

Front-end Evaluation
Vicious Fishes and Other Riches

Prepared for the Miami Museum of Science

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EXECUTIVE SUMMARY

This report presents and analyzes the findings from a front-end evaluation of *Vicious Fishes and Other Riches*, a National Science Foundation-funded traveling exhibition being developed by the Miami Museum of Science in Miami, Florida (MMS) in collaboration with the Science Museum of Minnesota in Saint Paul, Minnesota (SMM). Front-end evaluation helps planners understand how visitors comprehend and think about themes, ideas, concepts, and objects that will be displayed in an exhibition. It seeks common ground between visitors and the exhibition. Findings from the study demonstrate visitors' understanding of various concepts integral to the exhibition and will inform MMS in the exhibition development process.

Data consist of 40 in-depth interviews conducted with 73 individuals—41 adults and 32 children—collected during October and November 2003.

Only selected highlights of the study are included in this summary. Readers are urged to read the body of the report for a more detailed account of the findings.

PRINCIPAL FINDINGS

Perceptions of the Amazon River

- When asked what they associate with the Amazon River, most participants cited forests, lush plant life, or jungles. Many named fish, animals, and Indians. Some participants, mostly adults, identified South America or Brazil.
- In an activity in which participants were asked to write at least one sentence about the Amazon River using the words and phrases “trees,” “good for the Amazon,” “fish,” “people,” “flooding,” “seeds/fruit,” “food,” and “bad for the Amazon,” ten ideas emerged. The most common pre-interview ideas were “There are many/a great variety of/very unique fish and plants living in the Amazon,” “People can be bad for the Amazon (i.e., causing deforestation),” and “Plants and fish of the Amazon provide food for the people living in the Amazon.” The most common post-interview idea was “Local people of the Amazon make a living by fishing for tetra that are sold as aquarium fish in the United States. This is good for the Amazon.”

Stories of Adaptation and Flooding in the Amazon Region

Interviewees were shown three storyboards and asked a series of questions to gauge their comprehension of ideas planned for the exhibition. The storyboards included the anaconda breeding story; the muck fish discovery story; and the piranha seed dispersal story.

Preferences

- Nearly one-half of children and adults liked the anaconda breeding story best because they found the animal fascinating and “cool” or because they learned new information about a familiar animal.

- Nearly one-half of children and adults said they preferred the muck fish discovery story because it presented a new discovery or because the muck fish lives in unique circumstances.
- Less than one-fifth of interviewees said they preferred the piranha seed dispersal story because they liked following the process and learning about a food cycle.
- More than one-half of adult and child interviewees identified the piranha story as least interesting because it was boring, presented no new information, or was confusing.
- More than one-fifth of adult and child interviewees said they did not like the anaconda breeding story because they do not like snakes.

Main Idea

- One-quarter of adults and two-fifths of children said they did not know what the three stories had in common.
- One-quarter of adults and one-half of children said the three stories show there are many varieties of animals in the Amazon.
- Less than one-fifth of adults and one child said all the stories show how flooding or the river impacts the environment and/or the animals that live in it.

Response to Exhibition Statement

Interviewees were shown the statement, “The Amazon is a vibrant place. The Amazon’s flood cycle has triggered the evolution of a variety of life forms uniquely adapted to their environment” and asked to explain what it meant in relationship to the three stories.

- Two-thirds of the children said they did not understand the statement.
- One-half of adults said the statement explained that flooding of the river creates a unique environment to which animals adapt.
- One-third of adults said the statement indicated that the Amazon is a unique place with many animals.
- Interviewees who did not mention flooding in their explanation of the statement were asked what it had to do with the three stories. Most of these adults and children said the term “flood cycle” did not stand out to them and when thinking about it in relationship to the three stories it was not an obvious element.

The Tetra Journey Story

Interviewees were shown a storyboard and asked a series of questions to identify their reactions to the tetra fish industry.

Opinions

- Three-quarters of children and one-half of adults described the storyboard with no added judgment, explaining that it showed how tetra are captured by local people in the Amazon and sold for use in aquariums in the United States.
- One-third of adults and one child described the process and said the story showed the exploitation of a natural environment.
- The participants who described the process without judgment were asked if they thought it was good or bad for the Amazon. One-half of adults and one-fifth of children said they did not have enough information to make a judgment. One-half of children and one-fifth of adults said they believed taking tetra from the river might be harmful for the natural environment. One-quarter of these adults and children said they believed the process was good for the Amazon because it provided income for residents.

Response to Exhibition Statement

After discussing their own opinions, interviewees were shown a statement written by exhibition developers that described the process as good for the Amazon.

- One-fifth of adults and two children, all of whom had previously described the process as bad for the Amazon, said the statement did not change their opinions.
- Interviewees were then asked what specific information in the statement best supports the argument that the ornamental aquarium trade is good for the Amazon. Two-thirds of adults and one-half of children identified the part of the statement that says tetra “are able to successfully reproduce, maintaining a stable population.”

DISCUSSION AND RECOMMENDATIONS

Vicious Fishes and Other Riches promises to be an attractive and engaging exhibition. The topic and the unusual fish and animals that will be presented are appealing to the visiting public. Nevertheless, the front-end evaluation found that the exhibition faces challenges in moving visitors beyond the idea that the Amazon River is home to a great variety of animals to understanding the flood cycle, adaptation, and the relationship between the river and the people who live nearby. Overcoming this issue is not impossible, and findings from the evaluation, discussed below, point to ways to lead visitors to a new understanding of the complexities of the Amazon River.

Impressions of the Amazon River

Open-ended questions about the Amazon River and the sentence writing activity revealed visitors' perceptions—accurate and mistaken—of the region. Examining their ideas can help exhibition developers close the gaps between visitors' understandings and the exhibition's intent.

The idea that there is a great variety of animals living along the Amazon River is familiar to visitors of all ages. This impression surfaced in visitors' free associations with the Amazon and in the sentence writing activity. Furthermore, there seems to be some intuitive (although simplistic) understanding that plants, animals, and people of the Amazon are dependent on each other for survival. Thus, it appears that the notion that the Amazon is diverse and dynamic will resonate well with the public.

However, findings indicate that visitors may not understand the people who live along the Amazon River and their relationship to its plants and animals. For example, data show that quite a few visitors mistakenly believe that all individuals living in the Amazon Region are indigenous people who live a primitive lifestyle. And a number of visitors said that humans, especially outsiders or non-natives, can be bad for the Amazon causing deforestation and exploiting nature. Although this study did not specifically test the idea of the Ribeirinho's House, these findings suggest that visitors may be surprised and possibly confused by the presentation of modern, non-indigenous people residing in and making a living from the Amazon. Do not assume that visitors will view the Ribeirinhos without judgment; in fact some may see them as poachers or exploiters since they do not fulfill the expectation of the "noble savage." The challenge for the exhibition is to explicitly convey that the relationship between the forest, fish, and people of the Amazon is a modern relationship with positive implications for the river.

Understanding the Biodiversity Message

Asking visitors what they liked best and least about the three biodiversity stories revealed aspects of these stories that made an initial impression on them. Many visitors spend little time at individual exhibits and so first impressions often frame their interpretation of an exhibit. Thus, it is important that first impressions both attract visitors and also succinctly convey the component's main message. For the *Vicious Fishes* exhibition, it is important that the biodiversity stories convey the idea that the Amazon's flood cycle has triggered the evolution of a variety of life forms uniquely adapted to their environment.

Many visitors liked the anaconda story best; the anaconda itself and its bizarre breeding pattern captured their attention. However, even though the text included information about the dry season and flooding, no visitor's first impression included the idea that the flood cycle drives their reproductive practices. It was not until probing by the interviewer that some visitors even noticed or saw the relevance of the flood cycle. It is likely then, that most visitors would walk away from this exhibit with a new appreciation for the anaconda, but not necessarily connect its behavior to the flood cycle or adaptation. Nevertheless, this exhibit has great potential for conveying important messages about biodiversity. The exhibit contains a (literally) sexy story that will certainly attract visitors. The challenge for exhibit developers is to convey the story in a way that *emphasizes* rather than implies its connection to the flood cycle and adaptation. These ideas are too complex to be buried in a block of text.

The muck fish story also engaged most visitors. They were most intrigued by its discovery and liked being among the first to learn of the fish. To a lesser extent, some visitors were interested in the unique circumstances in which the fish live. By the very nature of this story, these messages were conveyed effectively. Though no visitors initially mentioned this story's connection to the flood pulse or adaptation, the ideas are implicit in the way the fish live. In fact, through probing interview questions, many interviewees connected the story to the flood pulse relatively easily. With a little revision, the muck fish story in the form of an interactive will make an intriguing exhibit *and* convey the exhibition's messages effectively.

The piranha story was problematic. Partially, this was due to the nature of the storyboard tested, which was a process graphic (intended to simulate an interactive exhibit). Nevertheless, much can be learned from the way visitors reacted to it. For most, this story explained what various animals of the Amazon eat and/or how they disperse seeds to new locations. Visitors found this boring. They missed this story's connection to flooding and adaptation completely and, even with probing, most could not make the association. Again, these key messages must be emphasized rather than implied; they should guide the development of the exhibit. Once visitors see the connection between the dispersal of seeds by piranhas and the flood cycle, it may make a more interesting story. The challenge for exhibit developers will be to re-conceptualize the story in a way that helps visitors understand the flood cycle's impact on piranha and how the fish have adapted.

In addition to gauging first impressions of the three biodiversity stories, the interview guide was designed to probe visitors to think more deeply about the information. By answering questions

about the common ideas in the three stories and considering what they had to do with flooding, biodiversity, and adaptation (as explained in a written statement), visitors formulated conclusions based on what was in front of them. Visitor responses to these inquiries reveal the gaps in their knowledge as well as the touchstones that help them to comprehend. Most children and many adults said the three stories showed that the Amazon contains a great variety of animals. This is an important message, but only a small part of the exhibition's big idea. Few adults and only one child saw the connection between the stories and flooding and the river. Once presented with the main idea written by the exhibition developers (which explicitly mentioned the flood cycle and adaptation), more adults but only a couple children associated the stories with flooding and adaptation. Finally, when asked directly about the flood cycle, many visitors still were not able to make the connection. This finding reveals the large gap between what many visitors, especially children, understand and where the exhibition would like to take them. Helping visitors connect the exhibits to the flood cycle and adaptation required quite a bit of probing and hand-holding during the interview process. Closing this gap is not impossible, but it will require a well-planned orientation area, repetition, and explicit methods of conveying the main message. Ideas are suggested in the recommendations that follow.

Opinions of the Ornamental Aquarium Industry Story

Exhibit developers had some concerns about how visitors would react to the idea that the ornamental aquarium industry is a positive option for conserving Amazon habitats. In this time of greater environmental awareness, taking fish out of their natural habitat and shipping them thousands of miles away to an artificial habitat might be easily interpreted as something bad. The evaluation tested a neutral, simple storyboard of this process to gauge visitors' gut reactions. Interestingly, the reaction was mixed among both locations (MMS and LSC) and adults and children. Some visitors were unsure whether it was good or bad; some were adamant that the process would have a negative impact on the Amazon; and others believed it was probably fine as long as the population of fish was maintained. Once provided with a more complex explanation that included information about the fish population and the generation of local income, many visitors were persuaded that the process was positive, though some remained unconvinced. The information that convinced most visitors that the process is positive was that the population of tetra is stable. Unless this information is explicit and clear, many visitors could misinterpret the tetra story. If important information is buried in a long text panel rather than shown visually or called out with large text, it could easily go unnoticed. Furthermore, although the exhibition takes a positive view of the tetra industry, findings indicate that presenting the story in a more open-ended way and allowing visitors to come to their own conclusions might be more engaging.

Recommendations

- In the introductory area, orient visitors to the flood cycle, adaptation, and the river's relationship to people. Prepare visitors for what they are about to experience and *be explicit* about these ideas. Consider questioning their assumptions directly. For instance, in video and/or text, come right out and say, "You probably think flooding is bad for the Amazon, but in fact it is a natural part of life there" and/or, "You might think that people who live along the Amazon are Indians and live a primitive lifestyle, but in fact XX% are not Indians and have modern homes like you and me."
- Because many of the exhibition's messages are unfamiliar to visitors, providing information as fact in text will probably be ineffective. First-hand experience is a much better method for conveying unfamiliar ideas. So, wherever possible, exhibits should be designed to help visitors *come to an understanding* of the flood cycle, adaptation, and the relationship between the river and its people. Rather than imbedding this information in a block text, design interactives that guide visitors through a process of problem-solving, inquiry, and discovery. Help them come to some "ah-ha" moments.
- Emphasize and reiterate biodiversity, adaptation, and the flood cycle throughout the exhibition since these ideas hold everything together. Do not assume visitors will make the connection between the exhibits and these ideas automatically. Do not worry about being redundant; each exhibit will maintain its uniqueness based on the variety of subjects and component mediums. Repetition of the main ideas will help direct and focus visitors' attention.
- To avoid any misunderstanding about the people who live in the Amazon region, be clear about who the Ribeirinhos are. Explain that they are not indigenous people, but have a long history along the river, they live a modern lifestyle, and their occupations benefit the Amazon.
- The development of each exhibit component should be driven by its main message. These messages should be explicit—in the form of the exhibit's title, probing questions, lead-in text message, and/or the "ah-ha" moments prompted by the interactives.
- In developing the anaconda breeding component (whether it be an interactive, text panel, or video), emphasize the flood cycle and adaptation. For example, consider titling the exhibit in a way that makes visitors think about why anaconda breed the way they do. Consider posing a question or problem that visitors must solve in order to come to an understanding of the significance of the flood cycle in the life cycle of anaconda.
- In developing the muck fish interactive, be careful to maintain the essence of the story's message—that the fish is a new discovery and survives in an unusual place. Be explicit about how this is tied to flooding and adaptation.

- Experiment with the piranha seed dispersal component so that its connection to the flood cycle and adaptation is obvious and interesting. In an interactive, the act of feeding the animal a seed is likely to dominate the visitor's experience, so it may be a challenge. This component may require several iterations in formative evaluation so that the main message is not, "piranhas eat seeds."
- Experiment with ways to present the tetra industry story so that all the pieces of the process, even those that are difficult to show visually, are evident and clear. Explicitly state that the tetra population is stable and local people generate much-needed income from the tetra industry. Use formative evaluation to refine the telling of this story.
- Present the tetra industry story in an open-ended way and invite visitors to examine all aspects of the process and draw their own conclusions about whether it is good or bad for the Amazon region.

INTRODUCTION

This report presents and analyzes the findings from a front-end evaluation of *Vicious Fishes and Other Riches*, a National Science Foundation-funded traveling exhibition being developed by the Miami Museum of Science in Miami, Florida (MMS) in collaboration with the Science Museum of Minnesota in Saint Paul, Minnesota (SMM). Front-end evaluation helps planners understand how visitors comprehend and think about themes, ideas, concepts, and objects that will be displayed in an exhibition. It seeks common ground between visitors and the exhibition. Findings from this study demonstrate people's understanding of various concepts integral to the exhibition and will inform MMS in the exhibition development process.

The objectives of the evaluation were to:

- Gauge visitors' general associations and impressions of the Amazon River
- Identify the strategies that best help visitors understand and appreciate the biodiversity of the Amazon, particularly how the flood cycle affects life and, in turn, how fish and aquatic animals are uniquely adapted to that environment
- Identify how to best tell the tetra fish story so that visitors understand that keeping certain wild fish in home aquariums is a positive approach to resource management in the Amazon.

METHODOLOGY

Data consisted of in-depth interviews, collected during October and November 2003.

Interviews

Interviews are a useful tool for understanding ideas and concepts from the visitors' point of view. The purpose of conducting in-depth interviews is to encourage and motivate interviewees to describe their experiences, express their opinions and feelings, and share with the interviewer the meaning they construct about ideas, concepts, and experiences. In-depth interviews produce data rich in information because interviewees talk about their experiences and ideas from a personal perspective.

Because the exhibition will travel, interviews were conducted at two locations—MMS and the Liberty Science Center in Jersey City, New Jersey (LSC)—to capture any potential regional differences. The interview guide was intentionally open-ended to allow interviewees the freedom to discuss what they felt was meaningful. All interviews were tape-recorded with participants' awareness and transcribed to facilitate analysis.

DATA ANALYSIS

The interviews were qualitative, meaning that results are descriptive. In analyzing qualitative data, the evaluator studies the data for meaningful patterns and trends.

METHOD OF REPORTING

The data presented in this report are qualitative in nature. Following the qualitative tradition of data reporting, trends and themes within the interview data are presented from most frequently to least frequently occurring. Verbatim quotations from the interviews (edited for clarity) are provided in this report to illustrate respondents' thoughts and ideas as fully as possible. The quotations are intended to give the reader the flavor of visitors' experiences. Within quotations, the interviewer's questions appear in parentheses, and an asterisk (*) signifies a change in speaker.

PRINCIPAL FINDINGS: IN-DEPTH INTERVIEWS

DEMOGRAPHICS

As shown in Table 1, 40 individual and group interviews—21 at MMS and 19 at LSC—were conducted in the front-end evaluation. Nearly one-half of the groups were composed of children and adults in families ($n = 19$). One-third of the interviews were with children only ($n = 12$), and less than one-quarter were with adults only ($n = 9$).

Table 1
Interview Group Composition
($n = 40$)

Group Composition	Miami Science Museum $n=21$	Liberty Science Center $n=19$	Total $n=40$
Family group (adults and children)	10	9	19
Children only (ages 10 years + from families)	6	6	12
Adult(s) only	5	4	9

As shown in Table 2 on the following page, the 40 individual and group interviews were comprised of 73 individuals, including 32 children and 41 adults, at MMS and the LSC.

At MMS, 21 individual and group interviews were conducted with 38 visitors, including 18 children and 20 adults. As shown in Table 2, three-fifths of interviewees were male ($n = 22$), and less than two-fifths were female ($n = 16$). Child interviewees' ages ranged from 7 to 15 years, with a median of 11 years. Adult interviewees' ages ranged from 18 to 74 years, with a median of 30 years.

At LSC, 19 individual and group interviews were conducted with 35 visitors, including 14 children and 21 adults. As shown in Table 2, more than one-half of interviewees were male ($n = 19$), and less than one-half were female ($n = 16$). Child interviewees' ages ranged from 7 to 14 years, with a median of 11 years. Adult interviewees' ages ranged from 18 to 73 years, with a median of 42 years.

Table 2
Demographic Characteristics of Interviewees

Characteristics	Miami Science Museum <i>n=38</i>	Liberty Science Center <i>n=35</i>	Total <i>n=73</i>
Gender			
Female	16	16	32
Male	22	19	41
Age			
<i>Children</i>			
7 to 9	3	5	8
10 to 12	12	8	20
13 to 15	3	1	4
<i>Adults</i>			
18 to 24	6	4	10
25 to 34	6	2	8
35 to 44	4	10	14
45 to 54	2	3	5
55 +	2	2	4

FINDINGS

Separate analyses were conducted of MMS and LSC data as well as adult and child responses. There were no notable differences between the MMS and LSC interviewees, but some difference between adults and children. When applicable, these differences are noted in the presentation of findings.

Perceptions of the Amazon River

Interviewees were asked to name ideas they associated with the Amazon. Most participants admitted to knowing very little. Most cited forests, lush plant life, or jungles. Many named fish, animals, and Indians; a few of these named specific fish and animals like piranha, anaconda, monkeys, and crocodiles. Some participants, mostly adults, associated South America or Brazil with the river. Generally, children younger than 10 years said they did not know anything. There was no difference between the perceptions of interviewees from MMS and LSC. Few interviewees had any particular positive or negative associations with the Amazon River. Those who had particular opinions said that cutting down trees is bad for the Amazon.

To further explore interviewees' perceptions, the interviewer asked the visitors to complete a sentence writing activity. The participants were given a sheet of paper that included eight words and phrases (see Appendix B) and were asked to use any or all of the words to write at least one sentence about the Amazon River. At the end of the interview, visitors were asked to review what they had written and make additions or changes based on what they discovered during the interview¹. The words and phrases included: "trees," "good for the Amazon," "fish," "people," "flooding," "seeds/fruit," "food," and "bad for the Amazon."

In the analysis of pre-interview and post-interview sentences written by participants, ten ideas emerged and are presented on the next page in Table 3. There was no significant difference between the perspectives of interviewees from MMS and LSC or between adults and children so the responses are presented together. The most common pre-interview ideas were "There are many/a great variety of/very unique fish and plants living in the Amazon;" "People can be bad for the Amazon (i.e., deforestation);" and "Plants and fish of the Amazon provide food for the people living in the Amazon" ($n = 15$, $n = 14$, and $n = 14$, respectively). The most common post-interview idea was "Local people of the Amazon make a living by fishing for tetra that are sold as aquarium fish in the United States. This is good for the Amazon" ($n = 13$).

¹ Nearly one-half of participants chose not to change their sentences after the interview. While this may be because they had nothing new to add, it may also have been because they were ready for the interview to end.

Table 3
Interviewees' Ideas about the Amazon River
Based on Sentence Writing Activity,
Pre-Interview and Post-Interview

Ideas	Pre Interview <i>n</i>=73	Post Interview <i>n</i>=34
There are many/a great variety of very unique fish and plants living in the Amazon.	15	2
People can be bad for the Amazon (i.e., cause deforestation).	14	2
Plants and fish of the Amazon provide food for the people living in the Amazon.	14	2
Flooding is bad for the Amazon.	9	1
The plants and animals of the Amazon are interdependent.	9	3
Flooding is good for/natural in the Amazon.	8	6
People should protect the natural environment of the Amazon.	6	1
People living in the Amazon are indigenous/Indians.	6	0
Fish of the Amazon should stay in their natural environment (otherwise it is exploitation).	1	4
Local people of the Amazon make a living by fishing for tetra that are sold as aquarium fish in the United States. This is good for the Amazon.	0	13

Stories of Adaptation and Flooding in the Amazon

Interviewees were shown three story boards and asked a series of questions to identify their understandings of ideas planned for the exhibition. Questions were designed to uncover connections visitors made to the ideas as well as gaps in their understanding. The storyboards included:

- The anaconda breeding story
- The muck fish discovery story
- The piranha seed dispersal story

Visitors' Reactions to the Stories

Interviewees were asked which stories they liked best and least. Some interviewees named more than one story they liked best. Nearly one-half of children and adults liked the anaconda breeding story best. Many of these interviewees were already familiar with the snake and said they preferred the story because they find the animal fascinating and “cool” (see the first quotation below). Some adults and children said they preferred the story because they learned new information about a familiar animal, specifically about how anaconda breed (see the second and third quotations).

[I like] the anaconda story. (Why do you like that one?) Well, because it is a snake. And I think that they're cool. [Female, 10, MMS]

The one about the anacondas [was most interesting to me]. (Why is that?) I've never seen anything, I mean, I've never heard of anything as unusual as this. (What makes it unusual?) Their mating patterns are quite unusual, and I just never knew anything about the way that anacondas lived and mated, or did anything. [Female, 18, MMS]

I just think it is amazing how 13 males can be on the same female, and she wouldn't die. *I just thought it was fascinating also that it would take that many males to fertilize the one female. That was fascinating. I didn't know they had live young but thought that was very interesting. [Male, 12, and Female, 73, LSC]

Nearly one-half of children and adults said they liked the muck fish discovery story best. Many of them said it was the most interesting story because it presented a new discovery—a fish that they were among the first to learn about (see the first and second quotations below). Several interviewees, both adults and children, said they liked the story best because of the unique circumstances in which the muck fish lives (see the third quotation).

The fish muck one [is most interesting] because of how they discovered new fish in the leaves, and that's pretty cool. [Male, 19, MMS]

Seeing this first . . . the muck fish was very appealing to me because we are among the first to ever see it. [Male, 18, LSC]

I think [the muck fish] story's more interesting because it shows you how these animals can survive in different, how different animals or fish can survive in not just water, but also in unusual places. [Male, 13, MMS]

Less than one-fifth of interviewees said their favorite story was the piranha seed dispersal tale. Most of these interviewees said they liked following the process and learning about a food cycle (see the quotation below). A few children said they liked this story best because the piranha is a "cool" fish.

The seed dispersal [story was most interesting]. (And why is that?) Because of the uniqueness of how the kind of animals that are eating the food that you're providing them, how it gets dispersed after they eat it. [Female, 11, LSC]

More than one-half of interviewees identified the piranha story as the least interesting. Most of the adults said it was boring or presented no new information. These adults said learning how food travels from an animal to another location is a familiar idea and not interesting (see the first and second quotations below). A few adults said they found the graphic very confusing and did not understand its intent. About one-half of the children who named the piranha story as least appealing said it was dull. These children said learning about the food animals eat is boring (see the third quotation). The other one-half said it was confusing, and they did not understand what the graphic intended to convey (see the fourth quotation).

[I found the seed dispersal story least interesting] because it shows a cycle, [something] we're used to seeing. [It] will make a good little side note, but I wouldn't focus too much on it because it's just a simple cycle while both [the anaconda story and muck fish story] are more complex. [Male, 19, MMS]

The seed dispersal one. *The seed dispersal also. (What doesn't appeal to you about it?) To me it is not really saying anything. *Yeah I think it's a little too simplified. [Male, 23, and Female, 22, LSC]

[The piranha seed dispersal story] is not that interesting. It doesn't have, it's pretty simple. It's pretty much about just one thing. (What makes it so simple?) The fact that like [the animals] simply eat [the fruit] and just dispose of it. (Why don't you like that story?) *I don't like it because [the animal is] just eating and then dropping and regrowing again. [Male, 13, and Female, 11, MMS]

When I first looked at it I didn't understand what all of it was. So I didn't understand what the [animals] were doing or anything. (Tell me more.) The [animals] were all doing the same thing and there was nothing really interesting that happened. [Male, 12, MMS]

More than one-fifth of adult and child interviewees said they did not like the anaconda breeding story. Nearly all of them said they do not like snakes, and a few found the anaconda and the breeding story repulsive (see the quotation below).

Actually the snakes [are least interesting]. (Why was this one least appealing to you or less appealing?) It's not a topic I would wish to pursue. (Snakes in general?) Yeah I mean, I don't see the benefit to learning [their breeding habits]. I mean, I wouldn't want to learn about it. [Female, 40, LSC]

About one-fifth of interviewees said they found none of the stories least interesting. A couple of adults and one child said the muck fish discovery story was boring because they are not interested in scientific research.

Visitors' Interpretation of the Stories' Main Idea

Interviewees were asked what ideas about the Amazon River the three stories shared. One-quarter of adults and two-fifths of children said they did not know what the stories had in common. Among responses from interviewees who provided an answer, the most frequent reply, voiced by one-quarter of adults and one-half of children, was that the stories show there is a great variety of or many animals in the Amazon (see the three quotations below).

It's a pretty unique place that you can't find anywhere else. It's just that, and that's why you have many types of life beings that you can't find anywhere else. [Female, 18, MMS]

[These stories] show that [the Amazon] is a very diverse ecosystem. It has a lot of life and producing potential. [Female, 47, LSC]

They're all about animals. *They're all about certain animals and how they're different and how they're all different. [Female, 9, and Male, 11, LSC]

Less than one-fifth of adults and one child said all the stories show how flooding or the river impacts the environment and/or the animals that live in it. Most of the interviewees were able to identify the river or flood connection to the muck fish and anaconda stories, but fewer saw these elements in the piranha story (see the first and second quotations).

I guess what I would say what they have in common is how the river impacts the wildlife and environment. (Could you explain that a little more?) The [muck fish story says] a river when it floods causes the [muck fish] to be tossed out of what they would normally think is their natural environment. In the anaconda story, this [dry season] is their environment where they do their breeding, and then [the piranha story tells] how the fish actually impact the movement of the seeds. [Male, 30, MMS]

All these animals, all in the Amazon are found near the sand, kind of. Like the [anaconda] is kind of near the sand. See, the [muck] fish are found near sand. So, that's one thing that they have in common. (The sand? You mean where water meets land?) Yeah. [Male, 10, MMS]

Several children and a couple adults said all the stories demonstrate the cycle of life. As examples, they identified the reproduction cycle and the food cycle (see the quotation below).

I think they all have something [to do with a] cycle. This one [about the anaconda] it's about reproduction. This one, where the animal eats and see the seed goes in the soil and then it's replanted. [Male, 13, MMS]

Several adults and one child said all the stories show scientific research or discoveries. A couple adults said the stories emphasize protection of the natural environment. A couple adults said that the stories show how animals are adapted to their environment.

Visitors' Reactions to MMS's Main Idea of the Stories

Interviewees were then shown a statement and told that that it summarized the main idea of the stories from the perspective of MMS. The statement read:

The Amazon is a vibrant place. The Amazon's flood cycle has triggered the evolution of a variety of life forms uniquely adapted to their environment.

Interviewees were asked to explain what the statement meant in relationship to the three stories. Adults' and children's comprehension of the statement differed. Two-thirds of the children said they did not understand the statement (see the first quotation). Of those who did understand it, a few said the statement meant there are many varieties of animals in the Amazon (see the second quotation below); a couple said it explained that flooding impacts animals and the way they live and gave the muck fish and anaconda stories as examples (see the third quotation); and a couple said it was about how animals adapt to their environment.

I don't know what it means. (Are some of the words hard?) No, it's just hard to understand, like, "triggers the evolution of a variety of life forms" and "adapted to their environment." I don't really understand what they're trying to say. [Male, 10, MMS]

It's telling that [the Amazon is] a very vivid place, it's really lively. There are a lot of different types of animals in the Amazon. It's bringing all the different animals to one place and you discover about the way that they live. [Female, 11, MMS]

[The statement] mostly has to do with the flood. [It is] mostly about water and animals that are near water a lot. [Male, 10, LSC]

One-half of adults said the statement explained that flooding or the river creates a unique environment to which animals adapt (see the first and second quotations below). These adults said that the muck fish and anaconda stories especially supported this idea. One-third of adults said the statement indicated that the Amazon is a unique place with many animals and said that all three stories supported the idea (see the third quotation). Less than one-fifth of adults said the statement indicated that animals in the Amazon are uniquely adapted to their environment and pointed to all three stories as examples (see the fourth quotation).

The Amazon makes it all happen. Without the river, this wouldn't be possible. In the case of the anaconda, it says here the dry season makes it possible for survival of the species and the continuation of life. And, in this one, once again, there seems to be a discovery of a muck fish which is only possible through the river and what happens here. What I come away with, is that it's all connected, and how the river makes it happen. [Male, 36, MMS]

Where we are, floods can be damaging and stuff. But in certain situations like the Amazon River, it's a form of growing and sustains the life around it. (Anything else?) *That flooding is essential to its survival. [Male, 48, and Female, 47, LSC]

[The statement says] that there are some unique species in this environment that aren't anywhere else in the world. [Female, 46, LSC]

It's just basically saying that the Amazon . . . has forced the animals to adapt to living that way, and by forcing animals to adapt you generate different species and different variations of the same animal. [Male, 19, MMS]

Interviewees who did not mention flooding in their explanation of the statement were asked about it specifically. Most of these adults and children said the term "flood cycle" had not stood out to them and its relationship to the three stories was not obvious (see the two quotations below). Some of the interviewees then studied the storyboards more carefully and noticed that the muck fish and anaconda stories mentioned flooding, but reiterated that it had not been obvious.

[The stories] don't talk about flooding. I mean, in Philadelphia, it goes from summer, which isn't necessarily flooding, to dry. It's not universal that you think of flooding as part of a seasonal change. There are places where that happens every year, but it's not in everybody's lexicon. [Male, 55, MMS]

I don't know how the [statement] get floods [from these stories]. *Where did you get that from? What? Flood cycle? *I don't know what the [flood cycle] has to do with anything. [Male, 18, and Female, 18, LSC]

The Tetra Journey Story

To identify interviewees' understandings and opinions of the story of the tetra's journey from the Amazon River to ornamental fish aquariums in the United States, they were shown a storyboard and asked a series of questions. Questions were designed to uncover visitors' opinions of the story and the ideas that helped them understand it.

Visitor Interpretation and Opinion of the Story

Interviewees were shown a storyboard that outlined the journey of tetra fish in the Amazon to ornamental fish aquariums in the United States in six sequential images and corresponding captions. The story was purposefully presented in a neutral tone. Interviewees were asked to explain the story in their own words.

Three-quarters of children and one-half of adults described the storyboard with no added judgment, explaining that it showed how the tetra are captured by local people in the Amazon and sold for use in aquariums in the United States (see the first and second quotations). One-third of adults and one child described the same process but with a negative slant. These interviewees explained that the story showed the exploitation of a natural environment (see the second and third quotations below). On the other hand, several adults and one child described the process with a positive spin. They said the story showed how the aquarium industry provides income for people living along the Amazon. Several young children were unable to explain what the storyboard showed.

[It shows the] tetra business. About how they capture the [tetra], they swim, and then the [people] fish for it, well they capture [the tetra]. Then they just like sort out the [tetra], and ship it to the U.S. [Female, 11, MMS]

It's telling you about the tetras and the people that are trying to sort them, and they're selling the tetras to other people. *Capture them and sell them. *Yeah, capture them and sell them. [Male, 9, and Female, 9, LSC]

This is telling me a bad story. (And what is that?) That these fish that are from somewhere else, are being caught, are being put on boats, they're being sold to aquariums over here. (And why do you think that is bad?) Because they should be in their natural environment. They shouldn't be taken from somewhere so far away and be brought here. [Female, 29, MMS]

[This storyboard shows] the invasiveness of Western Civilization upon the indigenous population destroying the [tetra's] basic life cycle. [Male, 49, MMS]

The three-quarters of children and one-half of adults who gave no judgment initially were asked if they thought the process was good or bad for the Amazon. Of these interviewees, one-half of adults and one-fifth of children said they did not have enough information to make a judgment (see the three quotations below). They explained that they needed to know the size of the industry and the tetra population.

If it affects the balance of the species of the Amazon, it will be negative. If it promotes growth and if it helps the people of the Amazon economically, I think it would be all right. Or if it's damaging the balance of the species, then it might not be good. [Male, 52, MMS]

To look at it on a small scale, I would say, yes, it is good . . . for the people of the area, but if it looks like there's heavy fishing here Not knowing where or how much, I'm not sure. [Female, 40, LSC]

There's not enough information. It doesn't say how it affected the Amazon. Like, it doesn't say if the Amazon needed some more fish to be a better place. [Male, 10, LSC]

One-half of children and one-fifth of adults said they believed taking tetra from the river might be harmful for the natural environment. They speculated that the food chain would be damaged or that the tetra population would become depleted (see the two quotations below). A few young children said they felt sorry for the tetra that were taken from their homes and might not survive the journey.

It's bad. (Why do you think it's bad?) Because they're taking all the fish away. (How about you?) *I guess it would be bad because everything else depends on something in the Amazon. So by anybody taking away from it, you're actually destroying it. [Male, 12, and Male, 11, MMS]

It's bad thing because the tetras have to do something that will help the environment. So if you take them out of their environment, something's going to go wrong. [Male, 9]

One-quarter of these adults and children said they believed the process was good for the Amazon because it provided a local income and/or they assumed the population of fish was stable (see the two quotations below).

It keeps [the number of fish] balanced. It keeps it balanced in a way. If you do it too much then the population of the fish will go down, but it helps kind of balance out the number of fish. [Female, 11, MMS]

It is definitely a source of income for the people living along the river. As long as they're not depleting the supply, then it's a good thing. [Female, 73, LSC]

Visitor Reaction to the Museum's Interpretation of the Story

After discussing their own opinions, interviewees were shown a statement written by exhibition developers that described the process as good for the Amazon. The statement read:

The ornamental fish aquarium trade is a positive option for conserving Amazonian habitats. Tetras, some of the favorite ornamental fishes, provide a source of income for a fraction of riverine people, some of the 23 million people who live in the Amazon. Although many tetras are netted each year, the several species are able to successfully reproduce, maintaining stable populations.

One-fifth of adults and two children, all who previously said the process was bad for the Amazon, said the statement did not change their opinions. These interviewees said they were skeptical of the person(s) who had written the statement and believed it was biased in favor of whoever profited from the tetra business (see the two quotations below).

I don't know how much research was done before this fishery was started. And I don't know how factual that statement is. (So you don't believe it?) I don't believe it at all. We work for Noah's Federal Fishery Service, and there are a lot of statements like these that are false. A lot of fisheries say things like this happen and then the fish are gone. [Male, 23, LSC]

Are these people that are fishing these fish controlled? Does anybody count the fish? Does anybody tell them you're done, you're done for the month? *That's what it says right here. No, no I doubt it. *Or for the year or? Maybe they need to show that it's controlled. (Okay that's a good point. Is there anything you think else that needs to be shown?) *Well who, who wrote this? Who made the statement? That's all. Is that by the fishing board of the Amazon? [Male, 43, and Male, 42, LSC]

Others accepted the statement as fact. Those who already thought the process was good for the Amazon said their opinion was validated. Those who were uncertain or had previously said it was bad for the Amazon changed their minds.

Interviewees were then asked what specific information in the statement best supported the argument that the ornamental aquarium trade is good for the Amazon. Two-thirds of adults and one-half of children identified the part of the statement that says tetra “are able to successfully reproduce, maintaining a stable population” (see the first and second quotations below). One-third of adults and a couple of children identified the information that explains the industry provides a source of income for local people (see the first quotation). The remaining children were unable to answer this question.

It’s really because it’s maintaining the population in the river. So it won’t get under populated. *Families are able to live off of what they’re doing. And in this case they’re working in, you know, sorting out the tetra and putting them in tubs and then sending them away to the US. [Female, 32, and Male, 13, MMS]

It sounds like there’s a lot of [tetra]. Even though many are caught a year, they are still able to reproduce. [Female, 11]

Appendices

Removed for proprietary reasons