The Effect of Outreach Programs on the Knowledge and Attitudes about Snakes in San Isidro de Upala, Costa Rica

ABSTRACT

I interviewed 30 people in San Isidro de Upala, Costa Rica, to reveal their knowledge and attitudes about snakes. I found that many people hated and feared snakes due to the false assumption that many or all snakes in the area were venomous. I then administered an education program designed to improve people's knowledge and attitudes about snakes. The program included information on the biology, identification, and ecological importance of snakes. I also explained how to safely respond to snake encounters. Before-and-after comparisons of responses to questionnaires measuring knowledge and attitudes showed that education programs made people more knowledgeable about snakes and less likely to kill them, therefore helping to preserve the biodiversity of Costa Rica.

Ashley Gramza/Wildlife Ecology
Author Name/Major

Ashley Gramza
Author Signature

5-15-08
Date

Stanley A. Temple / WLECOL
Mentor Name/Department

Stanley A Temple
Mentor Signature

COVER SHEET

TITLE: The Effect of Education Programs on the Knowledge and Attitudes about Snakes in San Isidro de Upala, Costa Rica

AUTHOR'S NAME: Ashley Gramza

MAJOR: Wildlife Ecology

DEPARTMENT: Forest and Wildlife Ecology

MENTOR: Stanley A. Temple

DEPARTMENT:Forest and Wildlife Ecology

MENTOR(2): Christopher Vaughan

DEPARTMENT(2):Forest and Wildlife Ecology

YEAR: 2008

(The following statement must be included if you want your paper included in the library's electronic repository.)

The Effect of Education Programs on the Knowledge and Attitudes about Snakes in San Isidro de Upala, Costa Rica

Ashley Gramza, Stanley Temple (University of Wisconsin-Madison), Christopher Vaughan (University of Wisconsin-Madison), Rebecca Christoffel (Michigan State University)

ABSTRACT

I interviewed 30 people in San Isidro de Upala, Costa Rica, to reveal their knowledge and attitudes about snakes. I found that many people hated and feared snakes because they assumed incorrectly that many or all snakes in the area were venomous. I then administered an education program designed to improve people's knowledge and attitudes about snakes. The program included information on the biology, identification, and ecological importance of snakes. I also explained how to safely respond to snake encounters. Before-and-after comparisons of responses to questionnaires measuring knowledge and attitudes showed that education programs made people more knowledgeable about snakes. Increased knowledge has been linked to positive attitudes. If people have positive attitudes towards snakes, they will be less likely to kill them; therefore helping to preserve the biodiversity of Costa Rica.

INTRODUCTION

Snakes are a very important group of animals in many ecosystems. Not only do they act as top predators, but they also act as prey. They are also important for medicinal purposes, rodent control, and protein sources in some regions (Christoffel 2003). Despite their importance, snake populations are declining globally due to anthropogenic reasons such as habitat degradation, intentional killing, biocides, and trade (Dodd 1987).

Therefore, there is a great need for snake conservation and research, especially in areas with high biodiversity. One such area is Costa Rica, which is one of the most biodiverse countries for its size (Vaughan 2003). However, many areas with high levels of biodiversity are

often developing countries whose people are often fear or have utilitarian views towards wildlife, especially snakes. If we are to save snakes and biodiversity, we must learn to change attitudes so that snakes and other wildlife are viewed as important. (Morgan and Gramann 1999).

One emerging method that seeks to change attitudes and knowledge about wildlife is environmental education (EE). Environmental education has been successful in rural Costa Rica with other groups of animals. Vaughan et al. (2003) found that after a one-month scarlet macaw EE program, elementary students did 71% better on post-program knowledge surveys and had more positive attitudes towards macaws. They also passed on some of their macaw knowledge to their parents.

It is challenging to educate people about snakes because they are feared by many. In fact, snakes were the 5th most disliked group of animals in one study (Kellert and Berry 1979). Because of this fear, many people know little about snakes and perpetuate inaccurate rumors. This lack of knowledge is dangerous for both people and snakes because frightened people make irrational decisions that often result in snake death and/or an increased risk of a snake bite (Christoffel 2003). Irrational snake persecution confounds conservation efforts. Even in some relatively undisturbed natural areas snake numbers and diversity may be depressed because local people kill snakes.

A number of social scientists have sought to explain the fear of snakes or ophidiophobia (Christoffel 2003). It has been hypothesized that the fear of snakes is learned more easily than the fear of other things (Ohman and Mineka 2003). Others have linked the fear of snakes to negative stories from the media and to the fears passed on from parents (Murray and Foote 1979). Snakes are commonly vilified in folklore and religion (Nissenson and Jonas 1995).

The few notable EE studies with snakes have found that the more experience people actually have with snakes, the less they fear them (Murray and Foote 1979). Morgan and Gramann (1979) evaluated different methods of snake EE with middle school students. They found that information slide shows significantly improved snake knowledge.

Rebecca Christoffel (2003) studied attitudes about venomous and non-venomous snakes in MI and MN. She found that an individual's sex and knowledge of snakes explained much of the observed variation in attitudes toward snakes. She also found that people knew little about local snake identities, species richness, and protection policies. After exposure to EE programs, participants had more knowledge and positive attitudes towards snakes than non-participants.

Despite Costa Rica's high diversity of snakes and great need for snake conservation, I could not find a single EE program focused on snakes in that country. Therefore, I thought it worthwhile to administer a snake EE program in rural Costa Rica. The goals of my research were to describe people's attitudes and knowledge about snakes and to determine if an EE program could change knowledge, understanding, and tolerance in a small rural community in Costa Rica.

METHODS

I performed my research in the town of San Isidro de Upala, Costa Rica. San Isidro is located in the northwest corner of the Alajuela province, in a valley that used to be tropical rainforest but is now a mixture of agriculture interspersed with natural habitats. The population is about 150 people, and the area is very rural. I spent 3.5 months with a family in the area while I completed my research in 2008.

Because of the coherence of Rebecca Christoffel's methodology (Christoffel 2003) and her helpfulness and cooperation, I decided to use the same general format for my study. I used

semi-structured oral interviews to learn the baseline knowledge and attitudes of community members. Based on what I learned from those interviews, I created a snake EE program aimed at increasing knowledge and positive attitudes towards snakes.

I performed 30 oral interviews to gather baseline data. Interviewees included 6 subjects in the 5-15 age group (2 female and 4 male), 4 in the 16-29 age group (3 female and 1 male), and 20 in the 30+ age group (6 female and 14 male).

The oral interviews consisted of open-ended questions aimed to reveal people's attitudes about snakes as well as experiences they have had with them. For the first part of the interview, I asked people questions about their overall attitudes and experiences snakes (a complete list of the oral interview questions is listed in Table 1).

I showed subjects photographs of common snakes of the region and asked them to identify the snakes as well as state if they thought the snakes were venomous or not. I also asked them questions about snakes' importance in the environment and how they had learned about snakes.

The last part of the interviews used preference scales (on a scale of 0-10) to assess interviewees' responses to photographs of certain snake species. On the fear scale a zero meant that the interviewee would be absolutely terrified seeing even a picture of the snake on television or in a book. A ten meant they had no fear and would be fine touching a snake. On the preference scale, zero meant absolutely hating snakes (having "the only good one is a dead one" mentality) while a ten meant liking a snake enough to want to have it as a pet. Fives on either scale meant having neutral attitudes. I also noted snake anecdotes and myths interviewees volunteered during the course of the interviews. At the end of each oral interview, I asked if my subjects would be interested in attending an education program about snakes.

Each interview was translated and interpreted for subjects by Jose Emilio Oporta Morales. At the beginning of each interview, I explained that participating in this study was completely voluntary and that the identities of interviewees would be confidential. I also explained the objectives and goals of the study as well as how I would use results and how I might disseminate them. All of this information was explained in a consent form that subjects read during my oral explanation. Before conducting the interview, each subject was required to sign a consent form signifying that they agreed to participate in the study and allowed me to use resulting data.

I performed the oral interviews in the home of my host family, in the homes of my subjects, and in a school for my subjects in the 5-15 age-group. I offered no monetary compensation to participants; however I did give them candies as a thank you gesture. I tried to complete each oral interview in the absence of bystanders or other family members. I did this to try to eliminate outside bias through non-participants voicing their opinions or subjects changing their answers in the presence of non-participants. I realized early on that in many cases this was not possible because I was entering a family's home as a guest and could not enforce my rules in their household. Sometimes, I had to perform multiple interviews at the same time due to time constraints and the importance of interviewing certain demographic groups. For example, I had to do this when I went to the elementary school to interview 5-15 year olds. This age group was very important to survey, but I could not interview kids individually. In this multiple interview setting, it was necessary to omit the snake identification data. In another multiple interview setting, I simply asked one of the two subjects to leave while I asked the other snake identification questions.

After analyzing the results of the oral interviews I then devised an education program catered to the needs of the community. The education program was held as a seminar at my host

family's home and lasted about an hour. Jose Emilio Oporta Morales once again served as my translator.

Before the start of the program, I administered a 15-minute initial questionnaire consisting of 19 questions that would be covered in the program (Table 4). In the program, I focused a significant amount of time to debunking prevalent myths about snakes. I also spent a significant amount of time teaching identification of local snake species (especially commonly misidentified species) as well as natural history information. Additionally, I explained the benefits of having snakes around as well as their role in the environment.

Other environmental education studies (Eagles and Demare 1999, Vaughan et. al 2003) have shown the importance of running programs over a long period of time and incorporating them with formal education to be effective. They have also shown the importance of field trips to truly foster environmental appreciation. However, given my brief time in Costa Rica and lack of access to the school system, I was unable to run the education program over a long time period. I was also unable to take participants on field trips.

I informed subjects what to do if bitten by a venomous snake as well as how to safely handle snake encounters. To make sure they remembered this venomous snake bite information, I created an informational handout listing steps to take if bitten by a venomous snake. The handout also listed important phone numbers like the hospital, taxi, and antivenom laboratory at the University of Costa Rica. At the end of my time in Costa Rica, I also donated a bi-lingual field guide of the snakes of Costa Rica by Alejandro Solórzano (Solorzano 2005) and a snake hook to the San Isidro community center.

To measure the impact of the program as well as retention rates, I re-administered the same 15-minute pre-program questionnaire immediately after the education program (Table 4).

These questions were objective, multiple-choice, translated into Spanish, and based directly off of information given in the education program. Before starting the questionnaires, I again distributed a consent form that subjects had to sign before starting the program. For subjects under 18, I required a parental signature as well. If subjects could not read, we read the questionnaire aloud.

I analyzed the interview data by categorizing open-ended answers as positive or negative towards snakes and then looked for patterns across demographic groups. I also categorized the preference and fear scale questions as positive, neutral, or negative based on the numerical answer (0-3 being negative, 4-6 being neutral, and 7-10 being positive). For the identification questions, I looked for trends in correct answers across demographic groups. I included answers of "I don't know", "do not recognize" in the incorrect category. On the other hand, I included Spanish answers that Jose Emilio Oporta Morales recognized in the correct category.

I analyzed the pre- and post-program questionnaires using the chi squared test to determine if there were any significant differences in correct answers between men and women as well as between pre- and post-program questionnaires. I considered a chi square statistic significant if it yielded a p-value of 0.05 or less. I also categorized the answers as mostly correct, intermediate, or mostly incorrect for each question. Mostly correct classification consisted of questions with greater than 65% of subjects answering correctly, intermediate consisted of questions with 35-64% correct, and mostly incorrect consisted of questions with less than 35% correct. I also compared pre- and post-interview answers to determine if individual subjects answered better or worse on the post-program questionnaire and by how much (percentage wise). For each question with a numerical answer, I noted whether the subjects overestimated or underestimated the correct answer when answering incorrectly.

RESULTS

Oral Interviews

Thirty subjects completed oral interviews before the education program. As stated in the methods section, some interviews had to be modified to fit the culture, age, and individual circumstances of each interviewee. The questions I asked in these interviews can be found in Table 1.

Questions 1-5

Questions 1-5 were simply demographic questions. Interviewees included six subjects in the 5-15 age group (2 female and 4 male), four in the 16-29 age group (3 female and 1 male), eleven in the 30-50 age group (4 female and 7 male), and nine in the 51-100 age group (2 female and 7 male). None of the interviewees finished high school, five had some high school education, eleven finished primary school, ten had some primary school education, and four had no education at all.

Question 6 and 7:

For these identification questions, only twenty six interviewees responded. I did not ask the four school children these questions because I interviewed them as a group. I considered an answer correct if the interviewee answered with a name that either I or my translator recognized. I considered an answer to be incorrect if neither I nor my translator recognized the name, the interviewee answered that they did not know the snake, did not recognize the snake, or did not know the name of the snake. The responses can be seen in Table 2. Answers are only analyzed as a whole and by sex because there were no significant differences in answers from other demographic groups. Below I give comments on responses to each of the snakes in the identification test.

Boa constrictor (*Boa constrictor)*: Of the incorrect answers, two interviewees thought the boa was a fer-de-lance and three did not recognize or know the snake's name.

False Coral (*Erythrolamprus mimus*): Of the incorrect answers, twenty five interviewees thought it was a real coral snake, and one interviewee did not know the snake's name. However, three interviewees realized that there were two types of coral snake and could not tell which was shown in the photograph.

Common Cat-eye (*Leptodeira annulata*): Of the incorrect answers, most people did not recognize the snake (8 interviewees), recognized but could not name it (7 interviewees), or thought it was a fer-de-lance (5). One interviewee recognized the snake as a "solcuata." I counted that answer incorrect, but I have never heard that name, and it may simply be an alternate common name.

Brown Vinesnake (*Oxybelis aeneus*): Of the incorrect answers, most people (10 interviewees) did not recognize the snake or could not name it.

Common Snaileater (*Sibon nebulatus*): Of the incorrect answers, most people (17 interviewees) did not recognize the snake or did not know its name.

Tiger Ratsnake (*Spilotes pullatus*): Of the incorrect answers, most people (7 interviewees) did not recognize the snake or did not know its name.

Allen's Coral Snake (*Micrurus alleni*): Of the incorrect answers, one did not recognize the snake, and the other thought it was a snake called a "cordoncillo." I did not recognize the name "cordoncillo."

Fer-de-lance (*Bothrops asper*): Of the incorrect answers, most people (7 interviewees) did not recognize the snake. There was a significant sex-specific difference (as calculated by chi

square test) in correct answers to the identification question with males answering more correctly than females.

Central American Bushmaster (*Lachesis stenophyrs*): Of the incorrect answers, most people (10 interviewees) did not recognize, recognized but did not know its name (2 interviewees), or thought it was a fer-de-lance (2 interviewees). There was a significant sex-specific difference (as calculated by chi square test) in correct answers to the venomosity question with males answering more correctly than females.

Question 8:

Thirteen interviewees said that they had touched a snake, and 12 said that they had not. Of the interviewees that had touched a non-venomous snake, most people touched boas (7 people), vinesnakes (2 people), and tiger ratsnakes (2 people). Four interviewees also said that they had touched a venomous fer-de-lance.

Question 9-11:

The most common snakes that interviewees reported seeing were fer-de-lance (21 people), boas (16 people), parrot snakes (9 people), and tiger ratsnakes (9 people). For those that have seen snakes, most interviewees report seeing snakes on the farm (11 people), on the road (10 people), in the house (10 people), and in the forest (9 people). When interviewees saw snakes, the snakes were usually sitting still (8 people), biting or in strike position (5 people), or simply moving away from the interviewee (4 people).

Question 12-13:

The vast majority of interviewees, twenty one people, stated that they felt afraid of snakes. Of these people, two said that their fear depended on whether or not the snake was venomous, and one said that fear depended on the size of the snake. Twenty three interviewees

stated that they had killed snakes and six said they had not. Of the interviewees that had killed snakes, six stated that they only killed venomous snakes; one said he only killed little snakes, and one said he only killed big ones. Most people reported killing snakes to avoid bites (10 people) or because they were scared (6 people).

Question 14-16:

Ten people reported watching snake programs on television, nine reported never seeing any media coverage about snakes, eight reported seeing movies about snakes, and two read snake books. The snake programs seen on television were on the National Geographic Channel, Discovery Channel, and on the program Blue Planet. The programs were about fer-de-lances, cobras, and rattlesnakes. Of the snake movies, six interviewees reported seeing the movie "Anaconda" while one saw a western movie featuring a snake. Nine interviewees said that the snakes were portrayed negatively in the media, eight said that they were neutral, and only one said that snakes were portrayed in a positive manner. Most interviewees (13 people) stated that they believed the media portrayed the snakes accurately.

Question 17:

Nineteen interviewees said that snakes were important to them personally, while seven said that they were not. Nineteen people also said that snakes were important to the environment, four said they were not important, and three people were unsure. Most people said that snakes were important to them for pest control (10 people), medicinal purposes (4 people), or to keep the food chain in balance (4 people). The main reason snakes were not important to people is that they bite and kill people (4 people). Most people recognized that snakes were important to the environment for pest control (8 people) and to keep the food chain in balance (8 people), even if snakes was not important to them personally. Snakes were considered

unimportant to the environment because they bite and kill people (1 person), have absolutely no place on Earth (1 person), and because they reproduce rapidly (1 person).

Question 18:

The most commonly stated advantage for having snakes on interviewee's property was pest control (12 people). The most common disadvantages for snakes on interviewee's property included snakes being dangerous to people (16 people) and snakes being dangerous to farm animals (5 people). The most common advantage for tolerating snakes within 5 kilometers of interviewee's property included pest control (7 people). The most common disadvantages for tolerating snakes within 5 kilometers of interviewee's property included snakes being dangerous to people (15 people), and snakes being dangerous to farm animals (6 people).

Question 19 and 20:

The number of responses in each category can be seen in Table 3. The greatest number of interviewees felt unfearful towards boas (57%) and tiger ratsnakes (50%). Conversely 60% of interviewees felt fearful towards fer-de-lance. In the preference scale, the greatest number of interviewees liked tiger ratsnakes and boas (47% and 43%, respectively). Conversely, many disliked the fer-de-lance (63%) and common cat-eye (47%).

Question 21:

Most interviewees, 28/30, said that they would be willing to attend an education program about snakes. Only 29 people responded because I forgot to ask one person the question. Another person said that he would like to attend but did not feel like he would have the time.

Pre- and Post-Program Questionnaires

Overall, fifteen subjects completed the pre-program survey, and twelve subjects completed the post-program survey. Of the subjects who completed the pre-program

questionnaire 4 were female, and 11 were male. In the post-program survey, three subjects were female, and nine were male. Because 93% of my subjects were between the ages of 18 and 40, I chose not to analyze the results according to age group. I initially separated the results from the pre- and post-program questionnaires into gross numbers and percentages of subjects who answered correctly and incorrectly. It was necessary to list the results as percentages so that I could compare the answers between pre- and post-education programs due to different numbers of subjects completing each questionnaire. When figuring out the percentage correct and incorrect, I took the percentage out of the total number of questionnaires received including the ones with no response for a particular question. I didn't consider non-answers incorrect because subjects could have forgotten to complete certain questions as well as not known the answer to that question.

In the pre-program questionnaire, answers to questions 5, 7, 10, 13, 14, 15, and 17 were mostly correct. Answers to questions 2 and 16 were intermediate. Answers to questions 1, 3, 4, 6, 9, and 11 were mostly incorrect, and answers to question 8 were all incorrect.

In the post-program questionnaire, answers to questions 5 and 14 were all correct. Answers to questions 7, 9, 10, 15, 16, and 17 were mostly correct. Answers to questions 1, 2, 3, 6, 11, and 13 were intermediate. Answers to question 4 were mostly incorrect. In the post-program questionnaire, all twelve subjects still answered question 8 incorrectly.

Question 1

Question 1 was answered most incorrectly in the pre-program questionnaire and with intermediate correctness in the post-program (Table 4). Of the subjects that answered incorrectly, most (73% in the pre- and 60% in the post-program questionnaire) underestimated

the correct answer. In the post-program questionnaire, there were 23% more correct answers than in the pre-program questionnaire.

Question 2

Question 2 was answered with intermediate correctness for both the pre- and post-program questionnaire (Table 4). Of the subjects that answered incorrectly, most underestimated the correct answer in both questionnaires. In the post-program questionnaire, there were 2% more correct answers than in the pre-program questionnaire.

Question 3

Question 3 was answered mostly incorrect for the pre-program and with intermediate correctness for the post-program questionnaire (Table 4). Of the subjects that answered incorrectly, most underestimated the correct answers in both questionnaires (67% in the pre and 86% in the post-program questionnaire). In the post-program questionnaire, there were 22% more correct answers than in the pre-program questionnaire.

Question 4

Answers to question 4 were mostly incorrect in both the pre-program and post-program questionnaires (Table 4). Of the subjects that answered incorrectly, an almost equal number of subjects underestimated and overestimated the correct answer in the pre-program questionnaire, and more subjects overestimated the correct answer in the post-program questionnaire (53% overestimated in the pre and 75% did in the post-program questionnaire). In the post-program questionnaire, there were 20% more correct answers than in the pre-program questionnaire.

Question 5

Answers to question 5 were mostly correct for the pre-program questionnaire, and in the post-program questionnaire all subjects answered the question correctly (Table 4). In the post-

program questionnaire, there were 33% more correct answers than in the pre-program questionnaire. This improvement in correct answers was statistically significant (as calculated by the chi square test).

Question 6

Answers to question 6 were mostly incorrect in the pre-program and of intermediate correctness in the post-program questionnaires (Table 4). In the post-program questionnaire, there were 25% more correct answers than in the pre-program questionnaire.

Question 7

Answers to question 7 were mostly correct in both the pre-program and post-program questionnaires (Table 4). In the post-program questionnaire, there were 5% fewer correct answers than in the pre-program questionnaire.

Question 8

No subjects answered question 8 correctly in either the pre- or post-program questionnaires. All subjects underestimated the correct answer.

Question 9

Answers to question 9 were mostly incorrect in the pre-program and mostly correct category in the post-program questionnaire (Table 4). In the post-program questionnaire, there were 48% more correct answers than in the pre-program questionnaire. This improvement in correct answers was statistically significant (as calculated by the chi square test).

Question 10

Answers to question 10 were mostly correct in both the pre- and post-program questionnaires (Table 4). In the post-program questionnaire, there were 10% fewer correct answers than in the pre-program questionnaire.

Question 11

Answers to question 11 were mostly incorrect for the pre- and of intermediate correctness for the post-program questionnaire (Table 4). In the post-program questionnaire, there were 51% more correct answers than in the pre-program questionnaire. This improvement in correct answers was statistically significant (as calculated by the chi square test).

Question 12

Question 12 was a qualitative question without a correct answer. This question was aimed to gauge people's attitudes before and after the education program. In the pre-program questionnaire, 27% of subjects answered that they feared snakes, 7% were neutral, 47% reported no fear whatsoever, and 20% did not respond. In the post-program questionnaire, 33% of subjects were afraid, 8% were neutral, 42% had no fear, and 17% did not answer. From these results, it would appear that people became more fearful of snakes with the percentage of people reporting phobia increasing by 5%.

Question 13

Answers to question 13 were mostly correct for the pre-program and of intermediate correctness for the post-program questionnaire (Table 4). In the post-program questionnaire, there were 15% fewer correct answers than in the pre-program questionnaire.

Question 14

Answers to question 14 were mostly correct for the pre-program, and subjects all answered the question correctly in the post-program questionnaire (Table 4). In the post-program questionnaire, there were 7% more correct answers than in the pre-program questionnaire.

Question 15

Answers to question 15 were mostly correct for both pre- and post-program questionnaires (Table 4). In the post-program questionnaire, there were 4% more incorrect answers than in the pre-program questionnaire.

Question 16

Answers to question 16 were of intermediate correctness for the pre- and the mostly correct for the post-program questionnaire (Table 4). In the post-program questionnaire, there were 23% more correct answers than in the pre-program questionnaire.

Question 17

Answers to question 17 were mostly correct for both pre and post-program questionnaires (Table 4). In the post-program questionnaire, there were 8% more correct answers than in the pre-program questionnaire.

DISCUSSION

Oral Interviews

The data from the oral interviews indicate that interviewees only had moderate knowledge of both local snake identification and venomosity, with the majority (over 50%) of interviewees knowing the correct identification and venomosity of 4 and 5 (out of 9) species respectively**.** All of the interviewees misidentified the false coral snake, common cat-eye, and common snaileater. Interviewees also misidentified these species' venomosity the most. This is unfortunate because they are all non-venomous snakes. Therefore, they are probably killed more than others because the majority of people who said they killed snakes try to only kill venomous ones.

There were significant sex-specific differences in the answers to two identification questions. Males did significantly better than females in identifying the fer-de-lance and knowing whether or not bushmasters were venomous (Table 2). Perhaps this difference occurred because women do not work in snake habitats as much as men do in Costa Rica, and therefore do not encounter snakes as much. Women were also more proportionately scared than men for all five snake species shown on the fear scale. Women may not be able to identify these snakes as well as men because they are more scared of them. However, the opposite may be true as well. Women may be more scared of these snakes than men because they can not identify them (either by species or venomosity).

Most people (21/26) were afraid of snakes in general, but some said that it depended on their size and if they were venomous. Additionally, of all the snake species shown for the fear and preference scale, the greatest number of people felt negatively and fearful about the venomous fer-de-lance. Interviewees also said that the venomous fer-de-lance was the most commonly seen snake in the area.

Of people who have seen snakes in the media, half said that snakes were portrayed negatively. Of the remaining people who saw snakes in the media, most said the snakes were portrayed as neutral and the program was educational. However, the educational or neutral programs that interviewees saw were about venomous or dangerous snakes.

Although most people are afraid of snakes in San Isidro de Upala, it is difficult to determine the cause of this fear from this study alone. However, the oral interviews give valuable insights into the cause of snake fear in interviewees. Snakes may be feared in this region because venomous snakes are the most commonly seen snakes. However, people may simply believe that they see venomous snakes more than others because they are scared.

Because snakes are commonly maligned in the media, and dangerous and venomous snakes are often shown in educational programs, people may develop the fear of snakes due to the media. Further research must be done to reach a conclusion.

Fear aside, the vast majority of people said that snakes were important to both them personally and the environment. They felt this way due to snakes' importance for pest control and because of their intrinsic value in the environment. Additionally, all but one interviewee expressed interest in attending an education program.

There were a few problems in the oral interview question content and format. Using a picture of both a false and true coral may not have provided a fair representation of baseline knowledge, especially when many interviewees recognized that there were two types of coral. Although both types of snakes are common to the area, they are very difficult to tell apart in photograph form as well as in the field. Judging snake knowledge by common name is problematic as well, due to my limited knowledge of the Spanish language as well as multiple common names for snakes.

There was also a potential problem in the administration of the interview. Although I tried to keep each interview private, I performed many interviews in homes where other family members like to express their opinions during the interview. I also had to perform some group interviews in lieu of time. Having others commenting during interviews may have biased my interviewees' answers.

Education Program and Pre- and Post-Program Questionnaires

Overall, subjects improved their answers to 65% of the questions (11/17) in the post-program questionnaire. Subjects also performed significantly better on questions 5, 9, and 11 (Table 4). Therefore, the subjects did learn and retain some knowledge from the education

program. Given the information, it is difficult to predict why subjects answered these three questions better than others. Two of these question's answers are non numeric, and therefore easier to remember, but question 9 does have a numeric answer.

Subjects did worse on 4 questions in the post-program questionnaire, and remained unchanged for 1 question. The question that remained the same was question 8, and everyone answered this question incorrectly in both questionnaires. Again it is difficult to say why no one answered this question correctly because it is a straightforward, objective question with a numeric answer. I may have done a poor job presenting the answer to that question in my education program.

I used question 12 to gauge subject's attitudes before and after the program. In this case I used fear to measure the attitude change. From these results, it would appear that people became more fearful of snakes with the percentage of people reporting ophidiophobia increasing by 5% which is not a significant change. Therefore, attitudes, as measured in this questionnaire, did not seem to change much over the course of the education program. This was also the question with the most blank responses. Subjects may not have understood what the question was asking of them. It should be noted that only one question of the survey is directly aimed at discovering attitudes. It may not be valid to analyze a change in attitudes with only one question dedicated to this purpose.

A general problem with my education program was that fewer people attended the program than said they would in the oral interviews. Additionally, fewer women attended than men. Therefore, it is difficult for the results to truly represent the community at large with such a small sample size.

Fewer people completed the post-program questionnaire than the pre-program questionnaire. I am unsure whether people simply did not want to fill out the questionnaire again, or they did not stay for the whole program.

FUTURE AND MANAGEMENT IMPLICATIONS:

Although I gained many insights from this study, there is still much more to learn. It would be good to go back in 6 months and measure retention rates using the same questionnaire without a refresher program. It would also be interesting to do pre- and post-education program censuses of snakes around San Isidro de Upala. This study could determine if education programs not only improve knowledge and attitudes, but also translates into an increase in snake numbers. However, the post-program censuses would have to be done over years to take into account lag time with the snakes' reproduction.

With Costa Rica becoming such a technologically modern country, television and movies are important parts of family life. The media needs to change their portrayal of snakes, especially in programs on "scientific" channels like the Discovery Channel. Instead of focusing on dangerous and venomous snakes (that represent a small fraction of the total snakes), they should instead focus on common snakes and ones with interesting traits.

Although most interviewees had some schooling (most at least up to 6th grade), no interviewee stated that they learned about snakes in school. Schools, especially those in rural areas, need to teach their students not to fear the natural world around them. They also need to teach them to respect snakes as well as all plants and animals, especially in a fragile and unique environment like Costa Rica.

Fortunately, this change in the school system is already beginning in richer areas and cities, but not in poor rural areas where they really need it. For students to gain knowledge about

snakes and the natural world, they must attend school as well. Areas like San Isidro are trying to increase attendance in rural areas by offering secondary school at night so that students are able to help their family by working during the day and going to school at night.

With much of this community's snake knowledge coming from media, religion (Catholicism), and myths learned over their entire life, it is difficult to change their viewpoints with one education program. This study showed a glimpse of the snake knowledge and attitudes of the small Costa Rican town of San Isidro de Upala. It also showed that an education program based on the specific needs of a community can foster an increase in knowledge about snakes. However, there is still a significant amount of snake human dimensions and education research to do, not only in San Isidro, but in Costa Rica and the rest of the world. Factual snake information needs to come at an early and from all angles (religion, school, media, and family to name a few) if it is to have a positive, lasting effect on individuals and communities.

Literature Cited

Christoffel, R.A. "Using Human Dimensions Insights to Improve Conservation Efforts for the Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus*) in Michigan and the Timber Rattlesnake (*Crotalus horridus horridus*) in Minnesota." PhD Dissertation. Michigan State University. 2007.

Dodd, K.C. Jr. "Status, Conservation and Management." In *Snakes: Ecology and Evolutionary Biology*, 478-513. Caldwell: Blackburn Press, 1987.

Eagles, P., & Demare, R. (1999). Factors influencing children's environmental attitudes. *The Journal of Environmental Education*, 30(4), 33-37.

Kellert, S.R. and J.K. Berry. *Public Attitudes Toward Critical Wildlife and Natural Habitat Issues*, Phase I. Washington: U.S. Department of the Interior, Fish and Wildlife Service, U.S. Government Printing Office, 1979.

Morgan, J.M., and J.H. Gramann. "Predicting effectiveness of wildlife education programs: a study of students' attitudes and knowledge toward snakes." *Wildlife Society Bulletin*, 17 (1989): 501-509.

Murray, E.J. and F. Foote. "The Origins of Fear of Snakes." *Behaviour Research and Therapy* 17 (1979): 489-493.

Nissenson, M. and S. Jonas. *Snake Charm*. New York: Harry N. Abrams, Inc., 1995.

Ohman, A. and S. Mineka. "The Malicious Serpent: Snakes as a Prototypical Stimulus for an Evolved Module of Fear." *Current Directions in Psychological Science* 12, no. 1 (2003): 5-9.

Solórzano, Alejandro. *Snakes of Costa Rica*. Eagle Mountain: Eagle Mountain Publishing, 2005.

Vaughn, C., J. Gack, H. Solorazano, and R. Ray. "The effects of Environmental Education on Schoolchildren, Their Parents, and Community Members: A Study of Intergenerational and Intercommunity Learning." *Journal of Environmental Education* 34, no. 3 (2003): 12-21.

Table 1. Table of oral interview questions

Question
1. How old are you?
2. Where do you live?
3. How long have you lived there, and/or where did you spend most of your childhood?
4. What is your highest level of education?
5. What is your name?
6. What do you think the name of this snake is (for each picture; Used: a) boa constrictor, b) stripe-bellied false coral, c) common cat-eye, d) brown vinesnake, e) common snail eater, f) tiger ratsnake, g) Allen's coral snake, h) fer-de-lance, i) bushmaster)
7. Is this snake venomous (for each picture: a-h)?
8. Have you ever touched a snake? If so what type?
9. What are the most common snakes you see?
10. Where are snakes when you see them?
11. What are snakes doing when you see them?
12. How do you feel about snakes in general?
13. Have you ever killed a snake; if so, why?
14. Have you ever read any books, magazine articles, or newspaper articles about snakes?
15. Do you remember what the media was like; were snakes portrayed as good or bad?
16. Do you think the portrayal was accurate?
17. Do you think that snakes are important to you; to the environment?
18. Describe the Pros and Cons of having snakes on your property; w/in 5 km of your property but not on it?
19. Would you rate these snake pictures (boa, common cat-eye, brown vinesnake, tiger ratsnake, and fer-de-lance) on a like/dislike scale of 1-10?
20. Would you rate these snake pictures (same species as above) on a fear scale of 1-10?
21. Would you be willing to attend an education program about snakes?

Table 2. Analysis of answers to oral interview questions 6 and 7

	Proportion Answering Correctly Common Name					Proportion Answering Correctly if Snake Was Venomous				
Snake	**Total**	**Male**	**Female**	**Chi^2 Value**	**P-Value**	**Total**	**Male**	**Female**	**Chi^2 Value**	**P-Value**
a) Boa Constrictor	21/26	15/17	6/9	1.762	0.184	20/26	15/17	5/9	3.540	0.060
b) Stripe-bellied False Coral	0/26	0/17	0/9	0	1	2/26	2/17	0/9	1.147	0.284
c) Common Cat-eye	0/26	0/17	0/9	0	1	7/26	4/17	3/9	0.287	0.592
d) Brown Vinesnake	13/26	9/17	4/9	0.064	0.800	13/26	11/17	5/9	0.197	0.657
e) Common Snail eater	0/26	0/17	0/9	0	1	5/26	4/17	1/9	0.584	0.445
f) Tiger Ratsnake	15/26	9/17	6/9	0.454	0.500	17/26	13/17	4/9	2.667	0.102
g) Allen's Coral snake	24/26	16/17	8/9	0.227	0.634	23/26	14/17	9/9	1.795	0.180
h) Fer-de-Lance	14/26	11/17	3/9	4.406	0.036	20/26	14/17	6/9	0.816	0.366
i) Central American Bushmaster	5/26	5/17	0/9	3.277	0.070	19/26	16/17	3/9	11.051	0.001

Table 3. Analysis of answers to oral interview questions 19 and 20.

	Positive Feeling		Neutral Feeling		Negative Feeling	
Snake	**Fear Scale**	**Preference Scale**	**Fear Scale**	**Preference Scale**	**Fear Scale**	**Preference Scale**
Boa Constrictor	17/30	13/30	5/30	10/30	8/30	7/30
Common Cat-eye	10/29	8/29	8/29	7/29	11/29	14/29
Brown Vinesnake	14/29	11/29	8/29	6/29	7/29	12/29
Tiger Ratsnake	15/30	14/30	3/30	7/30	12/30	9/30
Fer-de-Lance	7/30	8/30	5/30	3/30	18/30	19/30

Table 4: Analysis of responses to pre- and post-program questionnaires

Question	Proportion Responding		Proportion Answering Correctly				Pre-Program Proportion Answering Correctly				Post-Program Proportion Answering Correctly			
	Pre	Post	Pre	Post	Chi^2 Value	P-Value	Male	Female	Chi^2 Value	P-Value	Male	Female	Chi^2 Value	P-Value
1. How many snake species are in Costa Rica?	15/15	11/12	4/15	6/11	2.084	0.145	2/11	2/4	1.519	0.218	3/8	3/3	3.438	0.064
2. How many venomous snake species occur in Costa Rica?	15/15	12/12	6/15	5/12	0.008	0.929	3/11	3/4	2.784	0.095	3/9	2/3	1.029	0.310
3. How many snake species occur around Upala?	15/15	12/12	3/15	5/12	1.501	0.221	3/11	0/4	1.364	0.243	3/9	2/3	1.029	0.310
4. How many venomous (can kill people) snake species occur around Upala?	15/15	12/12	2/15	4/12	1.543	0.214	2/11	0/4	0.839	0.360	3/9	1/3	0	1
5. When are boa constrictors venomous?	15/15	12/12	10/15	12/12	4.909	0.027	6/11	4/4	2.727	0.099	9/9	3/3	0	1
6. What are some large threats to snake populations in Costa Rica	13/15	12/12	5/13	7/12	0.987	0.320	3/9	2/4	0.325	0.569	4/9	3/3	2.857	0.091
7. When are most snakes in this area active?	15/15	12/12	12/15	9/12	0.096	0.757	9/11	3/4	0.085	0.771	7/9	2/3	0.148	0.700
8. On average, how many people are bitten by venomous snakes each year?	15/15	12/12	0/15	0/12	0	1	0/11	0/4	0	1	0/9	0/3	0	1
9. Of the people that are bitten, how many of these people, on average, die each year?	15/15	12/12	4/15	9/12	6.238	0.013	3/11	1/4	0.008	0.929	7/9	2/3	0.148	0.700
10. What type of people are usually bitten by venomous snakes?	15/15	12/12	14/15	10/12	0.675	0.411	10/11	4/4	0.390	0.532	7/9	3/3	0.800	0.371
11. If you are bitten by a venomous snake, the most important thing to do is?	14/15	12/12	1/14	7/12	7.949	0.005	0/10	1/4	2.692	0.101	4/9	3/3	2.857	0.091
12. On a scale of 1-5 (1 being phobic and being no fear whatsoever) how scared are you of snakes as a group?	12/15	10/12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13. As a whole, snake populations in Costa Rica are declining? (True or False)	12/15	11/12	11/12	7/11	2.650	0.104	8/9	3/3	1.010	0.315	6/8	1/3	1.637	0.201
14. Snakes always live together? (True or False)	15/15	12/12	14/15	12/12	0.831	0.362	10/11	4/4	0.390	0.532	9/9	3/3	0	1
15. Rattlesnakes occur in the region? (True or False)	15/15	12/12	13/15	10/12	0.059	0.808	9/11	4/4	0.839	0.360	7/9	3/3	0.800	0.371
16. Snakes with triangular shaped heads and slit pupils are always venomous? (True or False)	15/15	12/12	9/15	10/12	1.741	0.187	7/11	2/4	0.227	0.634	7/9	3/3	0.800	0.371
17. Bushmasters like to live near people and commonly consume livestock? (True or False)	14/15	11/12	10/14	9/11	0.365	0.546	8/11	2/3	0.042	0.838	7/8	2/3	0.637	0.425