


# The Buzz on Insects

## A Study of Attitudes and Knowledge Among Visitors to the National Museum of Natural History

September 2007



 Smithsonian Institution

Office of Policy and Analysis  
Washington, DC 20013

## TABLE OF CONTENTS

DIRECTOR'S PREFACE .....	3
BACKGROUND AND METHODOLOGY .....	4
FINDINGS .....	6
Personal Connections.....	6
Attitudes: Fear.....	10
Dirty .....	11
Swarming .....	12
Crawling.....	12
Horrifying .....	13
Alien in Appearance .....	13
Dangerous .....	14
Inexplicable Fear.....	15
Lack of Fear .....	16
Attitudes: Power.....	17
Controlling One's Territory .....	17
Addressing or Confronting Fears.....	20
Hurting Bugs for Fun .....	21
Contempt for the Inferiority of Insects .....	22
Using Insects to Scare Others .....	24
Morality and Respect .....	24
Knowledge .....	26
Knowledgeable Visitors.....	27
Uncertainty and Lack of Information .....	28
Considerations for a Renovated Insect Zoo .....	29
Subjects and Themes of Interest .....	29
Experiences at Other Museums .....	37
CONCLUSIONS AND RECOMMENDATIONS.....	39
The Power of Misconceptions and Urban Myths .....	39
The Need for Practical Information .....	40
A Bug's Eye View .....	41
Hands-On Activities.....	43

## DIRECTOR'S PREFACE

In January, 2007, the Office of Policy and Analysis (OP&A) was asked to do a study of visitors' attitudes toward and knowledge about insects by Nathan Erwin, Insect Zoo Manager, at the Smithsonian's National Museum of Natural History (NMNH).

Two OP&A interns, Nikoo Paydar and Alison Drury, did the bulk of the data collection, conducting over 60 visitor interviews. Interviews took place in the Bug Corner, located on the second floor of NMNH. In addition, they observed visitors for extended periods of time, noting reactions to the displays, demonstrations, and insects themselves; and they themselves interacted with NMNH docents. The result is a shining example of formative qualitative research.

The study's findings are thought-provoking and captivating. Visitors of all ages and backgrounds freely discussed their thoughts about, feelings toward, and connections to insects. Many discussed fears and anxieties related to insects, and many also touched on themes of dominance and control. Notably, visitors' background knowledge concerning insects ranged from extremely superficial to surprisingly deep. OP&A hopes that these findings will help shape the Museum's desire to educate audiences about insects by providing engaging experiences—including hands-on experiences—and balancing entertaining and “crowd-pleasing” offerings with more focused educational offerings that will expand visitors' understanding of insects and their worlds.

I would like to thank the OP&A staff and interns who put this project together. Nikoo Paydar and Alison Drury are to be commended for their diligence and energy in conducting most of the qualitative data collection and analysis under the careful guidance of OP&A Senior Analyst Andrew Pekarik, and for drafting the report. Intern Katharine Dean also participated in the data collection. James Smith edited the draft, and Andrew Pekarik did the final editing and formatting.

Thanks also to Nathan Erwin, an exceptionally talented curator, whose interest in creating a vivid, effective, and creative exhibition to introduce NMNH visitors to the fascinating world of insects drove this project. I have no doubt that, with the input from this study and Nathan's passion for his subject, the new Insect Zoo will succeed in educating and delighting visitors, and foster dialogue.

Carole M.P. Neves  
Director  
Smithsonian Office of Policy and Analysis

## BACKGROUND AND METHODOLOGY

Since its opening in 1976, the Insect Zoo has been a popular attraction for visitors to the National Museum of Natural History (NMNH), especially children. In November 2006, the Insect Zoo was temporarily closed for renovation, and a temporary Bug Corner was set up on the first floor of NMNH, featuring a limited selected of specimen displays, photographs, and activity carts.

In January, 2007, Nathan Erwin, Insect Zoo Manager, approached the Office of Policy and Analysis (OP&A) to request a study of NMNH visitors' attitudes toward and knowledge about insects,<sup>1</sup> the results of which might help to inform programmatic changes in the renovated Insect Zoo. Thus, the two central questions addressed in this study are:

- What are visitors' attitudes toward insects?
- What do visitors know (or think they know) about insects?

To answer these questions, the OP&A study team conducted 61 interviews with NMNH visitors between February 7 and March 14, 2007. Interviews ranged in length from about one minute to almost three-quarters of an hour, and included individuals ranging in age from toddlers to 65 years of age.

Interviews took place in the NMNH Bug Corner, the temporary exhibit constructed to take the place of the Insect Zoo during renovations. The Bug Corner consists of displays of mounted butterflies, bees, beetles, and other insects, and seven large photographs

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<sup>1</sup> Unless otherwise noted, the term "insect" is used in this study as a term of convenience for all types of creatures represented in the Bug Corner—including those that are *not* insects in the scientific sense. The distinction between insects and creatures such as arachnids or worms is not relevant to the questions addressed in this study. The term "bug" is also used for convenience in this loose sense.

showing close-up views of insects, accompanied by quotations from well-known figures such as Charles Darwin and Mark Twain. The main attractions, however, are the learning carts that are rolled into the space by docents six days a week. These offer live insects, some of which visitors are allowed to touch and hold (such as the hissing cockroach) and others of which are used for demonstrations (tarantula feedings). These insects include eastern lubber grasshoppers, Madagascar hissing cockroaches, Australian walking sticks, tarantulas of various species, and tobacco hornworm caterpillars at three different stages—pupa, larva, and a full-grown moth..

Interviews were conducted at both high- and low-traffic times, on days when docents and carts were present and days when they were not. Interviews were recorded, transcribed, and analyzed to identify patterns. Content analysis software (NVivo 7) was used to manage the large quantities of text created, and concept mapping software (Cmap) was used to structure ideas as they developed during the analysis.

In addition to conducting interviews, the study team observed visitors for extended periods, noting for example how they responded to live insects, what they said to one other, how they reacted to holding the insects, and which aspects of the Bug Corner drew the most attention. Study team members also participated in some of the same experiences as visitors, interacting with docents and holding live insects.

## FINDINGS

A museum visitor never arrives alone. Each brings *attitudes* and *knowledge* that shape new perceptions that will arise during the visit. When the subject is insects, these attitudes and knowledge play a particularly powerful role.

- *Attitudes.* The study team was able to identify two overarching themes relating to visitors' basic attitudes toward insects:

*Fear*—Many people are frightened or repulsed by insects at some level.

*Power*—People's attitudes toward insects often reflect ideas of dominance and control.

- *Knowledge.* Different visitors demonstrated very different levels of basic knowledge about insects, ranging from remarkably well-informed to almost completely in the dark.

In addition to discussions of visitors' attitudes and knowledge, this report addresses two specific issues that may be of some value in designing the renovated Insect Zoo: specific subject areas that visitors said they would like to see addressed in such an exhibition; and visitors' thoughts about other insect exhibits they had encountered at zoos or museums.

### Personal Connections

Most of the visitors interviewed by the study team told about personal connections to insects. Hearing these helped the study team to understand how encounters with insects

in a museum are shaped by experiences, memories, and feelings—which may, in turn, suggest ways the museum can better engage and inform visitors.

Interviewees recounted tales of catching, collecting, and hunting insects, keeping bugs as pets, and even eating them. Others shared unpleasant encounters with frightening or dangerous insects. These personal experiences often exerted an enduring influence on people’s attitudes toward insects, and on their willingness to engage the subject during their visit to NMNH.

For example, adult interviewees sometimes recalled childhood memories of insect encounters—both fond and unpleasant—or mused about how their feelings toward insects had changed, or failed to change, over the years since they were small:

*My first [memory] of any kind of insect was when we moved from Brooklyn to Long Island in the early 50s. I remember seeing all of these white pieces of paper—or what I thought were white pieces of paper—and I said, “Why are those papers flying?” ... It was white butterflies. That was the first time I had ever seen them. I was about five, I guess—four or five. For me, that was a whole new experience. ... [To this day,] I’m always interested when I see different butterflies.*



*I don’t like getting stung by bees, because when I was little I got stung on my little toe by a bee.*



**Visitor:** *When I was little, I would pick [insects] up and I would kiss them and they were my friends. ... Now I am like, “It’s a bug and I don’t know where it has been and I don’t know what it is going to do to me.”*

**Interviewer:** *Why do you think that it is?*

*Visitor: I don't know. I think when you are little, you have this sense of discovery about the world that is a lot deeper. I just loved all things when I was a little kid. No matter how gross it was, I wanted to touch it.*



*I like [some] insects, especially certain ones you feel comfortable [around] as you grow up—ladybugs, butterflies. You know, the colorful, typically ones you always [see] and hear about when you are younger.*



*When you grow up on a farm, your childhood memories are of swatting flies. Flies are a big memory.*



*Interviewer: Do you think that there is any way that your [negative] feelings towards bugs could change?*

*Visitor: Probably not. When you are little, you develop that fear that sits with you forever.*

Among specific experiences cited by interviewees, catching bugs was common. For some, these experiences had emotional connotations, while others saw them more in educational terms:

*I had a pet worm. I named it Charlie and I carried it in a box every day. I'd let it go at night and it would always stay around the same place where I would have the box. Then it died. And you know, it was heartbreaking—and that was just a worm!*





*[When] you're a little kid, [a captured insect] is like your pet for the day. Or just like, "Wow; this is an animal and I'm hanging out with it." It's an interacting-with-nature kind of thing*



**Visitor 1:** *My wife actually has a bug collection at home. ... She took a couple of entomology classes at college, so there is a whole range of them.*

**Visitor 2:** *We used to have them in my freezer in college, and every time we found a weird bug we would throw it in the freezer.*

The connection between insects and food also seemed to have a particular personal resonance for many interviewees. While numerous visitors stressed a desire to keep insects away from their food, a number also seemed fascinated by the idea of the insects as food:

*We went to the Department of Agriculture, and they cook crickets during their tour. The kids can eat them if they want, and they can season them with different things.*



**Parent:** *[Tell them] what dessert you like...*

**Child:** *Worm Dirt. It's gummy worms that has Oreo sprinkles with it, and then it has pudding—chocolate pudding.*



*There is this guy on TV ... [who] eats bugs and different things indigenous to that area that will keep him alive.*



*Visitor 1: I've eaten [a bug] before.*

*Interviewer: So you would eat one, but you wouldn't hold one? Why?*

*Visitor 1: Because those things scare me. One bit me before.*

*Visitor 2: I suppose it's like some people eat alligators, but they wouldn't want to hold an alligator.*

### **Attitudes: Fear**

*Against the wall in the Bug Corner, a man in a white coat stands behind two carts pushed together. On the other side of the carts are children gazing at the insects on the carts, mesmerized. A few of them poke the insects with giggles. One child, a small girl around the age of seven, is looking at the bugs with great interest. One of the docents notices this and asks the girl if she would like to hold one. At first, the girl is leery, but with the help of the docents she finally works up the courage to hold a cricket. By the end of her visit, she holds all the bugs on display, and even has a favorite bug. It is difficult not to share her obvious sense of pride and accomplishment.*

Why are insects frightening for many individuals? Visitors interviewed and observed at Bug Corner provided the study team with some insight into what makes insects unappealing or scary: insects are perceived as *dirty, swarming, crawling, horrifying, alien in appearance*, and *dangerous*.<sup>2</sup> In addition, some visitors admitted to a fear of insects, but were unable to articulate any specific reasons for it. And of course, others felt no fear at all.

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<sup>2</sup> These six categories were constructed by the study team based on analysis of interview transcripts. Generally speaking, visitors who commented on the fear response alluded to more than one of these categories.

## ***DIRTY***

Many visitors associated bugs with filthy places such as garbage, unsanitary restaurants, or the fur of animals. Interviewees expressed a particular revulsion for cockroaches:

*Why [don't I like] cockroaches? They eat garbage and old food. Nasty!*

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***Visitor:*** *There are no circumstances under which I'd let a cockroach crawl on my hand. ... Because [cockroaches are] associated with being dirty, you know...?*

***Interviewer:*** *What if they told you they weren't dirty...?*

***Visitor:*** *Still—no thank you.*

***Interviewer:*** *You wouldn't believe it...?*

***Visitor:*** *Rationally, I know they're not dirty. But still, that stigma's there.*

Interviewees told of going to restaurants and finding a cockroach in their food or seeing one scurry across the floor. Some talked about roaches in their own homes—for example, a woman recounted how she almost drank one that had decided to investigate her bedside glass of water. The study team observed a woman ask a docent, after her children had held the giant hissing cockroach, if there was hand sanitizer she could use.

Flies were also unpopular among interviewees due to their association with filth and germs:

*If you have bugs in your house, you just feel that your house is dirty, or that they're carrying germs. Since I was a child, I have been afraid of house flies. I know that sounds ridiculous, but they just gross me out. If there's a fly in a room, I have to leave.*

## **SWARMING**

The idea of swarming insects, everywhere and inescapable, was terrifying for some interviewees. Some simply did not like the image of countless bugs in one place. Others recounted bad experiences with bugs in large numbers:

*I have a fear of hornets. My brother and I got surrounded one time. There were big black and white ones*



*[There's a park in] Austin, Texas. I haven't seen daddy long leg spiders anywhere else. They're kind of gross when they're together. ... There will be thousands of them in these teeming, gross masses hanging from the ceiling.*

## **CRAWLING**

The characteristic movements of insects triggers fear in some people. For some interviewees, the root of this response lay in imagining the sensation of a bug crawling their skin:

*If they're dead and they're just sitting there, its fine. But [when] I see a big insect crawling around, that'll just make me cringe.*



*I think they are fascinating, but they kind of creep me out because they are crawly. I am not big on the crawly thing. Butterflies don't bug me because they fly. But all of that crawly stuff, I just can't [stand].*



*Interviewer: Are all insects horrible?*

*Visitor: No, just the ones that move.*

### ***HORRIFYING***

For some people, horrifying images derived from films or urban myths are a deep source of unease with insects. In some cases, an interviewee recognized intellectually that a particular type of insect was not harmful, yet continued to harbor unease about it because he or she recalled being scared by an onscreen portrayal:

*Visitor: Have you ever seen that movie “Arachnophobia”...? There are these spiders everywhere that eat people’s faces.*

*Interviewer: How about that picture over there? [Referring to picture of a spider]*

*Visitor: Yeah, as soon as I saw that, I got freaked out.*

Urban myths also were a source of revulsion toward some bugs:

*Interviewer: Do you have a least favorite bug?*

*Visitor: The earwig. The myth is that if an earwig gets into your ear it will eat your eardrum and then you will be deaf in that ear.*

### ***ALIEN IN APPEARANCE***

More so than most other creatures we commonly encounter in our lives, insects differ radically from humans in appearance. Although many visitors admitted there were bugs that were beautiful, many expressed discomfort with the insect aesthetic:

*When we look at something, I think our eyes have been trained to say what's pretty and what's not. Something that's uglier is going to be scarier. Something that is, in the human eye, more beautiful seems easier to deal with than something like a big hairy spider.*



*I would prefer snakes on me than a spider. They are evil-looking creatures.*



***Interviewer:*** *One guy told me [the cicada] looks like something from a movie...*

***Visitor:*** *"Alien."*



*I am more into mammals. ... They are more similar to us*

## ***DANGEROUS***

Individuals who have been stung or bitten by an insect often remain leery of similar bugs. For others, wariness about genuinely dangerous insects underlies the fear response:

*I got [stung] by a scorpion three or four times. ... I was wearing no shoes and I stepped on it and it got me between the toes. ... That's probably why I have a fear of little bugs.*



*I lived in Suma, Montana [where] they had Hobo spiders, and they are really poisonous. When they bite, they kill the skin and they leave a big gaping hole. I think that actually caused my fear of spiders.*



*She was at a museum with her class and one of her friends got stung on the head by a bee. Now she will not even go out in the summertime if there are bees outside. ... She wouldn't even wear the color yellow, because her friend had yellow on.*



***Interviewer:*** *What do you think of insects?*

***Visitor:*** *They're pretty good, as long as they ain't bitin' me.*

### ***INEXPLICABLE FEAR***

Many interviewees could not articulate their fear of insects—they just knew they were scared. Some even recognized that their fears were irrational, and expressed a desire to overcome them:

***Interviewer:*** *Why do you think you fear insects...?*

***Visitor:*** *I have no idea. I just find them really repulsive.*



***Visitor:*** *They freak me out.*

***Interviewer:*** *Any particular reason...?*

***Visitor:*** *No. Well... I don't know. I have a reaction to bugs, just like I do with snakes. It's physical reaction.*

*Interviewer: Does that stem from any...*

*Visitor: ...Traumatic experience? Probably; I just don't know about it. I need help! I need to seek help.*

### **LACK OF FEAR**

Finally, some visitors expressed a lack of any fear of insects, or talked about the fearlessness of someone else that they knew. Some noted that children tend to be less fearful toward insects. Others indicated that calm attitudes toward bugs had to do with the way people are raised, their level of exposure to them, or their level of knowledge:

*When we get older, we develop more ideas about what is gross. When you are little, you have no concept of good and bad; it is all just cool.*

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*When [I was a child and] it rained, I refused to go outside because there would be worms on the ground. [Laughs] My grandmother used to be like, "Suck it up!" She lived on a farm when she was little, so she [knew] all about worms and fishing and all of that stuff.*

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*Interviewer: You mentioned that you're not afraid of insects...*

*Visitor: I think I just like animals and insects. I guess it was just how I was raised.*



## Attitudes: Power

*It is a relatively quiet afternoon in the Bug Corner, and no docents are present. Three visitors in their 20s are giggling as they approach the giant tarantula image on the back wall. The man in the group exclaims, “We should take a picture of this for Brad. He hates spiders!”*

Issues of power are central to many peoples’ attitudes toward insects. The ease with which insects can be controlled, manipulated, harmed, and killed—and the reasons people might do so—were recurring themes in the interviews. The study team identified five areas in which the idea of power was frequently raised with respect to insects: *controlling one’s territory; addressing or confronting fears; harming insects for fun; contempt for the inferiority of insects; and using insects to scare others.*

Interestingly, however, some visitors also discussed how the huge imbalance in power between people and bugs presents a fine opportunity for moral instruction. For example, several interviewees discussed how teaching children to show respect in interactions with tiny, powerless creatures imparts a larger lesson about respect for life in general.

### ***CONTROLLING ONE’S TERRITORY***

Interviews suggested that one of the primary power issues in human-insect interactions revolves around territory. Interviewees defined their territory in various ways—“my house,” “my bed,” “my backyard,” and so on—but regardless of the definition, the upshot was that insects were not welcome there. One image that came up repeatedly was that of an insect “crossing the line,” or exceeding some threshold of tolerance:

*The outdoors is the place where [insects] exist naturally. We build houses for ourselves and want [nothing] to impede our lifestyle without consulting us first. That’s where they cross the line.*



*It's not that I really mind insects, now that I think about it. As long as they don't come into my house. ... [But when they interfere with my life,] I draw the line.*

The distinction between outdoors and indoors was crucial. For many interviewees, an insect outside is deserving of some respect, while an insect inside is to be destroyed or removed:

*I never squash bugs when they're outside. But when they're in my house, then yes [I do].*



*All of a sudden you just see ants crawling up your wall and you're like, "You can't be in my house!" If you're outside, I'll respect you and I'm not going to kick your ant mounds. But please don't crawl up my walls.*



*When it's in the house, you want to get rid of it right away. But when you're walking through the woods, you want to stare at it and look at it—look at the different colors.*



*We don't kill spiders outside, but we kill them inside. Spiders outside are good; spiders inside are not good. ... No bugs inside.*



*If I am outside and there is a bug, that doesn't bother me. But when it's inside and it's crawling around the house—that just creeps me out. I've got to get it out of there.*

Visitors also discussed concerns about insects that have the potential to overtake their space or harm their plants or other cherished items. And while some acknowledged that insects might have “been there first,” the foremost consideration for most interviewees was their own right to an insect-free home or picnic:

*I know they have their place. ... They're everywhere, but then as humans move into an area, they want to have them further away—as opposed to sharing the space with them. [But] it's understandable. As you get ready to eat, you don't really want ants crawling on your food, even though the ants were there before you came to eat. ... I don't want them laying eggs [in the house] and having more of them crawling around.*

#

**Visitor 1:** *In Africa [where I lived], you get tons of cockroaches. They will come up through drains. My husband got up one night and you could here this noise—this little rattling in the bathroom—and when he turned on the lights, the whole wall and the inside of the bathtub was full of them.*

**Visitor 2:** *I kept a glass of water by my bed and I found out there is a reason you should put a cover on it. I went to take a drink and I got feelers up my nose before I drank. No, cockroaches are not my favorite insect by a long ways.*

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*Whenever I see black ants, they seem harmless. But I always want to eradicate them, because they spread scale. Ants [also] like to exploit aphids and other*

*kinds of species. ... So whenever I see ants in my garden, I know they're going to start spreading pests and scale ... and then they'll infest my garden.*

For many people, killing an insect that violates their space (particularly their house) is an easy decision—it is self-defense.

### ***ADDRESSING OR CONFRONTING FEARS***

For some interviewees, exercising power over insects was a response to their own fears about bugs. For example, many interviewees indicated a willingness to kill insects that aroused their anxieties:

*Just to see [an insect] around—that wouldn't bother me. But if it was in my house, and there was a possibility that if I didn't kill it, it would crawl on me eventually...*

##

***Interviewer:*** *Are there any bugs that you're scared of?*

***Visitor:*** *No. Well... [If there were,] I'd probably kill it. I could get a shoe; I'd put my shoe on, and step on it.*

##

*Any [insect] that scares the living heck out of me—like, if it surprises me—my first instinct is to squish it.*

Also relevant to the theme of confronting fears are issues of peer pressure and demonstrating bravery to one's peers. For example, a teenage visitor at the Bug Corner carts was observed asking members of her group “*Will you touch it, if I touch it?*”

Similarly, when asked about holding insects, one interviewee said, “*If someone dared me to, I would do it.*”

### ***HURTING BUGS FOR FUN***

Some interviewees found hurting or killing insects to be a diverting pastime, or talked about people they knew who did. Younger people in particular often seem to consider this a harmless way of getting in touch with their inner sadist, and hurt or kill bugs without any thought to the moral consequences. Many adult interviewees recounted childhood memories of inflicting damage on insects. Some told their stories with laughter and humor; others, with a sense of remorse:

*I got in trouble for killing ants with a magnifying glass. [Laughing]*



*The inch worms—you divide them up. ... No, they don't die. If you have one [and you cut it in half,] you'll have two worms. We used to cut them up and see how many worms we could make.*



*You know what my grandpa used to do? Take lightning bugs, pull the wings off, and make jewelry for me. ... The poor thing, it'd still be alive. ... Torturing them on a little girl's finger [to make] her feel like she's a princess.*



*If you put two daddy long legs together, one will kill the other one.*



*I used to go out to this field by my house with my friend and we'd catch crickets and pull off their legs.*

☛

**Visitor 1:** *I played with daddy long legs when I was little—well, destroyed daddy long legs. You know, you pick them up and throw them by their legs and stuff like that. ... And lightning bugs. ... [You] crush them when they're glowing, and rub them on your hand...*

**Visitor 2:** *You could smoosh them, and it'd be like war paint for hide and seek.*

☛

*My brother and a bunch of his friends caught a praying mantis and cut it [to pieces] with a pocket knife. I remember being traumatized. [Laughter]... They were awful. ... They were bad boys. They wanted to see what happened, I guess. They were about ten, and they were mean.*

☛

*I had a little assembly line with bricks, and I would smash [insects]. ... That was how I entertained myself. ... [I didn't feel remorse] because I think my dad told me they were bad—that they killed plants.*

### **CONTEMPT FOR THE INFERIORITY OF INSECTS**

Implicitly and sometimes explicitly, many interviewees suggested that insects are insignificant creatures, unworthy of the kind of practical and moral consideration that creatures more like us might deserve. One teenage boy reflected on this attitude in the following words:

*If you step on an insect, you don't really think much of it. ... [Insects are] so small, and we're usually too caught up in everyday life to notice something like that. But if [people] see, I don't know, a poster of a guy holding a dead lion or something, they'll think, "Awww, he didn't need to do that." ... You don't think of an insect as something you want to feel sympathy for, I guess. ... [When] people think of animals, they'll pick something like [a monkey, or a lion, or a bear, or a fox] as their favorite. But have you ever heard of someone [who] picked any kind of insect as their favorite animal? Never! ... But [our relationship to bugs is different from our relationship to larger animals] only because people think that way. It really shouldn't be any different.*

Indeed, the same respondent suggested that the word “bug” itself denoted a creature one could “squish” without remorse, at least in his mind:

*“Bug” is not a real scientific word, so I think “bugs” include all insects, spiders— basically anything small and easy to squish on. ... [Of course] anyone could squish a mouse, too. But if it's a mouse you'd still have some kind of emotional reaction. You wouldn't like that.*

However, some interviewees were also conscious of the power and influence of insects. One of the quotes on the Bug Corner wall inspired the following exchange:

**Visitor:** *I just read “Insects won't inherit the earth, they own it now.”*

**Interviewer:** *Do you think that's true...?*

**Visitor:** *Probably. They've been around a lot longer than us, and they'll probably outlast us.*

## ***USING INSECTS TO SCARE OTHERS***

Another power issue that came up in interviews was the use of insects as instruments to provoke fear in others. Again, this activity was particularly popular with younger people, although as the observation at the start of this section indicates, adults are not above the occasional prank with insects. Visitors shared vivid descriptions of throwing insects at parents, rattling cicadas, and various other successes in frightening people with bugs:

*[I like bugs] because they are gross. ... So I can scare my mom. ... Bird-eating spiders [would freak out my mom the most].*



**Visitor 1:** *I brought a cicada into my kitchen one time and it kind of freaked my mom out.*

**Visitor 2:** *Yeah, my older brother did that. My brother got one of those big fat cicadas that year that they were all coming out of the ground, and he brought it over and kept shaking it around the people in my house to make that noise.*

## ***MORALITY AND RESPECT***

Interestingly, the subject of morality and respect also frequently emerged from the interviews, and was sometimes discussed with reference to the obvious power asymmetry between people and bugs. For some visitors, insects were tools for teaching their children about ethics and values—for example, teaching them to have respect for smaller or less powerful creatures by instructing them not to kill bugs:

*I brought [my children] up differently ... Not to [step on bugs] ... It is a life. So far, it has stuck with them.*



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*My son wants to check everything out, and he doesn't always handle things gently. I am always like, "Don't kill it. You know, just because it is little and you **can** kill it doesn't mean you **should**." He should have respect for God's creatures; it is alive and [he should] let it stay that way.*

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**Visitor 1:** *[A butterfly display] feels like exploitation.*

**Visitor 2:** *Yeah. They used to be living things, and now they're sitting in my home. It's kind of weird, you know? For museum exhibits and things like that, I think it is a wonderful thing. But for personal home decoration? I don't know...*

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*My mother taught me to respect bugs.*

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*The young people and people who are not knowledgeable get a lot out of being able to have a grasshopper crawl on [their] hand, and realizing it is not a dangerous animal and it is to be respected.*

One interviewee described her reservations about a school project that involved bug collecting:

*At the beginning of the year, we would buy nail paint remover, put it on a cotton swab and then put it in a little container with the bug and wait for the bug to die. Every time I did that, I felt like it wasn't a very good thing to do. ... We had to kill the bugs to get an A. ... And then, to add insult to injury, we had to take a piece of Styrofoam and a whole bunch of little nails, and you can fill in the blanks...*

Another visitor discussed her experience teaching preschool:

*We got all these caterpillars and we were able to watch them turn into butterflies. We taught the kids [about] how important it is to respect the bugs and not step on them and squish them. ... We got them to realize that, you know, you wouldn't want somebody to step on you. [You wouldn't want a] big foot to come and smoosh you. We're sharing our home with [the insects] just like they share their home with us when we go out on the playground. So if we bring it from that perspective, they love it. We'd catch bugs and then let them go and let [the kids] know that [the bugs] had to go back home, just like they did. ... It was something they could relate to on their level.*

The comments of one young boy, however, offered some insight into the fragility of moral lessons learned in this way:

*If nobody's looking, I kill it. But if anyone else is there, I have to take it outside. ... My dad's all—whatever—“It's a life; it's not hurting you; there's no reason to do that.”*

## **Knowledge**

*Sometimes, during peak visit periods, the crowds in Bug Corner get so close to the carts, there is hardly space to see. One young girl picks up a caterpillar and describes it as “goopy.” In fact, the caterpillar is very smooth and soft to the touch—hardly “goopy.” Did this girl's strong mental image of the green caterpillar overpower sensory reality?*

The knowledge and beliefs that visitors bring with them to the Bug Corner exert a powerful influence on their experience there, even if these beliefs are not correct—as in the case of the mismatch between perception and reality recounted above.

One of the key questions the study team addressed was, “What do visitors know about insects?” The study team found the range of knowledge demonstrated by visitors was wide. Some had an incredibly thorough knowledge of insects, as well as a deep interest in, and capacity for, learning more. They indicated they had learned about insects in high school and college, in museums, from collecting insects, and from a range of other activities and sources. On the other hand, some visitors knew very little about insects. One, for example, admitted, “*All I know [about bugs] is that I always have to kill them for my sister; she hates them.*”

### ***KNOWLEDGEABLE VISITORS***

Some visitors impressed the study team with their knowledge of insects. Interviewees discussed how ants fertilize and aerate the ground; termites are food in parts of Africa; dung beetles roll dung around and break it up; insects decompose the vegetation; monarch butterflies lay their eggs on milkweed so they taste bad to birds; tarantulas throw hairs; ladybugs exude poison; a cockroach can live without its head for a time; and other fascinating examples of insect trivia. Visitors also impressed the team with their knowledge of obscure types of insects, such as the “toe biter” in Florida, mosquito hawk, viceroy butterfly, assassin spider, and a wasp that kills tarantulas. The following quotes illustrate the impressive insect knowledge of some visitors:

*My favorite beetle is the bombardier beetle. It waits for prey to move underneath it, then it drops on top from a branch. In its behind, it has a reaction chamber, where it puts two different chemicals together that react, and it shoots out a hot stream of noxious gas and hooks its prey. ... [I learned this] from an encyclopedia. ... I'm always reading science stuff. ... My son is the same way.*

*When I took him to a bookstore and told him he could buy any book he wanted, he got a book on the encyclopedia of science. Instead of buying comic books or whatnot, he got a thick book on science. He's four. ... [Insects] represent [at least] 90 percent of the non-vegetal biomass of the planet, and it might be more than that—98 percent or something. They're the most diverse [type of] species—there's ten times more species of bugs than there are of everything else combined. ... They're also the first organism, right? Arthropods came out of the ocean and adapted to dry land first. So, they've been around forever.*



*Without them, we wouldn't have any food. For example, everyone knows about bees pollinating. In our hometown, bees are required to pollinate the apple blossoms or else we don't have any apples in the fall. Farmers actually bring in bees to pollinate [their crops]. The [recent] decimation of the bee population with the mites has really put a dent on the bee population, and that has been a hindrance to pollination.*



*They're very varied in their ... wing size, body shape, stuff like that; and all that serves a purpose. Like, bright colors can attract mates ... while bigger wings let them fly farther. They can also blend into the environment a lot, and a lot of them can burrow.*

### ***UNCERTAINTY AND LACK OF INFORMATION***

While many visitors were quite knowledgeable about insects, others had little knowledge on the subject. The information volunteered by such interviewees was typically sketchy, and respondents were often uncertain where they acquired it and whether it was accurate:

*I never really thought of it, but insects play a big part in the world. I just learned a little while ago what ants do. My teacher wasn't very descriptive when he said it, but they do something to the soil, and if they weren't around we'd all be dead.*



**Visitor 1:** *I heard that daddy long legs have the most poisonous venom—is that true? But you don't get bitten by enough of their poison to actually get hurt.*

**Visitor 2:** *I didn't even think they were spiders...*



**Visitor 1:** *I know a lot of people think that if you get bit by a scorpion [or a tarantula], you'll die.*

**Visitor 2:** *Or that you have to pee on insect bites...*

**Visitor 1:** *That's a sea urchin. I saw that on "Survivor."*

## **Considerations for a Renovated Insect Zoo**

Another important purpose of this study was to find out what visitors would like to see in a renovated Insect Zoo. Two types of comments were of particular interest in this connection: visitors' comments about subjects or themes they would like to see in such a place; and visitors' recollections of insect education experiences at other museums and zoos.

### ***SUBJECTS AND THEMES OF INTEREST***

Interviewees indicated specific subjects and themes that they would like to see in a museum insect exhibition. The study team classified these in the following categories:

- Exotic and unique insects
- Beautiful insects
- Insect-insect interactions
- Insect-human interactions
- Insects in their habitats
- Insects' development, growth, and physical structure
- Evolution and diversity
- Particular insects of interest.

### ***Exotic and Unique Insects***

Some visitors were particularly interested in seeing unusual insect specimens with “alien,” “weird,” or “exotic” qualities reminiscent of science fiction or fantasy—as opposed to the more familiar species that they might encounter in their own homes or yards. A few visitors also mentioned a desire to learn about extinct insects. Visitors with such inclinations wanted an Insect Zoo that would provide them with a chance to see insects they might never otherwise see, or even conceive of:

*[I like] the idea of seeing new, exotic bugs. Not gnats and flies, but things you wouldn't see normally. Rare things.*



*If there are extinct insects that you have specimens of, that would be pretty cool—very interesting.*



*Seeing the molting tarantula ... was awesome. The kids around me were going “Oooh!” [because they were seeing] something that they might not ever get to see. [When you hear] an “oooh” or a “wow” ...you know the kids are getting something out of it.*

### ***Beautiful Insects***

Some visitors were drawn to the beauty of certain insects—with butterflies receiving more attention than other types of bugs, and color receiving more attention than other aesthetic characteristics. (One of the most precious moments observed by study team occurred when a boy around the age of ten offered a man in his forties wearing a business suit the following advice about viewing a mounted specimen: “*Sir, if you look at this butterfly from this angle, it’s iridescent and even more beautiful.*”) Visitors mentioned beauty not only in form and color, but also in movement—for example, describing the delicate flutter of a butterfly as “soothing” and “peaceful.”

*Actually, my favorite [bug] is a black widow, because black and red were the colors I used to use when I was little. I like black and red a lot.*



*I’m an artist, a painter. So, when I see colors, I like that. I can work with that.*



*I just like colors. They're pretty. Butterflies are soothing. ... The colors. How they flutter. They're peaceful. ... Don't get me wrong about these [other] bugs; they have different colors too [and] they're ugly and scary. [But] butterflies aren't really scary.*



*They're so colorful. I love seeing the diversity of life, but there's so much [else] in the museum that I wouldn't spend a whole lot of time looking at [most of these insects]. I just look at the really colorful, iridescent ones, and I'm blown away. But I wouldn't try to figure out where they're from and how they evolved or what. I'd just be choosing ones that look beautiful to me.*



*I would let those crawl on me, because they're pretty.*

### ***Insect-Insect Interaction***

Many visitors expressed a desire to know more about insects' relationships with their own and other insect species, including predator/prey relationships. Seeing individual insects in isolation is not very satisfying for those visitors who want to see how insects relate to other species in that environment:

*[I am interested in how members of an insect species] organize themselves and communicate. Things like that. How millions of individual behaviors get patterned.*

*Certain kinds of wasps lay eggs on caterpillars that are harmful to crops. The wasp eggs hatch and use the harmful caterpillar for food and kill it. Now that is a relationship that is very interesting.*





*[I would like to see] a big tank that has a lot of different kinds of insects in a controlled environment—insects that aren't hostile to each other, and that are easy enough to care for that you could just drop a bunch of aphids or leaves or plants or whatever [into the display] and they could eat it without much trouble.*



*I think [the Insect Zoo should show how insects] interact with different things—like one butterfly should see another butterfly. Not [butterflies of the same species], but another set of butterflies, to see what happens when the two butterflies interact with each other.*

### ***Human-Insect Interaction***

Interviewees also expressed an interest in learning more about the relationships between insects and humans, such as how human societies are helped (pollinating bees) or harmed (swarming locusts) by insects, and the consequences of human efforts to deal with the latter:

*I have a nephew who is in crop management. ... Insects can do a lot of damage to the crops they depend upon. He gives them advice on spraying various pesticides. He says they all have been tested, and they all are safe. However, I asked him if this one and that one have been tested together, so you [know what happens if you] end up with a pesticide soup. What are we doing—not only to the insects but to ourselves...?*



*I grew up on a farm. ... I remember we had swallows, and during the DDT period ... there were very, very few swallows. Now they are back, and there are fewer mosquitoes. So we do have to be careful when we try to kill off the insects we view as harmful.*



*[You should not] just say, “Well bugs are nasty; they look nasty and ugly,” [because] they might be helping you.*

### ***Insects in Their Habitats***

Some visitors wanted a better understanding of insects in their natural environments—including what they eat and what part of the world they live in. Some saw this as essential for grasping how insects fit into the human world. For example, what is it about a person’s garden that makes it a good habitat for certain kinds of insects, and what role do they play in that environment?

*It’s very interesting when [you can see] see how they live [in] their environment. So you can place them in the real world.*



*Another thing that would be pretty cool is termites. You could build a little fake termite habitat, and put glass over it so people can see how termites [live].*



*I just probably [would like to know] a little about where they live, how they live, what they eat, what they do, how long they live.*

## ***Insects' Development, Growth, and Physical Structure***

A number of visitors were curious about insects' bodily structures, how they develop over the course of their life cycles, and how their bodies are similar to and different from those of other creatures:

*You know how you have skeletons of other animals? Maybe [the Insect Zoo could have] a model of a chopped-open [insect]—you know, half of it, so you can look inside and see what's inside a bug*



*One thing that I'd like to know is what bugs besides butterflies/caterpillars change appearances as they go through life.*

## ***Evolution and Diversity***

Some interviewees wanted to know how there came to be so many different insects. They expressed an interest in the enormous variety of insects—the diversity of color, shape, size, structure, habitat, and roles in the ecosystem:

*It's amazing how many species there are. That's what blows me away.*



*We spent a lot of time overseas, and that's where I got acquainted with cockroaches—on a first name basis, practically. I began to appreciate the diversity of the insect world, [as well as the] bird world, animal world, and even the human world. ... [We] are all connected.*

### *Particular Insects of Interest*

Finally, most interviewees found some insects more interesting than others, noting their individual preferences for the species or types of insects they would like to see or touch in the Insect Zoo:

*[I like tarantulas] because they are scary and hairy.*

☛

*I would like to see a scarab beetle or a rhinoceros beetle or a dung beetle rolling in the dung. That's really cool.*

☛

*You should get some camel spiders. [I heard they] live on the undersides of camels and their legs are about two feet long, [and] they suck the blood of camels. Yeah—definitely get those in here.*

☛

*I have never seen a cockroach before. ... I want to see a cockroach.*

☛

*I would like to see those huge tarantulas.*

☛

*[I would like to see] the type of praying mantis, the pink type that specializes in hiding inside orchids, or orchid-type flowers. Those really interest me.*

☛

*[I would like to see] centipedes. I'd like to see one wrap around my hands and go through my fingers.*



*Scarab beetles are cool. They have these huge horns on their face and all. They live in Egypt.*



*[I would like to see] a praying mantis, because nobody knows much about them. You only see them on occasion. ... One time our science class found a praying mantis, so we put it in a biscotti jar with a cricket. Then we went out to do an experiment outside, and when we came back all that was left [of the cricket] were a couple legs and a head.*



*I really like to observe praying mantises. I find them really interesting. Their camouflage ... and the [way the] female eats the male.*

### ***EXPERIENCES AT OTHER MUSEUMS***

Some interviewees also discussed past experiences with insects in other museums. These discussions had clearly influenced their current perspective on insects, and in many cases provided a useful point of reference when describing what they would like to see in a redesigned Insect Zoo.

*I [held] a scorpion one time when I was little ... at the zoo.*



**Visitor 1:** *[We saw an insect exhibit at] the Natural History Museum in New York.*

**Visitor 2:** *It was at the Planetarium, right...? It really felt like you were in their natural habitat, and that was fabulous.*

**Visitor 1:** *Amazing...*



*The best thing I ever saw [was] in Germany, where I was stationed in the military. They had a butterfly house [where] they had butterflies just flying all through it. They would take the cocoons and hang them on a little fishing wire against one of the walls, and you could watch the butterflies hatch out of the cocoons. That was really neat.*



*[At our zoo,] they let you go in and have hands-on [interactions] with some of the bugs. They have all kinds of bugs in there. They teach you which ones are dangerous, what “poisonous” versus “venomous” means—you know, ingesting it versus being stung by it. They explain which ones, even though they might look scary, are really friendly. They let you touch the spiders, and the things they know won’t harm the kids. [It works] as long as the parents go in with a positive attitude. That’s huge, because [it’s a problem] if you get a parent in there who is going “No! No!” So the parent has to be at an even keel throughout this whole thing.*

## **CONCLUSIONS AND RECOMMENDATIONS**

Based on its interviews and observations in the Bug Corner, the study team was able to draw some conclusions about the major issues that a renovated Insect Zoo may wish to address in order to connect as effectively as possible with visitors. On the basis of these, the team also offers some recommendations.

### **The Power of Misconceptions and Urban Myths**

Are daddy-longlegs poisonous...? Do camel spiders attack camels...? Do earwigs burrow into people's heads...? Can tarantulas kill people...?

Insect misconceptions and urban myths abound. Many visitors to the Insect Zoo bring misconceptions based on tall tales that they have heard since childhood, and that they believe to be true. There is a significant need for dispelling myths and providing visitors with the real story, particularly regarding questions of general interest such as:

- Which insects are really dangerous to humans?
- What are the facts underlying some of the frightening portrayals of insects in films?
- Are insects “dirty”? Which ones, and in what ways? (For example, which ones occupy habitats that people would consider filthy? Which ones play a role in the transmission of diseases?)
- Which peoples and cultures incorporate insects into their diet, and why?

Addressing such areas of misunderstanding is of more than trivial interest. Many visitors—especially adults—come to NMNH bound by a mindset that prevents them from appreciating insects, and misconceptions and urban myths play an important role in creating this mindset. An increased emphasis on “myth busting” in the renovated Insect Zoo would be valuable not only for the sake of increasing visitors’ knowledge, but also for indirect benefits this is likely to have in alleviating visitors’ fears and encouraging more positive attitudes.

- **Recommendation:** Conduct a focused study to identify the most common and outrageous misconceptions about insects held by the visiting public.
- **Recommendation:** Explicitly address insect urban myths through wall text and media presentations in the Insect Zoo; a FAQ handout for Insect Zoo visitors; a section on the Insect Zoo website; and an increased emphasis on “debunking” in the training of docents.

A related tactic for increasing visitor’s interest in and appreciation for insects would be to emphasize the real-world “achievements” of various insect species—including those that directly benefit the ecosystems on which humans depend (aerating soil, pollinating plants) and those that are simply good stories—such as the unique life cycle of cicadas or the activities hidden within beehives and ant colonies.

## **The Need for Practical Information**

Related to this imperative to address misconceptions, the study team perceived a need for practical information on real-world insect encounters. For example, one visitor noted that many people would not know how to handle a situation where some type of insect bit their child, because most people do not know the likely effects of different types of insect



bites. The study team feels that visitors with a better understanding of how to respond appropriately to insects are likely to be calmer around them, and therefore more open to appreciating and learning about them. Particular issues might include:

- How to distinguish venomous spiders and insects from their benign brethren.
- Discussing what various kinds of insect bites might feel like, and what to do if bitten by (or in the presence of) a harmful insect.
- Understanding the role that insects play in local ecosystems (such as one's garden).
- Discussing what to do about unwanted insect visitors in the home, and how to distinguish those that might be destructive from those that are merely annoying.
- Providing visitors with the bigger picture of how our collective responses to insects affect the world—for example, the possible environmental consequences of pesticide use.
- **Recommendation:** Utilize the Insect Zoo as a forum for encouraging a better practical understanding of insects and how to respond to them.

## **A Bug's Eye View**

Many visitors admitted they have a difficult time relating to insects because they are so different from humans. Perhaps the most vivid illustration of the enormous gulf that separates us from the world of bugs can be seen in the casualness with which many

people resort to killing insects for even the slightest annoyance, without feeling or even thinking.

The study team believes that approaches that give visitors a glimpse of the world from a “bug’s eye view” could serve to increase people’s engagement with insects. For example, some interviewees talked about multimedia presentations in other museums and how engaging they can be. Similarly, a renovated Insect Zoo might offer multimedia, video-game, or virtual-reality experiences that would enable visitors to see the world from the perspective of particular insects as they eat, work, and interact with their own and other species: a bee flying from flower to flower; a praying mantis prowling a garden landscape for prey; a cicada burrowing up from beneath the soil and joining a swarm of millions of its fellows; a fly trapped in a spider’s web.

Another way to help visitors get engaged with the mysterious world of bugs would be to show insects, as much as possible, in their habitats—either through the presentation of live specimens in recreated environments, or through video presentations.

**Recommendation:** The Insect Zoo should explore creative ways to place visitors within the world of insects—through media offerings and the presentation of live specimens in recreated habitats.

Another way to encourage engagement with insects would be to draw attention to some of the surprising similarities between the social worlds of humans and bugs. A current example of this approach can be found in the quotation displayed in the Bug Corner that lauds one species’ industriousness and organizational skills: “As a thinker and a planner, the ant is the equal of anyone.” Drawing attention to such similarities may help to make the “alien” world of insects a little easier for some visitors to grasp.

## **Hands-On Activities**

A hands-on learning experience in a place such as the Bug Corner can be an extremely powerful tool for changing perceptions and encouraging learning. In the course of its interviews, the study team discovered that one bad experience with a bug is sometimes enough to alienate a person from insects (or certain kinds of insects) for life. For example, some visitors admitted that one bad bee sting has left them frightened of bees, flying insects, stinging insects, or insects in general. Analogously, the study team would suggest that a positive experience with insects in an environment like the Insect Zoo may spark lasting interest and engagement among some of those who come in with no particular predispositions, and counterbalance negative experiences from the past for those who come in with this baggage.

The friendly, positive environment of the Bug Corner created a palpable sense of comfort and ease among visitors toward observing, touching, and learning about insects. For example, a number of interviewees noted they would never have touched a large insect if they came across one outdoors or in their own homes, but in the Bug Corner, the presence of knowledgeable, friendly, and encouraging docents eased their anxieties and made touching such creatures a fun experience. Many of those observed or interviewed by the study team—as well as some study team members themselves—found it relatively easy to face their fears about insects in Bug Corner, and to enjoy interacting with them.

Numerous interviewees specifically stressed the importance of providing children with hands-on learning opportunities. The study team observed that, when held up by their parents, even very small children—infants and toddlers—seemed captivated by the insects they were observing or touching. One visitor explained that many children live in urban surroundings and never actually get to experience insects. In this sense, the Bug

Corner offered such children an opportunity that was novel and exciting, as well as educational.<sup>3</sup>

**Recommendation:** In light of the unique benefits of the hands-on approach to learning for children—as well as its general popularity with visitors of all ages—the study team recommends expanding hands-on learning opportunities in a renovated Insect Zoo.

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<sup>3</sup> Academic literature on informal learning strongly supports the claim that hands-on activities enhance young people’s educational experiences in museums. This literature was reviewed in a recent OP&A report for the Smithsonian Center for Education and Museum Studies, *Enhancing the Visits of Middle-School Tour Groups to the Smithsonian* (January 2007) (<http://www.si.edu/opanda/docs/Rpts2007/MiddleSchoolTourGroups.final.pdf>.) A number of other recent OP&A reports also deal with the value of hands-on learning techniques as a central theme. See *The Finest Expedition: A Program Evaluation of Art a la Cart at the Smithsonian American Art Museum* (May 2007); *An Evaluation of the National Museum of Natural History Discovery Room* (April 2007); and *An Evaluation of the Hands-On Science Center at the National Museum of American History* (September 2006). All are available online at <http://www.si.edu/opanda/docs>.