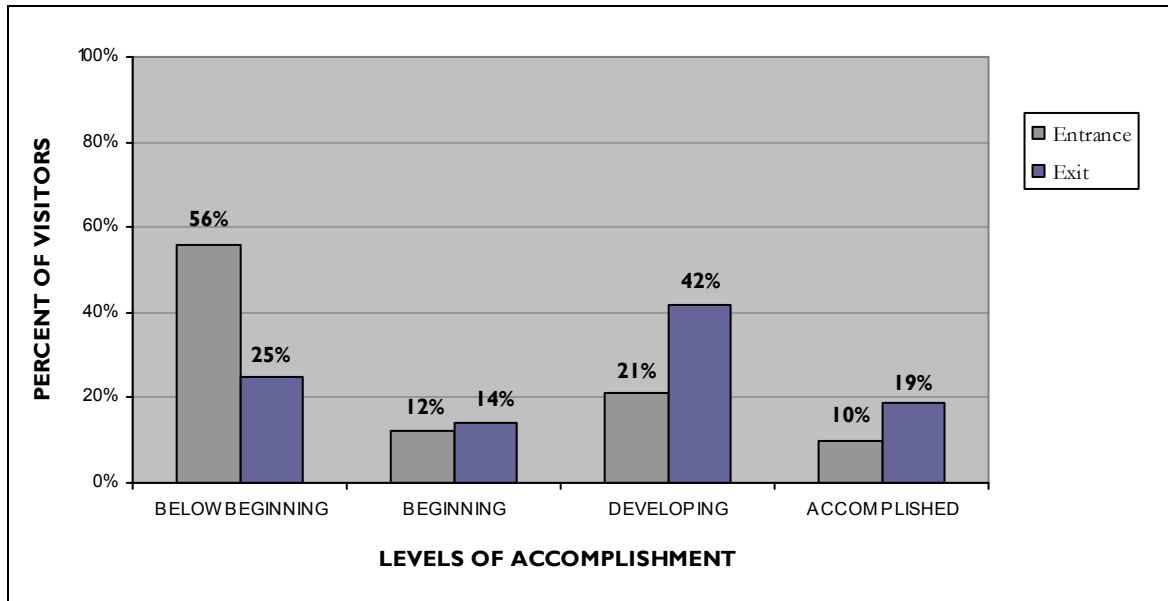
FIGURE 6
RUBRIC SCORE AND CRITERIA FOR OBJECTIVE 6

SCORE	CRITERIA FOR OBJECTIVE 6
Below beginning (1)	The visitor does not know what WCS scientists are doing to preserve animals/habitats (may not know there are WCS scientists there).
Beginning (2)	The visitor makes random, far-fetched guesses for what WCS scientists are doing in Madagascar.
Developing (3)	The visitor names only vague, general explanation of what WCS scientists are doing to preserve animals/habitats in Madagascar (such as "raising awareness")
Accomplished (4)	The visitor names at least one concrete example of the strategies WCS scientists are using to preserve animals/habitats in Madagascar (breeding endangered animals, studying them in captivity, setting up reserves, etc.)

For Objective 6, *exit* interview pairs have higher ratings than *entrance* interview pairs (see Figure 6a). The finding is statistically significant.

- ◆ Of entrance interview pairs, 68 percent have a "Beginning" or "Below Beginning" rating. Of exit interview pairs, 39 percent have a "Beginning" or "Below Beginning" rating.
- ◆ Of entrance interview pairs, 21 percent have a "Developing" rating, and 10 percent have an "Accomplished" rating. Of exit interview pairs, 42 percent have a "Developing" rating, and 19 percent have an "Accomplished" rating.

FIGURE 6a
VISITORS' KNOWLEDGE OF THE COLLABORATIVE WORK DONE BY WCS ZOOS AND INTERNATIONAL CONSERVATION PROGRAMS



$\chi^2 = 14.398; df = 3; p = .002$

OBJECTIVE 7:

VISITORS WILL WANT TO TAKE CONSERVATION ACTION OR SUPPORT CONSERVATION WORK BECAUSE OF AN INCREASED VALUE FOR WILDLIFE AND WILD PLACES

The rubric for Objective 7 describes the continuum for interviewees’ achievement (see Figure 7 below). Representative verbatim quotations are available in Appendix E.

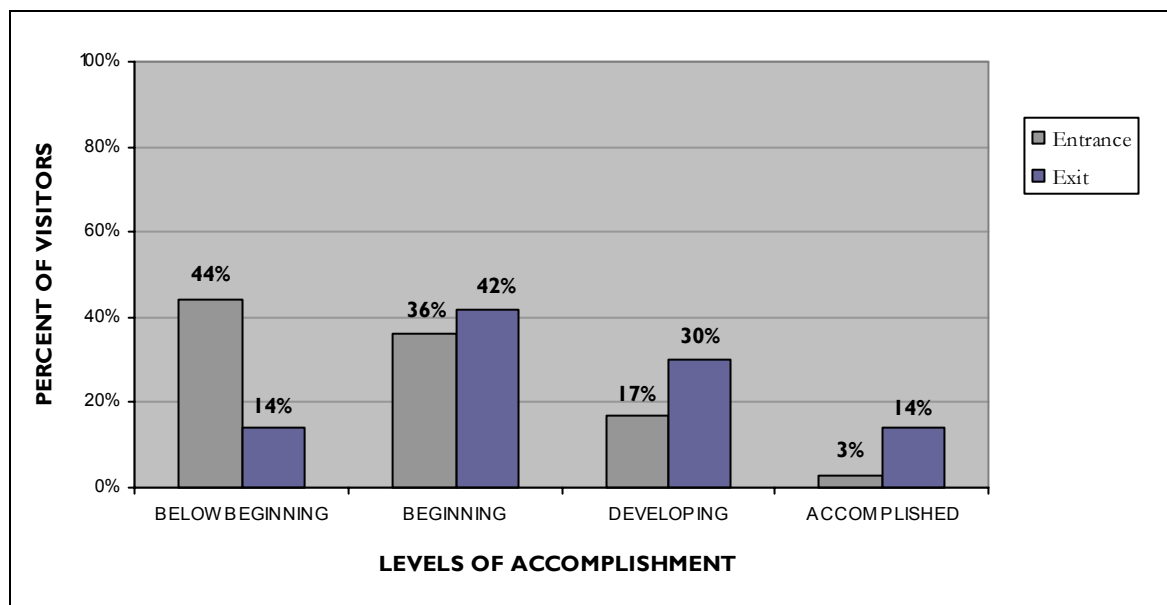
FIGURE 7
RUBRIC SCORE AND CRITERIA FOR OBJECTIVE 7

SCORE	CRITERIA FOR OBJECTIVE 7
Below beginning (1)	The visitor does not know that Madagascar needs to be protected or knows that its animals and habitats should be protected but shows little to no interest.
Beginning (2)	The visitor expresses a belief that Madagascar’s animals and habitats should be protected but does not demonstrate in-depth responses or use emotional language.
Developing (3)	The visitor expresses a strong belief that Madagascar’s animals and habitats should be protected as demonstrated by in-depth responses to the questions and/or emotional language, but does not cite any ways he/she can support conservation.
Accomplished (4)	The visitor expresses a strong belief that Madagascar’s animals and habitats should be protected as demonstrated by in-depth responses to the questions and/or emotional language. Includes the visitor who cites at least one concrete way he/she can support conservation action in Madagascar, such as by giving money.

For Objective 7, *exit* interview pairs have higher ratings than *entrance* interview pairs (see Figure 7a). The finding is statistically significant.

- ◆ Of *entrance* interview pairs, 80 percent have a “Beginning” or “Below Beginning” rating. Of *exit* interview pairs, 58 percent have a “Beginning” or “Below Beginning” rating.
- ◆ Of *entrance* interview pairs, 17 percent have a “Developing” rating, and 3 percent have an “Accomplished” rating. Of *exit* interview pairs, 30 percent have a “Developing” rating, and 14 percent have an “Accomplished” rating.

FIGURE 7a
VISITORS’ DESIRE TO TAKE CONSERVATION ACTION



$\chi^2 = 17.264; df = 3; p = .001$

OBJECTIVE 8:

VISITORS WILL UNDERSTAND THAT MADAGASCAR IS AN ISOLATED ISLAND AND AS A RESULT IS HOME TO A GREAT NUMBER OF ANIMALS FOUND NOWHERE ELSE IN THE WORLD

The rubric for Objective 8 describes the continuum for interviewees’ achievement (see Figure 8 below). Representative verbatim quotations are available in Appendix E.

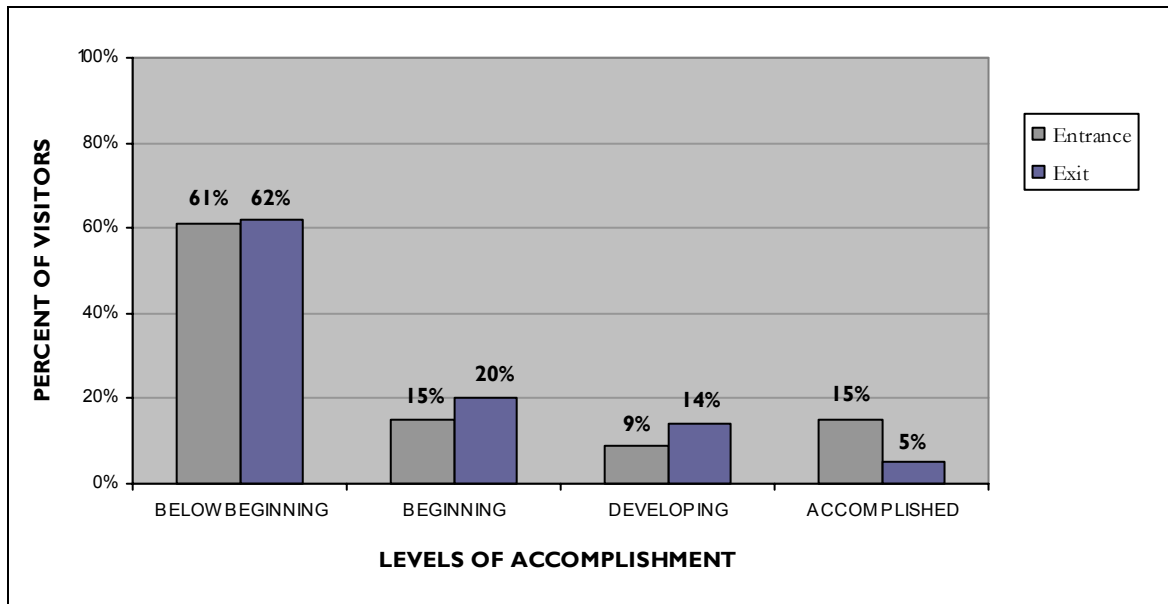
FIGURE 8
RUBRIC SCORE AND CRITERIA FOR OBJECTIVE 8

SCORE	CRITERIA FOR OBJECTIVE 8
Below beginning (1)	The visitor does not know that the animals of Madagascar are different from animals in other places because they live on an island (he/she may name other incorrect reasons, such as climate.).
Beginning (2)	The visitor says that Madagascar is an island or isolated but does not accurately explain how that connects to the fact that its animals are different from animals in other places.
Developing (3)	Prompted, the visitor says the animals of Madagascar are different (more unique) than animals in other places because of adaptation that happens in an isolated (island) environment (may or may not use the term evolution or adaptation).
Accomplished (4)	Unprompted, the visitor says the animals of Madagascar are different (more unique) than animals in other places because of adaptation that happens in an isolated (island) environment (may or may not use the term evolution or adaptation).

For Objective 8, *entrance* and *exit* interview pairs have similar ratings (see Figure 8a).

- ♦ The majority of *entrance* and *exit* interview pairs have a “Below Beginning” rating on this objective (61 percent and 62 percent, respectively).

FIGURE 8a
VISITORS’ UNDERSTANDING THAT MADAGASCAR IS AN ISOLATED ISLAND AND HOME TO GREAT NUMBER OF ANIMALS FOUND NOWHERE ELSE



SUMMARY OF PARTICIPANTS' ACHIEVEMENT OF EXHIBITION OBJECTIVES

Table 9 summarizes the rating scores for each of the exhibition objectives, according to the 4-point scale: 1 = Below Beginning; 2 = Beginning; 3 = Developing; 4 = Accomplished. The objectives are listed in rank order from highest to lowest mean score of the *exit* interview group.

TABLE 9
SUMMARY OF PARTICIPANTS' ACHIEVEMENT OF EXHIBITION OBJECTIVES BY INTERVIEW GROUP

OBJECTIVES	INTERVIEW GROUP	
	ENTRANCE	EXIT
	MEAN	MEAN
1 (personally engaged in the scientific process and explore work of individual scientists)	n/a	3.00
2 (emotional attachment and wonder for Madagascar's environment and animals) ¹	2.25	2.98
3 (know what conservation scientists are doing to preserve Madagascar's animals and habitats) ²	1.93	2.78
4 (know how/why conservation science is important for Madagascar) ³	1.94	2.66
5 (know that Madagascar's unique species are threatened due to agricultural practices and land use, but there is hope for their survival) ⁴	2.04	2.61
6 (know about collaborative work by WCS to save wildlife) ⁵	1.85	2.55
7 (want to take conservation action and value wildlife and wild places) ⁶	1.79	2.44
8 (understand Madagascar is isolated island and as a result is home to unique animal species)	1.78	1.62

¹F = 16.139; *p* = .000

²F = 25.870; *p* = .000

³F = 23.996; *p* = .000

⁴F = 10.674; *p* = .001

⁵F = 13.608; *p* = .000

⁶F = 18.135; *p* = .000

DISCUSSION AND IMPLICATIONS OF FINDINGS

As evidenced by this study's findings as well as similar studies, visitors enter zoos relatively unfamiliar with the concept of conservation science (Roper Starch Worldwide, 1998). And, even though recent public discourse on global warming has grown substantially, the general public's familiarity with environmental issues still tends to be vague or even ill-conceived (Yalowitz, 2004). Yet, findings demonstrate that *Madagascar!* shifted visitors' knowledge of conservation science toward a more accurate, specific, and concrete understanding. Most visitors entered *Madagascar!* with little to no understanding of Madagascar, its animals, or conservation efforts. In fact, some visitors entered the exhibition with incorrect ideas, such as those who confused the animated film with the real place, or those who made assumptions about Madagascar's environment based on a vague familiarity with global warming.

For the sake of illustrating this lack of understanding, we can examine Objective 4, "Visitors will understand how and why conservation science is important to protecting places like Madagascar." The majority of visitors who did not see the exhibition scored at the "below beginning" or the "beginning" level" (39 and 31 percent, respectively). The two quotations below represent entrance interviewees who scored at these levels.

(Why do you think scientists are in Madagascar-what are they doing there?) Trying to see all the animals that live there. (Can you tell me more?) They want to take them to a lab and do studies on them. [Entrance Interview, Score of 1]

The scientists are just trying to learn as much as they can about the animals and the insects and how the habitat operates, how everybody has to get along together. (Can you tell me anything else about the work of scientists?) No. [Entrance Interview, Score of 2]

As previously stated, findings demonstrate that the exhibition helped many visitors move away from these uniformed, naïve understandings to develop *new, more accurate, understandings* of Madagascar. But, the question remains, "what *is* this *new understanding*?" Did visitors go from knowing nothing about Madagascar and conservation science to having a comprehensive understanding of the subjects? No, of course, not. It would be unrealistic for any exhibition to have such high expectations for all its visitors. To understand the ways in which visitors' understandings shifted, it is helpful to closely examine the scores of the visitors who had seen *Madagascar!* **An examination shows that, for most of the objectives, more interviewees exiting the exhibition scored at the "developing" level than at any other level.** The "developing" level is a score of 3 and represents an early understanding—that point at which a learner experiences an, "ah-ha" moment. This may mean a visitor moves from knowing very little, having hunches, or believing misconceptions to having an accurate and informed, even if limited, understanding.

For example, let us look again at Objective 4, "Visitors will understand how and why conservation science is important to protecting places like Madagascar." Slightly more than one-half (52 percent) of visitors who saw the exhibition scored at the "developing" level (see the first quotation below, which represents an exit interviewee who scored "developing."); Only 11 percent scored at the "accomplished" level (see the second quotation below, which represents an exit interviewee who

scored “accomplished”). A comparison of the two quotations illustrates the difference between an early understanding and a more advanced understanding (for representative quotations for each objective at every level, see Appendix E).

(Why do you think scientists are in Madagascar-what are they doing there?) [Scientists] are trying to save [lemurs]. Right? They’re trying to understand their habitat so that they don’t become endangered or extinct. (Can you tell me more?) No. [Exit Interview, Score of 3]

They’re helping the animals survive. (Can you tell me more?) They’re monitoring them to see how many there are and trying to make sure that the habitat, well, studying them to try and make sure that they can see what they need and how they live so that they can make sure that they have the environment they need to survive. [Exit Interview, Score of 4]

Identifying these subtle differences is especially notable because this nuanced shift toward greater understanding is very difficult to detect in informal learning research, yet important to acknowledge. Despite the variation in degree to which visitors gained new knowledge, findings show with no uncertainty that *there was indeed growth* in understanding for nearly all the exhibition objectives³.

Overall, these positive findings are remarkable when one considers how difficult it is to change people’s knowledge and attitudes, particularly in one relatively short visit to a single exhibition. Visitors come to zoos with varying degrees of prior knowledge, experiences, and interests. Through experiences in exhibitions like *Madagascar!*, visitors assimilate new ideas and perceptions with their pre-existing ideas and perceptions and create new meaning (Falk & Dierking, 1992). Ideally, the meaning they create is accurate, but that certainly is not always the case. Sometimes visitors remain “fixed” in their ideas about subject matters and convincing them otherwise through an exhibition is extremely difficult. For example, a front-end study of an exhibition on evolution as well as other research shows that people cannot easily change their thinking about evolution (RK&A, 2005a; RK&A, 2005b; Scott and Guisti, 2006). Similarly, another study shows that museum visitors have strong, fixed ideas about gravity—even after a science demonstration, visitors held the same incorrect notions of gravitational pull (Borun, 1993). Communicating new ideas is problematic in all subjects. In an evaluation for an exhibition about the American Flag, RK&A learned that people’s ideas about the meaning of the American Flag were unwavering (2002).

HOW THE EXHIBITION ACHIEVED THESE POSITIVE FINDINGS

To repeat, it is quite amazing for an exhibition to have such a strong impact on visitors. Changes in attitudes and understanding typically require repeated exposure and facilitation by a live person (such as in programming). Since observations were not part of the summative evaluation, it is impossible to know exactly what about the exhibition was so effective. Yet, one can speculate, and these explanations are provided below:

³ The only objective for which there was no difference between entrance and exit interviewees was Objective 8, the one related to island biogeography. This is not surprising for two reasons: 1) these ideas are extremely dense and complicated; and 2) the concept was only presented once in the exhibition—though the exhibition had originally planned to focus on distinct evolution of life in Madagascar, over time the focus changed to conservation science and threats to Madagascar.

- ◆ Low-tech, interactive science exhibits. The exhibition contained several interactive exhibits that allowed visitors to “do” science, such as lifting a simulated stone to find and interpret animal remains and studying bite marks to determine what animal had been in a particular area. These exhibits were interspersed in an area that simulated a Madagascar habitat. Furthermore, other interactive components of *Madagascar!*, such as the spotting scopes, magnifiers, and simulated sounds of lemurs communicating appear to have had a positive impact on visitors’ experiences and understanding. The interactive exhibits aimed to help visitors understand the work, and reason for the work, that scientists do in places like Madagascar. The exhibits seem to have been extremely convincing. For one, visitors rated the “look of the exhibits” 6.44 on a scale from 1 to 7, indicating extreme satisfaction. Moreover, of all the objectives, visitors scored highest on Objective 3⁴, “Visitors will be personally engaged in the scientific process,” (39 percent scored “developing” and 36 percent scored “accomplished”), indicating that most visitors accurately described ways he or she did science in the exhibition (ranging from watching animals carefully to identifying animal tracks). These positive experiences likely contributed to the fact that so many visitors who experienced the exhibition gained accurate, concrete knowledge about conservation science.
- ◆ Video Walls. Another aspect of the exhibition that likely affected visitors was the large video walls that displayed a short, looped, silent video of trees being destroyed, followed by rebuilding. On a scale from 1 to 7, visitors rated the videos highly (5.76). These videos quickly and successfully conveyed the notion that Madagascar is in danger, and may account for why so many visitors who had seen the exhibition knew that Madagascar is threatened by the loss of trees (66 percent).
- ◆ Area devoted to WCS’s efforts in Madagascar. The final area of the exhibition provided information about the work WCS and other conservation scientists are doing in Madagascar, which probably accounts for the fact that 61 percent of visitors exited the exhibition able to explain why WCS is in Madagascar (versus just 31 percent of visitors who had not seen the exhibition).
- ◆ Live Interpretation. 37 percent of exit interviewees reported interacting with a live interpreter. This sample size was not high enough to correlate it to positive findings. Nevertheless, on a scale from 1 to 7, visitors rated the live interpretation highly (5.80), and we know from other exhibition studies that staff interaction with visitors can transform the visitor experience (RK&A, 2006).
- ◆ Intimate setting for viewing the animals. And, of course, the animals themselves likely had an enormous impact on visitors. Visitors obviously visit zoos to see animals. However, in some cases, animals are hard to see because they are too far away or hidden within their habitat. *Madagascar!* is located in a closed, relatively small space, and without sacrificing the animals’ safety and comfort, visitors have the opportunity to get very close to the animals. And, as mentioned above, the exhibition provided a few tools, such as spotting scopes, for looking closely at the animals, thus increasing appreciation.

⁴ Because achievement of this objective required experiencing the exhibition, no comparison was made to visitors entering the exhibition.

CONCLUSION

We have learned that *Madagascar!* enhanced visitors' understandings and attitudes of Madagascar, its animals, and conservation science. Ultimately, WCS hopes to impact visitor behavior by inspiring them to conserve environments and wildlife of places like Madagascar. This goal reflects a 30-year trend in zoos and aquariums to educate visitors about conservation efforts and inspire them to take conservation action (Yalowitz, 2004). No doubt, the goal is challenging, as seen by the attempts of other major public institutions, such as the Monterey Bay Aquarium (Yalowitz, 2004; RK&A, 2003). Other studies also show that exhibitions do not necessarily inspire people to act on conservation issues (Adelman, et al. 2001; RK&A, 2003; Yalowitz, 2004). And, in fact, the *Madagascar!* evaluation found that only a small percentage (14 percent) of visitors to the exhibition believed that he/she could do anything to protect Madagascar.

Nevertheless, visitors to the exhibition most definitely demonstrated an increased knowledge-base that enhanced their overall interest in Madagascar and its wildlife. These achievements cannot be understated. Before any zoo can expect to persuade visitors to change their behaviors and take conservation action, they must first *lay the groundwork* for such actions. This means that zoos must provide visitors with experiences and information that can nurture a strong interest that is informed by understandings of the issues, the places, the animals, and conservation efforts—this is precisely what *Madagascar!* has done for its visitors. The *Madagascar!* exhibition has shown that zoos can be appropriate environments for moving visitors beyond the novelty of seeing wild animals to developing an understanding of where the animals come from, why they are important, and how conservation efforts can protect them. Conceivably, this new understanding will provide visitors a starting point from which, over time, they may further ponder conservation efforts and begin to understand specific ways they can take action.

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APPENDICES

APPENDIX A

MADAGASCAR/EXHIBITION ENTRANCE INTERVIEW GUIDE

Removed for proprietary purposes

APPENDIX B

MADAGASCAR/EXHIBITION EXIT INTERVIEW GUIDE

Removed for proprietary purposes

APPENDIX C

MADAGASCAR/SCORING RUBRICS

Removed for proprietary purposes

APPENDIX D

STATISTICS

DESCRIPTIVE STATISTICS

FREQUENCY DISTRIBUTIONS

Interview Group (entrance or exit)
Adult Participant's Age Group (<35, 35-54, 55+)
Adult Participant's Gender
Child Participant's Gender
Child Participant's Age Group (6-7, 8-9, 10-11)
Interaction with Staff (exit only)
First-Repeat Bronx Zoo visit
First-Repeat Exhibition visit
Member of Bronx Zoo
Travel time to Bronx Zoo
Visit to Bronx Zoo Web site

DESCRIPTIVE AND SUMMARY STATISTICS

FREQUENCY DISTRIBUTION, RANGE, MEAN, STANDARD DEVIATION, AND MEDIAN

Adult Participant's Age
Child Participant's Age
Rating of Exhibits (exit only)
Rating of Videos (exit only)
Rating of Live Interpretation (exit only)
Interview rubric scores for all objectives

INFERENCEAL STATISTICS

CHI-SQUARE TEST

Adult's Age Group (<35, 35-54, 55+)
Adult's Gender
Child's Gender
Child's Age Group (6-7, 8-9, 10-11)
First-Repeat Bronx Zoo visit by Interview Group(entrance or exit)
First-Repeat Exhibition visit
Member of Bronx Zoo
Travel time to Bronx Zoo
Visit to Bronx Zoo Web site

INFERENCEAL STATISTICS

ANALYSIS OF VARIANCE

Interview rubric scores for all objectives (except #3-A) by Interview Group (entrance or exit)

APPENDIX E

VERBATIM EXAMPLES OF INDICATORS

WCS *Madagascar!* Exhibition Interview Scoring Rubric With Representative Quotations

Objective	Below beginning (1)	Beginning (2)	Developing (3)	Accomplished (4)
1. Visitors will develop emotional attachment and wonder for Madagascar's animals and environments.	The visitor is unable to name one animal that lives on Madagascar (may or may not refer to characters from the movie.)	The visitor accurately identifies an animal of Madagascar, but also believes animals from the movie, <i>Madagascar</i> , live on the island.	The visitor accurately identifies at least one animal that lives on Madagascar, but does not express much enthusiasm—provides a cursory description.	The visitor accurately identifies at least one animal that lives on Madagascar, and expresses affection for or awe of the animal, by providing a rich description.
Sample Quotations	(Can you talk about one particular animal that lives on Madagascar?) A lion. (Can you tell me more about that animal?) His name is Alex, and he's the one who escapes. (What about a particular animal that lives in Madagascar?) Monkey. (Tell me more about that.) They jump a lot, they climb fast.	(Can you talk about one particular animal that lives on Madagascar?) Um, penguins. (Can you tell me about another one?) Lemur. (Can you tell me about lemurs?) They climb. They jump. They jump to trees. They climb up trees to get their food.	(Can you talk about one particular animal that lives on Madagascar?) A fossa. (Can you tell me more about the fossa?) I think they eat Lemurs.	(Can you talk about one particular animal that lives on Madagascar?) The lemur. I really like those because I studied the rainforest this year, so it was really cool to see them after learning all these things about them. (What, if any, issues do lemurs face today?) Since they live in trees, their home is getting destroyed. (Can you tell me more about that?) The rainforest in Madagascar—that's the only place that lemurs are. So everything's getting destroyed, and if they keep destroying the rainforests, then there's going to be no more lemurs.

Objective	Below beginning (1)	Beginning (2)	Developing (3)	Accomplished (4)
<p>2. Visitors will know that Madagascar's unique species are threatened by deforestation due to slash-and-burn agriculture and over-harvesting of timber, but understand that there is hope for their survival.</p>	<p>The visitor does not realize or acknowledge that Madagascar is a threatened environment.</p> <p>Or the visitor identifies (seemingly guesses) inaccurate threats of Madagascar and its animals (i.e., being eaten by other animals).</p>	<p>The visitor says that Madagascar and its animals are threatened by global or general environmental issues (such as global warming).</p>	<p>The visitor says that Madagascar and its animals are threatened by the loss of trees but does not use specific terminology.</p>	<p>The visitor <i>specifically</i> says that Madagascar and its animals are threatened by deforestation (may or may not specify slash-and-burn agriculture or over-harvesting of timber).</p>
<p>Sample Quotations</p>	<p>(Can you tell me about a major issue that is facing Madagascar today?) A lot of people are taking away the animals; then there's not going to be that many left. (Can you talk about that more?) If there's like tigers there, they start taking them away and killing them, some of them.</p>	<p>(Can you tell me about a major issue that is facing Madagascar today?) Their environment is being demolished. (Can you talk more about that?) Like global warming and stuff.</p>	<p>(Can you tell me about a major issue that is facing Madagascar today?) Lots of trees are being cut down. (Can you talk more about that?) We saw the video and that a lot of the people who work here are helping to save it. I was glad that was happening.</p>	<p>(Can you tell me about a major issue that is facing Madagascar today?) Deforestation. (Can you talk about that more specifically?) The fact that I recall is that two million trees are being cut down every month.</p>

Objective	Below beginning (1)	Beginning (2)	Developing (3)	Accomplished (4)
<p>3. Visitors will be personally engaged in the scientific process [through inquiry-based approaches] and explore the work of individual scientists.</p> <p>EXIT ONLY</p>	<p>The visitor says he/she did not do science in the <i>Madagascar</i> exhibition.</p>	<p>The visitor says he/she did science in the <i>Madagascar</i> exhibition, but is unable to name any specific examples.</p>	<p>The visitor names at least one <i>accurate but general</i> example of a way he/she did science in the <i>Madagascar</i> exhibition (e.g., “looking” or “watching.”)</p>	<p>The visitor names at least one <i>accurate and specific</i> example of a way he/she did science in the <i>Madagascar</i> exhibition (e.g., observing, counting, compare/contrasting, making guesses, look at ethogram).</p>
<p>Sample Quotations</p>	<p>(Can you talk about something that you did in the exhibit that a scientist might do in Madagascar?) We can’t touch anything [in the exhibition]. Because of the way the exhibit is designed, you can’t really experience what scientists do out in the field.</p>	<p>(Can you talk about something you did in the exhibit that a scientist might do in Madagascar?) I looked at the alligator. (How is that like the work of real scientists in Madagascar?) It’s good. (And, can you tell me more?) They kind of get animals for the zoo, and, they kind of get this exhibit for them.</p>	<p>(Can you talk about something that you did in the exhibit that a scientist might do in Madagascar?) [My child] looked at things carefully because he’s got a magnifier here. So he was being very careful, just like a scientist. (And how is that like the work of real scientists who are working in Madagascar?) They would take notes and stuff. (Can you tell me more about that?) They look at things very carefully.</p>	<p>(Can you talk about something that you did in the exhibit that a scientist might do in Madagascar?) Yeah, that fun part when we got to examine a couple of different things...well, for example, that part about the bites on the different leaves and fruits. And we got to observe them and to learn about who takes a bite out of what and what it looks like for each individual. (And how is that like the work of real scientists who are working there?) It helps them to keep track of who’s doing what and who’s eating what and to learn about diet, of animals, and behaviors. (And can you tell me anything more?) Yeah. What else did we look at? We looked at tracks.</p>

<p>4. Visitors will understand how and why conservation science is important to protecting places like Madagascar.</p>	<p>The visitor says he/she does not know why there are scientists working in Madagascar</p> <p>Or makes far-fetched guesses to explain what they are doing there, such as blood testing</p> <p>Or says scientists are there to “protect the environment” but does not relate this to the actual work of scientists (i.e, studying animals).</p>	<p>The visitor says that scientists are in Madagascar but <i>does not</i> realize they are there to protect it. He/she provides only general explanations for what they are doing in Madagascar and does not connect the work that scientists do with protection of the place and animals (such as, “studying animals.”)</p>	<p>The visitor says that scientists are in Madagascar to <i>protect</i> it (or “take care of” the animals), but he/she provides only general explanation for what they are doing (such as “studying animals to protect them”).</p>	<p>The visitor says that scientists are in Madagascar to <i>protect</i> it and provides at least one concrete example of the work of scientists (counting numbers of animals, studying environmental clues, like bite marks, trying to figure out what happened by looking at markings on the ground.)</p>
<p>Sample Quotations</p>	<p>(Why do you think scientists are in Madagascar-what are they doing there?) Trying to see all the animals that live there. (Can you tell me more?) They want to take them to a lab and do studies on them.</p>	<p>(Why do you think scientists are in Madagascar-what are they doing there?) Are the scientists just trying to learn as much as they can in there about the animals and the insects and how the habitat operates, how everybody has to get along together. (Can you tell me anything else about the work of scientists?) No.</p>	<p>Why do you think scientists are in Madagascar-what are they doing there?) [Scientists] are trying to save [lemurs]. Right? They’re trying to understand their habitat so that they don’t become endangered or extinct. (Can you tell me more?) No.</p>	<p>(Why do you think scientists are in Madagascar-what are they doing there?) They’re helping the animals survive. (Can you tell me more?) They’re monitoring them to see how many there are and trying to make sure that the habitat, well, studying them to try and make sure that they can see what they need and how they live so that they can make sure that they have the environment they need to survive.</p>

<p>5. Visitors will know what conservation scientists are doing to preserve Madagascar's animals/habitats (captive breeding of endangered animals, reintroduction, habitat conservation, studying indigenous species in captivity, setting up reserves, etc.).</p>	<p>The visitor does not know what scientists are doing to preserve animals/habitats in Madagascar (may not know there are scientists there).</p>	<p>The visitor makes random, far-fetched guesses about the work that scientist are doing in Madagascar (i.e., "cleaning up oil spills").</p>	<p>The visitor provides only vague, general explanations of what scientists are doing to preserve animals/habitats in Madagascar (such as "raising awareness" or "looking for ways to save the animals").</p>	<p>The visitor names at least one concrete example of the strategies scientists are using to preserve animals/habitats in Madagascar (captive breeding endangered animals, reintroduction, habitat conservation, studying them in the zoo, setting up reserves, etc.).</p>
<p>Sample Quotations</p>	<p>(Why do you think scientists are in Madagascar-what are they doing there?) Maybe they're studying the animals. (Can you tell me more?) I don't know. I have no idea.</p>	<p>I think scientists are there to help protect the animal and try to stop pollution.</p>	<p>I think that if it wasn't for the research everybody's doing over there, a lot of these animals would be disappearing from the planet. It would be really sad. Wouldn't it? Imagine a world without lemurs.</p>	<p>Some of the animals are being bred; there are programs to breed the animals and the fish. Some of the fish there don't exist anywhere else in the wild.</p>

<p>6. Visitors will know this is an exemplary case of collaborative work done by WCS zoos and international conservation programs to save wildlife.</p>	<p>The visitor does not know what WCS scientists are doing to preserve animals/habitats (may not know there are WCS scientists there).</p>	<p>The visitor makes random, irrelevant or far-fetched guesses for what WCS scientists are doing in Madagascar.</p>	<p>The visitor provides only vague, general explanations of what WCS scientists are doing to preserve animals/habitats in Madagascar (such as “raising awareness” or “looking for ways to save the animals.”)</p>	<p>The visitor names at least one concrete example of the strategies WCS scientists are using to preserve animals/habitats in Madagascar (breeding endangered animals, studying them in captivity, setting up reserves, etc.)</p>
<p>Sample Quotations</p>	<p>(Can you tell me anything Bronx Zoo scientist are doing to help Madagascar’s animals?) I don’t know.</p>	<p>(Can you tell me anything Bronx Zoo scientist are doing to help Madagascar’s animals?) I guess studying them so see what they eat. How they survive and all that. (Can you tell me more?) We don’t really know.</p>	<p>(Can you tell me anything Bronx Zoo scientist are doing to help Madagascar’s animals?) I guess raising awareness of the problems. (Can you tell me more?) I guess without awareness and contributions they’ll just continue to have extinction over there.</p>	<p>(Can you tell me anything Bronx Zoo scientist are doing to help Madagascar’s animals?) Preserving them and trying to make more of them. Then, let them go and re-populate the species, the ones that are becoming extinct, or extinct in the wild. (And can you guys tell me anything more?) They’re re-populating them.</p>

Objective	Below beginning (1)	Beginning (2)	Developing (3)	Accomplished (4)
<p>7. Visitors will want to take conservation action or support conservation work because of an increased value for wildlife and wild places.</p>	<p>The visitor does not know that Madagascar needs to be protected.</p> <p>OR</p> <p>He/she knows that Madagascar's animals and habitats should be protected but shows little to no interest.</p>	<p>The visitor expresses a belief that Madagascar's animals and habitats should be protected but does not demonstrate in-depth responses to the questions or emotional language.</p>	<p>The visitor expresses a strong belief that Madagascar's animals and habitats should be protected as demonstrated by in-depth responses to the questions and/or emotional language, but does not cite any ways he/she can support conservation.</p>	<p>The visitor expresses a strong belief that Madagascar's animals and habitats should be protected as demonstrated by in-depth responses to the questions and/or emotional language. Includes the visitor who cites at least one concrete way he/she can support conservation action in Madagascar, such as by giving money.</p>
<p>Sample Quotations</p>	<p>For the most part, this objective was scored based on the entire interview so that there is not one illustrative quotation.</p>	<p>For the most part, this objective was scored based on the entire interview so that there is not one illustrative quotation.</p>	<p>For the most part, this objective was scored based on the entire interview so that there is not one illustrative quotation.</p>	<p>The zoo makes us aware of what is going on there [in Madagascar]. I think they [the zoo] are trying to raise funds to help out with this, trying to keep the animals healthy and learn about the animals, that kind of thing. (Is there anything else you can say about that?) I think it's very important that we do this, and we're here today because my son raised \$245 for the animals, so we just dropped our check off. So instead of birthday presents he asked for checks. It's important; it's very important that we do this.</p>

Objective	Below beginning (1)	Beginning (2)	Developing (3)	Accomplished (4)
<p>8. Visitors will understand that Madagascar is an isolated island and as a result is home to a great number of animals found nowhere else in the world.</p>	<p>The visitor does not know that the animals of Madagascar are different from animals in other places because they live on an island (they may name other incorrect reasons or guesses, such as climate.).</p>	<p>The visitor says that Madagascar is an island or isolated, but does not accurately explain how that connects to the fact that its animals are different (more unique) from animals in other places (adaptation).</p>	<p>Prompted, the visitor says the animals of Madagascar are different (more unique) than animals in other places because of adaptation that happens in an isolated (island) environment (may or may not use the term evolution or adaptation).</p>	<p>Unprompted, the visitor says the animals of Madagascar are different (more unique) than animals in other places because of adaptation that happens in an isolated (island) environment (may or may not use the term evolution or adaptation).</p>
<p>Sample Quotations</p>	<p>(How are the animals that live on Madagascar different from those in other places in the world?) I don't know. We hope to find out [when we see the exhibition.] (There is a great variety of animals living on Madagascar than in any other place in the world. What is it about that place that makes it that case?) I don't know!</p>	<p>(How are the animals that live on Madagascar different from those in other places in the world?) I have no idea. They're in the rainforest? They're like on an island. (Can you tell me more about that?) It has sand. (Can you talk more specifically about that at all?) About the island? I know nothing about the island. (There is a greater variety of animals living on Madagascar than any other place in the world. What is it about this place that makes this the case?) Different animals from the island.</p>	<p>(There is a greater variety of animals that live on Madagascar than any other place in the world. What is it about the place that makes that the case?) Because they live on an island. They're separated from other breeding populations. (Can you tell me more about that?) Madagascar separated from Africa millions of years ago and left a unique deposit of species that haven't gone anywhere else. That's about it, right?</p>	<p>[The animals in Madagascar are different than in any other place because of] geographic isolation. I guess Madagascar split off from mainland Africa hundreds of thousands of years ago and became genetically isolated so they have a separate—they ended up with radically different branch of evolution.</p>

APPENDIX F

EXHIBITION GOALS AND OBJECTIVES

TABLE 10
ACHIEVEMENT OF OBJECTIVE 1 BY INTERVIEW GROUP

	INTERVIEW GROUP	
	ENTRANCE (n = 67)	EXIT (n = 64)
OBJECTIVE I-A RATING ¹	%	%
1 = Below Beginning	36	14
2 = Beginning	15	8
3 = Developing	37	44
4 = Accomplished	12	34
SUMMARY STATISTICS ²	RATING	RATING
Mean	2.25	2.98
± Standard Deviation	± 1.08	± 1.00

¹ $\chi^2 = 15.127$; $df = 3$; $p = .002$

²F = 16.139; $p = .000$

TABLE 11
ACHIEVEMENT OF OBJECTIVE 2 BY INTERVIEW GROUP

	INTERVIEW GROUP	
	ENTRANCE (n = 67)	EXIT (n = 64)
OBJECTIVE I-B RATING ¹	%	%
1 = Below Beginning	39	19
2 = Beginning	28	15
3 = Developing	22	52
4 = Accomplished	10	14
SUMMARY STATISTICS ²	RATING	RATING
Mean	2.04	2.61
± Standard Deviation	± 1.02	± 0.95

¹ $\chi^2 = 14.890$; $df = 3$; $p = .002$

²F = 10.674; $p = .001$

TABLE 12**ACHIEVEMENT OF OBJECTIVE 3 BY INTERVIEW GROUP**

OBJECTIVE 2 RATING	INTERVIEW GROUP	
	ENTRANCE (n = 67)	EXIT (n = 65)
	%	%
1 = Below Beginning	61	62
2 = Beginning	15	20
3 = Developing	9	14
4 = Accomplished	15	5
SUMMARY STATISTICS	RATING	RATING
Mean	1.78	1.62
± Standard Deviation	± 1.12	± 0.89

TABLE 13**ACHIEVEMENT OF OBJECTIVE 4 BY INTERVIEW GROUP**

OBJECTIVE 3-A RATING (n = 61)	EXIT GROUP
	%
1 = Below Beginning	12
2 = Beginning	13
3 = Developing	39
4 = Accomplished	36
SUMMARY STATISTICS²	RATING
Mean	3.00
± Standard Deviation	± 0.98

TABLE 14**ACHIEVEMENT OF OBJECTIVE 5 BY INTERVIEW GROUP**

	INTERVIEW GROUP	
	ENTRANCE (n = 67)	EXIT (n = 64)
OBJECTIVE 3-B RATING¹	%	%
1 = Below Beginning	39	8
2 = Beginning	31	30
3 = Developing	27	52
4 = Accomplished	3	11
SUMMARY STATISTICS²	RATING	RATING
Mean	1.94	2.66
± Standard Deviation	± 0.89	± 0.78

¹ $\chi^2 = 21.458; df = 3; p = .000$ ² $F = 23.996; p = .000$ **TABLE 15****ACHIEVEMENT OF OBJECTIVE 6 BY INTERVIEW GROUP**

	INTERVIEW GROUP	
	ENTRANCE (n = 67)	EXIT (n = 64)
OBJECTIVE 3-C RATING¹	%	%
1 = Below Beginning	46	11
2 = Beginning	22	22
3 = Developing	24	45
4 = Accomplished	8	22
SUMMARY STATISTICS²	RATING	RATING
Mean	1.93	2.78
± Standard Deviation	± 1.01	± 0.92

¹ $\chi^2 = 23.155; df = 3; p = .000$ ² $F = 25.870; p = .000$

TABLE 16**ACHIEVEMENT OF OBJECTIVE 7 BY INTERVIEW GROUP**

	INTERVIEW GROUP	
	ENTRANCE (n = 67)	EXIT (n = 64)
OBJECTIVE 3-D RATING¹	%	%
1 = Below Beginning	56	25
2 = Beginning	12	14
3 = Developing	21	42
4 = Accomplished	10	19
SUMMARY STATISTICS²	RATING	RATING
Mean	1.85	2.55
± Standard Deviation	± 1.09	± 1.07

¹ $\chi^2 = 14.398; df = 3; p = .002$ ² $F = 13.608; p = .000$ **TABLE 17****ACHIEVEMENT OF OBJECTIVE 8 BY INTERVIEW GROUP**

	INTERVIEW GROUP	
	ENTRANCE (n = 66)	EXIT (n = 64)
OBJECTIVE 4 RATING¹	%	%
1 = Below Beginning	44	14
2 = Beginning	36	42
3 = Developing	17	30
4 = Accomplished	3	14
SUMMARY STATISTICS²	RATING	RATING
Mean	1.79	2.44
± Standard Deviation	± 0.83	± 0.91

¹ $\chi^2 = 17.264; df = 3; p = .001$ ² $F = 18.135; p = .000$