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THE ROLE OF INTERPRETATION IN INFLUENCING PUBLIC KNOWLEDGE OF
WILDLIFE AND WILDLIFE VIEWING BEHAVIOR

THE UNIVERSITY OF ARIZONA

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THE ROLE OF INTERPRETATION IN INFLUENCING
PUBLIC KNOWLEDGE OF WILDLIFE AND
WILDLIFE VIEWING BEHAVIOR

by

Deborah Hill

A Thesis Submitted to the Faculty of the
DEPARTMENT OF RENEWABLE NATURAL RESOURCES
In Partial Fulfillment of the Requirements
For the Degree of
MASTER OF SCIENCE
WITH A MAJOR IN WILDLIFE ECOLOGY
In the Graduate College
THE UNIVERSITY OF ARIZONA

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ABSTRACT

Visitors to a Coronado National Forest campground were interviewed in 1981 to determine socio-demographic characteristics, knowledge of wildlife and wildlife viewing etiquette, and awareness of wildlife and of human behaviors which may disturb wildlife. Of the 126 groups of visitors in the study, 64 of the groups had been exposed to information about local wildlife and wildlife viewing prior to being questioned. Responses of the exposed and unexposed groups were compared. Results showed no differences in knowledge between groups but did show significant differences in awareness of human activities which disturbed wildlife.

INTRODUCTION

Americans today are better educated, with more leisure time, discretionary income, and mobility than ever before (U.S. Dept. of the Interior, 1962). As a result, over the past 30 years, there has been an increase in participation in all forms of recreational activities especially in outdoor recreation. In the decade from 1960-1970 alone, visits to National Parks increased 400%, and since 1968, sales of backpacking equipment have risen 500% (Kellert, 1978). Results from outdoor recreation participation studies support this trend (Bureau of Outdoor Recreation, 1972; U.S. Fish and Wildlife Service, 1977).

In addition to the increased use of outdoor recreation areas, there have been changes in values which have led to corresponding shifts in the patterns of resource use. The dominant ways in which Americans use and value wildlife has shifted from utilitarian to recreational and aesthetic values (Shaw, 1974). One result of this value change has been an increase in numbers of nonconsumptive users of natural resources (Schick et al., 1976).

These trends have given rise to problems such as crowding and overuse of outdoor recreation areas. Natural resource managers are faced with the dilemma of attempting to protect and allocate sensitive, limited resources while

still providing opportunities for high quality recreational experiences. Resource managers find themselves in the position of managing the resource user rather than the resource itself (Hendee and Potter, 1971).

Wildlife agencies, in addition to the problems cited above, are also facing a loss of support, both political and monetary, due to a per capita decline in participation in hunting, as a result of increasing urbanization and changing value systems. The number of nonconsumptive users of wildlife, however, is on the rise (Schick et al., 1975).

Traditionally, wildlife agencies have most often dealt with overuse problems by manipulating access, bag limits, seasons, and/or habitat, as well as by increased law enforcement activities. However, the new pressures on wildlife resulting from the increased focus on nonhunting uses of wildlife are difficult to regulate with traditional methods (More, 1979; Hendee, 1971). Declining or sensitive populations of nongame wildlife species cannot be stabilized by regulating hunting pressure. Nor does any licensing procedure yet exist for nonhunting wildlife users, despite the adverse impacts these users can exert on wildlife resources and habitat (Graham, 1979). In addition, groups opposing traditional management methods are on the rise and have become politically involved in wildlife management policies (Schick et al., 1976).

Wildlife managers are developing new responses in order to deal with changing management problems. In addition to the traditional hunter safety courses, educational programs designed to affect how the public uses and values resources have become increasingly important to wildlife agencies.

Education has been advocated as a wildlife management tool for decades. Stevens (1944) cited education as the "salvation" of our wildlife resources. King (1947) called education the best, if not the only solution to unresolved conservation problems. Without the support of a public educated about ecological principles, conservation policies cannot be implemented, according to Webb (1968). Carlson (1968) said of East African wildlife management programs that laws alone were ineffective, without a program based on education. Hernbrode (1974) noted that the American public is easily misled about wildlife conservation because they have no comprehension of its basic concepts.

The assumption behind educating the public is that a knowledgeable user will be more aware of the resource in question, will consequently come to have a greater appreciation of the resource, and, finally, will seek to protect the resource from damage (Sharpe, 1976). Although this sequence is intuitively appealing, little data is available to document that this change in sentiment occurs.

If wildlife agencies are to be expected to allocate money from already over-burdened budgets toward education programs, some data on the effectiveness of those programs in producing the desired results will be required. It was the scarcity of such research that originally inspired this study; it is an attempt to determine whether significant changes in recreationists' knowledge or awareness had occurred as a result of an educational program.

The area chosen for this study was the South Fork Campground area of Cave Creek Canyon in the Chiricahua Mountains of Southeastern Arizona. This area was selected for several reasons. It has the reputation of being the focal point for wildlife viewing activities in Southeastern Arizona and, as such, draws large numbers of wildlife enthusiasts (Shaw, 1979). A number of unique and highly sought-after species of Mexican wildlife are found in the area. Wildlife viewers travel long distances to see these animals, especially the Coppery-tailed Trogon (Trogon elegans), because they occupy limited ranges in the United States. There has been some speculation that pressure from wildlife enthusiasts has caused Trogon nest failure (Taylor, 1980). This has caused concern among both local residents in the area and the Forest Service which administers Cave Creek Canyon. The Forest Service has expressed interest in developing an interpretive program in Cave Creek Canyon, in hopes that educating visitors will

alleviate the adverse impacts some wildlife viewing activities might have on Trogons and other animals.

The purpose of this study was to examine the knowledge visitors to South Fork had about Mexican wildlife species and techniques for minimizing the adverse effects of wildlife viewing activities on the animals. The role of educational programs in influencing visitor knowledge and awareness was investigated by manipulating the amount of information about wildlife that was available to the public.

Certain facts about target audiences must be known in order for effective education to take place. It is important to know for which segment of the public the message is intended (Field and Wagar, 1972). This includes knowing which groups are using the resources, what forms this use takes, and what the users know about the resource, as well as demographic statistics on the age, social class and/or education levels of the users (Gilbert, 1971). This study was designed to obtain the data needed to create such a visitor profile for the South Fork area. This information will be of interest if future education programs are undertaken in the area.

The study was also designed to provide a profile of human activities in the area, as these activities may have effects on wildlife.

Specific objectives of this investigation were:

1. to obtain demographic information about visitors to South Fork,
2. to determine types and amounts of human uses of the area,
3. to measure the effects of providing information about wildlife on visitor knowledge of wildlife, and
4. to determine the effects of providing information about wildlife on visitor awareness of wildlife.

The study took place during the peak season for birdwatching and other wildlife viewing activities in Cave Creek Canyon. These activities begin to pick up about the end of April and continue through mid- to late-June, at which time visitation begins to decline (Hill, 1980). Data were collected during an 8-week period in 1981, beginning in mid-May and continuing through the second week in July.

Definitions

Some of the terms used in this paper require explanation. "Appropriate viewing behavior" and "wildlife viewing etiquette" refer to techniques for viewing wildlife which minimize adverse impacts on wildlife. Examples of some of these techniques are given in the material which was given out as part of the study (Appendix A, Leaflet).

The terms "interpretation" and "education" are used interchangeably here because, although the methods used differ slightly for each, the goal of both is the same; to influence human behavior through teaching.

"Mexican wildlife" refers to species whose range is primarily Mexican. "Rare wildlife" refers to those species in Cave Creek Canyon which are listed in the publication "Threatened and Unique Wildlife of Arizona" (Arizona Game and Fish Department, 1978).

The terms "control" and "unexposed" refer to the group of visitors who did not have access to information about wildlife before the interview. "Treatment" and "exposed" are used to refer to the group who had access to this information prior to the interview.

A "correct response" to an interview question was one which correctly utilized information which had been provided to the treatment group during the study.

Related Research

The following is an overview of related research on outdoor recreation and visitors to outdoor recreation areas.

Interpretive programs are instituted for various reasons, depending on the agency's goals. Wagar (1974, 1976) noted that interpretive programs can increase the effectiveness of resource management, and are important in helping people understand the consequences of their actions. By creating a better public understanding of the dynamics

of ecosystems, interpretation can improve the quality of public decisions about management practices.

In order to accomplish these goals, interpretive programs must be carefully designed. Mahaffey (1968) defined effective interpretation as including these steps: (1) inventory the resource and determine the total significance of the area, (2) investigate who the visitor is, his awareness, and his level of understanding, and (3) place the visitor into a personal perspective at his level of understanding with the resource.

When designing the interpretive message, Dick, McKee, and Wagar (1974) noted it must be created and delivered in such a way that it will gain the attention of the intended receiver, and must be stated in terms of the visitors' interests. Mahaffey (1970) compared the effectiveness of leaflets, signs, and recorded messages, and he found differences between the media were negligible. Ross (1974) found that campers who received rule brochures or saw posted signs had higher scores on knowledge of rules.

The relationship between knowledge of the environment and attitudes or beliefs has been investigated in several studies. Cohen (1974) found that high school students were more willing to express attitudes when they had been given information about the environment. Ramsey and Rickson (1976) found that a knowledge of environmental

issues was more likely to lead to a moderate, rather than extreme, position on those issues. Young (1980) showed that there was a general positive correlation between knowledge of wilderness and a positive attitude toward the concept of wilderness. Similarly, Stankey (1976) found that knowledge of fire impacts and effects on natural systems was the best measure of visitor beliefs related to the suppression of wilderness fires.

The studies above acknowledge a correlation between knowledge and beliefs, but how one measures environmental knowledge has not received as much attention. Determining the amount of knowledge possessed by a group of people as diverse as the general public and relative to a specific area is difficult, as Dahlgren et al. (1977) noted. Socioeconomic factors were found to be important in determining knowledge about wildlife. Dahlgren et al. state that any education program to increase knowledge of wildlife should include contacts with wildlife in a natural setting.

Visitors to the Cave Creek area were the focus of a study by Shaw, Cooper, and Richards (1979). These authors found most of the users were family groups. Two-thirds of those interviewed were repeat users. Wildlife was rated as the second most appealing characteristic of the area, surpassed only by the scenery. Birdwatching accounted for 74% of the wildlife-related activities.

The wildlife that attracts visitors to Cave Creek Canyon is of interest because of the number of species there that are not commonly seen in the United States. In his guide for birdwatching in Southeastern Arizona, Lane (1977) listed many species of primarily Mexican wildlife that can be found in the Chiricahua Mountains. He also noted that many birders consider these mountains the best birding spot in the United States.

One of the greatest attractions for birdwatchers and other wildlife enthusiasts in Cave Creek Canyon is the Coppery-tailed Trogon. Taylor (1980), who has studied Trogons in Southeastern Arizona for several years, stressed the need for a birdwatching etiquette to reduce the potential for negative impacts by birdwatchers on Trogon populations.

METHODS

The Forest Service has expressed concern over the large numbers of visitors to the Cave Creek Canyon area, and the impact this might have on sensitive wildlife populations. Regulations exist which limit certain types of visitor activities, but my observations indicated that few visitors were aware of those regulations. Therefore, the materials presented to visitors in this study centered around two themes:

1. The idea that the area was home to various wildlife species which were more common in Mexico.
2. That visitor behavior could adversely affect these animals.

Some specific guidelines for wildlife viewing behavior were presented, including moving away from animals showing signs of alarm, leaving nests and dens alone, photographing or viewing nests or dens for short time periods only, and not using tape recorders to attract breeding birds.

Because I wanted to model a real life situation, I used means of presenting this material that were likely to be chosen if the Forest Service were actually to undertake an interpretive program in South Fork Canyon.

I constructed a wooden sign, using the rules for effective interpretive signs detailed by Sharpe (1976).

This sign (Appendix A, Sign Text) was installed near the entrance to South Fork Campground, close to the only trailhead. The sign was located where it could be easily seen by hikers and campers. Attached to the sign was a wooden box labeled "Wildlife Information." This box contained the one-page leaflets designed for this study. The leaflet (Appendix A) presented detailed information about seven wildlife species, as well as the guidelines for viewing wildlife. The leaflet was free to visitors.

Within the fields of education and psychology, many theories have been developed to explain and measure learning, and to define the variables involved. One means for measuring the amount of learning which has taken place is the administration of pre- and post-tests. Both tests contain identical or very similar items. A pre-test is given before the learning situation. A post-test is given after the learning situation. Comparison of pre- and post-test scores gives an indication of how much learning has taken place. This system has been used to measure learning in public schools since the development of Sequential Tests of Educational Progress (STEP) in 1956 (Chauncy and Dobbin, 1963).

Administering pre- and post-tests requires a very structured testing situation. Both tests must be given the same way. Test questions must be clear and precise. The

material to be learned must be unambiguous and well presented. Even if all these conditions are met, there is some question about whether the final score measures the amount the student has learned, or the goodness of the test itself. As with all human research, many additional variables must be accounted for, including interactions between the researcher and the student (Davitz and Davitz, 1973).

Despite its limitations, pre- and post-testing does provide quantifiable results that give some indication of how much learning has taken place. For this study, an adaptation of the pre- and post-test method was used. Inasmuch as I wanted to model a real situation, I wanted to avoid test instruments that might alter visitors' behavior. The standard pre- and post-test design requires that the same subjects take both tests. Completing two tests would take a great deal of time, and would alter the normal campground situation considerably. Therefore, the experiment was designed to compare two separate groups of visitors: the control, or pre-test group, to whom no information had been presented prior to testing, and the treatment, or post-test group, who had had access to the information on the sign and leaflet prior to testing. Differences between the scores of the control and treatment groups I assumed to be due to the effects of the study.

In order to avoid a disproportionately large number of birdwatchers in either group, I devised a system in which the sign and leaflet were available during alternate 2-week periods. Any subjects contacted during the periods when the material was not available were in the unexposed group. Those subjects contacted during periods when the sign was in place were in the exposed group, whether or not they had actually seen the material.

Constraints of the study design and a review of the literature on recreation research indicated that a questionnaire was the best means of obtaining data in this case. Questionnaires have the advantage of flexibility and are tolerated well by campers (LaPage, 1969; Burton, 1971). Using some items from questionnaires used in related research and some items designed specifically for this study, I developed a four-page questionnaire that was administered orally (Appendix A).

The questionnaire was divided into two parts:

1. Part A, given to all visitors, contained questions about demographic data, knowledge and awareness.
2. Part B, given to the treatment group only, contained questions about the visitors' use of and opinions about the sign and leaflet.

Subjects were approached and asked if they wished to take part in a study about wildlife and recreation in

represent morning users, and from noon to 5 P.M. to represent afternoon users. Interviews were given on three weekdays and two weekend days per week.

Upon completion of the investigation, I tabulated and categorized the responses from each questionnaire. Data were divided into control and treatment categories for comparison. Descriptive statistics (percentages) were used to obtain demographic profiles of each sample. Inferential statistic analysis of the data obtained from questions about wildlife, wildlife viewing, and human activities was used to test hypotheses.

The number of wildlife species visitors had seen was of importance as respondents were expected to have a better chance of doing well on the test for knowledge of wildlife if they had had the opportunity to view many species of wildlife. To compare treatment and control groups for knowledge and awareness, it was necessary to determine whether both groups had seen similar numbers of wildlife, so a Pearson's chi-square test was run, with the number of animals seen and treatment group as variables.

Following this, all questionnaires were grouped into categories determined by the number of wildlife species the visitors had seen. The categories were: (1) Few: 1-3 species seen; (2) Moderate: 4-6 species seen; and (3) Many: 7-13 species seen. Within these these categories, each questionnaire was given a grade (number of

correct responses/number of total responses). Tallies of the frequency of specific grades were made separately for treatment and control groups, within the categories for number of species seen. A three-way contingency table was constructed, using the number of species seen, frequency of correct responses, and treatment as variables. A likelihood ratio test was used to determine differences in knowledge between treatment and control groups.

Effects of the study on awareness of wildlife were determined by comparing the frequency with which exposed and unexposed samples mentioned certain wildlife species. A difference in the frequency of mention would indicate that the study affected visitor awareness.

To determine the effects of the study on respondents' awareness of their own and other visitors' behavior, a comparison was made of the relative frequencies of positive and negative responses to questions 11 and 12 of the questionnaire (Appendix A) for treatment and control groups.

In summary, the following six interactions were analyzed:

1. Demographic data; treatment vs. control groups.
2. Number of wildlife species seen; treatment vs. control groups.
3. Effect of numbers of wildlife species seen on number of correct responses; treatment vs. control groups.

4. Effect of treatment on number of correct responses; treatment vs. control groups.
5. Effect of treatment on number of species respondents saw, and on the specific species that were seen; treatment vs. control.
6. Effect of treatment on perceptions of the impact of human behavior on wildlife; treatment vs. control groups.

RESULTS

Demographic Data

Only one party of the 127 contacted during the course of this experiment declined to take part in the study. A total of 126 questionnaires were completed, with 64 parties exposed to information and 62 unexposed parties sampled.

Demographic data were obtained from all participants for two reasons. It was necessary to have this information for comparison of the control and treatment groups in order to be certain that they represented samples from the same or very similar populations. Demographic data were also considered important in determining, for future management plans, what sort of visitors were using the South Fork area. Data were obtained for the variables of sex, party type, and education. Also included in this section are data regarding the activities visitors engaged in while in South Fork Canyon.

Sex of Respondent

Results from Table 2 would seem to indicate that more males use this area than females. Since only one person from each group was interviewed, however, females within a group would not be represented unless they acted in the role of group spokesperson.

Table 2. Sex of respondents for both control and treatment samples

	Control Group	Treatment Group
Male	45	44
Female	17	20

Education

Kellert (1979) found that birders had the highest educational background of animal interest groups (his analysis did not include hunters). Since it was expected that a large number of the visitors to South Fork would be birders, it was not too surprising that educational levels were quite high for both the control and treatment groups (Table 3). Ninety-two percent of the treatment group and 93.6% of the control group had completed some college work. Over 50% of both the exposed and unexposed samples had completed more than 4 years of college. This indicates that visitors to South Fork are generally a highly educated group.

Table 3. Education background of respondents

Grade Completed	Control Group		Treatment Group	
	#	%	#	%
Junior High School	0	0	1	
High School	4	6	4	6
1-2 years college	7	11	11	17
3-5 years college	19	31	14	22
Post-graduate	32	52	34	53

Type and Size of Party

Groups contacted during the study were divided into five party types: family, recreationist (singles or groups of unrelated persons), research, tours, and school classes. In both treatment and control groups, over half of the parties were family groups. This supports earlier findings by Shaw et al. (1979). There were few school classes or tour groups interviewed (Table 4).

Activities

In order to get some idea of the ways in which South Fork is used, visitors were asked to indicate the primary activity they were or would be engaged in, as well

Table 4. Frequencies of various partytypes contacted during the study

Party Type	Control		Treatment	
	#	%	#	%
Family	35	56	38	59
Recreationist	18	29	14	22
Research	6	10	9	14
School class	1	2	2	3
Tour group	<u>2</u>	<u>3</u>	<u>1</u>	<u>2</u>
Total	62	100	64	100

as any other activities done in South Fork. Birding was, by far, the most often given response for primary activities. Obviously, some hiking or camping must have occurred concurrently with birding activities. It is interesting, though, that most persons listed birding as the primary activity and hiking or camping as secondary activities (Tables 5 and 6). These findings illustrate the importance of South Fork Canyon as a wildlife viewing area in Southeastern Arizona.

Table 5. The number of parties listing each activity as the primary one they had engaged in

Activity	Control		Treatment	
	#	%	#	%
Birding	38	61	33	52
Hiking	6	10	9	14
Picnicking	3	5	8	12
Camping	2	3	7	11
Research	4	7	4	6
Photography	3	4	2	3
Resting	1	2	1	2
Backpacking	2	3	0	-
Enjoying Nature	3	5	0	-
Total	62	100	64	100

Table 6. The number of parties listing each activity as the secondary one they had engaged in

Activity	Control		Treatment	
	#	%	#	%
Hiking	20	38	10	22
Camping	21	28	15	33
Photography	11	15	1	2
Picnicking	5	7	4	8
Birding	4	5	3	6
Collecting insects	0	-	3	6
Collecting reptiles	1	1	2	4
Collecting mammals	1	1	0	-
Swimming	0	-	1	2
Relaxing	1	1	1	2
Enjoying nature	1	1	1	2
Botany	1	1	1	2
Getting lost	0	-	1	2
Backpacking	0	-	1	2
Napping	0	-	1	2
Organizing data	1	1	0	-
Total ^a	76	100	45	100

a. Some persons gave more than one response, and some listed no secondary activities, so totals in this table do not match those in Table 5.

A summary of the demographic results reveals that family groups are the most numerous party type using the South Fork area. Over half of the visitors to South Fork have had more than four years of college. Their main purpose in visiting the area is to birdwatch. If the Forest Service continues an education program in the South Fork area, this information will provide a good idea of the type of program and kind of visitor it should be designed for.

Effects of Interpretation on Knowledge

The primary reason for this study was to determine the effect providing information had on the knowledge and awareness visitors had of wildlife. In testing for changes in knowledge, the responses of the unexposed sample were used as an indication of the knowledge visitors had of wildlife before the experimental material was provided. The responses for the exposed group were used as an indication of the effect of the experiment.

Because of the possibility that the amount of wildlife people had seen might affect the test scores, the control and treatment groups were compared with regard to the number of animals seen. The results of the Pearson's chi-square test indicated that the number of animals seen did not differ significantly between groups at the 99.99% level, so further comparisons between treatment and control groups could then be made.

Those persons who reported seeing no animals were not included in analyses as they could not answer the questions asked during the interview. The number of rejected questionnaires was small: two for the treatment group and one for the control group.

Analysis of pre- and post-test knowledge levels was done by comparing test scores for questions 6, 7, 8, and 9 (Appendix A, Questionnaire). These questions dealt with visitors' knowledge of what Mexican or rare wildlife species were in the area, what actions were incompatible with a wildlife viewing "etiquette," and alarm behaviors of wildlife.

The number of correct responses to questions dealing with knowledge of wildlife and wildlife viewing techniques per questionnaire ranged from 0-8 for the control group with an average of 1.43 correct. For the treatment group, the number of correct answers per questionnaire ranged from 0-5 with an average of 1.77 correct. A likelihood ratio test was run to compare the scores of the two groups. Three hypotheses were tested:

H_{01} : There is no three-way interaction between the number of animals seen, the treatment, and the number of responses.

H_{02} : There is no interaction between the number of animals seen and the number of correct responses

(allowing a relationship between treatment and the number correct).

H_{03} : There is no interaction between the treatment and the number of correct responses (allowing a relationship between number of animals seen and number correct).

The test statistic value of 8.848 for H_{01} was not significant, and H_{01} was not rejected. This meant that there was no evidence of interaction between the number of animals seen and the treatment, and allowed for the effect of the two factors on the number of correct responses to be examined separately (Table 7).

Table 7. Results for likelihood ratio tests of the three hypotheses

Hypotheses	Test Statistic	Degrees of Freedom	p-value
H_{01}	8.848	7	.30
H_{02}	35.701	16	.005
H_{03}	15.725	11	.20

The next step was to test number of animals seen and treatment separately for their effect on the number of correct responses. H_{02} looked at the effect of the number of animals seen. A test statistic of 35.701 with 16 degrees of freedom was significant at the 99.995% level. H_{02} was therefore rejected, indicating that, as expected, there was a relation between the number of animals seen and the number of correct responses. This result is presumed to be due to the wording of the test questions. In order to avoid respondents' fear of giving incorrect answers, subjects were asked, for instance, to list rare or Mexican wildlife they had seen, rather than asking if respondents' knew which were Mexican or rare. Someone who had had more opportunity to see the local wildlife could gain a higher score by being able to list more animals. Still, it was hoped that better results would be obtained by accepting this potential bias and getting more information from visitors who might otherwise have been too intimidated to respond.

The final and most important test explored the effect of treatment on the test scores. A test statistic of 15.725 with 11 degrees of freedom was not significant and H_{03} could not be rejected. Therefore, there is no evidence that the presentation of educational material in this study had an effect upon visitor knowledge.

Effects of Interpretation on Awareness

Awareness was more difficult to test for than knowledge as it is less concrete and can exist at a less conscious level. In order to analyze the effects of the experiment on the respondents' awareness of wildlife, it was assumed that having prior knowledge of an animal's presence in the study area would increase the visitor's awareness of that animal. The visitor with prior knowledge would thus be more likely to mention having seen the animal than someone without that information. A comparison was made of the number of times the animals described in the experimental material (Appendix A, Leaflet) were listed in response to the question, "What kinds of wildlife, if any, have you seen on this trip or ever in South Fork Canyon?".

It was assumed that both treatment and control groups had equal opportunities to see any of the seven animals described in the material. All seven are commonly seen in the South Fork area. If both samples had an equal chance of seeing these animals, it would be expected that both groups would mention having seen them with equal frequency, unless the experiment had some effect on visitor awareness. Each mention of a study animal was given a score of one point. The scores for the two groups were then averaged and the means were compared using a t test. Only animals mentioned specifically by name were counted. For example, "bird" was not accepted as a correct response,

as there was no way of telling what type of bird it had been. Obviously, the responses of persons who had seen no wildlife were not included.

The results of the t test comparing the means of the two groups showed that the test statistic fell in the critical region ($t = .689$ for the control and $t = .742$ for the treatment) and so $H_0: \mu_1 = \mu_2$ could not be rejected. Therefore, there was no evidence of a difference in awareness between the treatment and control groups with regard to wildlife.

A second category of awareness that was tested was awareness of human activities and their effects upon wildlife. Of interest was whether the visitors were aware of any human behaviors, either their own or those of others, which might have disturbed the wildlife, and how respondents viewed the behavior of others as compared with their own. Thus there are three groups of results to be discussed here:

1. Visitors' awareness of the effects of the behavior of other visitors (treatment vs. control).
2. Visitors' awareness of the effects of their own behavior (treatment vs. control).
3. Visitors' awareness of their own behaviors as compared to their awareness of the behavior of other visitors (treatment vs. control).

Questions 11 and 12 of the questionnaire (Appendix A) were used to obtain this data.

As shown in Table 8, there were some obvious differences between the treatment and control groups when asked about the disruptiveness of their own behavior. Although the treatment group was almost evenly split between those who felt they had and those who felt they had not disturbed wildlife, the majority of the control group felt they had not disturbed wildlife.

Another interesting difference between treatment and control groups is shown in the number of responses given when asked for examples of disruptive activities. The treatment group gave four times as many responses as did the control group. For both groups, the example given

Table 8. A comparison of how disturbing to wildlife the control and treatment groups felt their own behavior was

	Disturbed Wildlife		Did Not Disturb Wildlife		Number of Behaviors Cited
	#	%	#	%	
Control	20	32	42	68	8
Treatment	30	47	34	53	33

most often was that any human presence in the area would be disruptive to wildlife.

These results show a marked difference between samples in terms of perceptions of the effects of human behavior on wildlife. Apparently, visitors were more likely to view their own behavior as disruptive after exposure to the educational material.

A similar trend developed in a comparison of the answers to a question about the behavior of other visitors. The percentage of respondents in the treatment group who felt other visitors had disturbed the wildlife was more than three times that of the control group (Table 9). The exposed group also listed many more examples of specific

Table 9. A comparison of how disturbing to wildlife the control and treatment groups felt others' behavior was

	Disturbed Wildlife		Did Not Disturb Wildlife		Number of Behaviors Cited
	#	%	#	%	
Control	8	13	54	87	6
Treatment	27	42	37	58	20

behaviors they had observed which disturbed the wildlife. Noisy children were the most often mentioned disturbance for the treatment group, and general noise was most often mentioned by the control group. Overall, a majority of both groups felt human activities had not disturbed the wildlife.

The final investigation of awareness was to compare the respondents' awareness of their own behavior with their awareness of other visitors'. It had been postulated that respondents would be more likely to view their own behavior as less disturbing than that of others. At least for the control group, this did not hold true. Table 10 compares the responses for control and treatment groups. Both

Table 10. A comparison of how disturbing to wildlife the treatment and control groups thought their own behavior was in relation to the behavior of others

	Own Activities Disturbed Wildlife (%)	Others' Activities Disturbed Wildlife (%)
Control	32	13
Treatment	47	42

groups felt that their own activities were more disruptive than were those of other visitors. However, for the treatment group the difference was very slight and may be statistically insignificant.

Respondents' Evaluations of the Educational Material Provided

One of the major difficulties in developing the methods used in this study and in justifying the use of education for management purposes is that very little research has been done to determine public response to interpretive programs. Little is known about which media work best in which situations, who responds to interpretive programs, how much material is retained by visitors attending programs, and whether the programs attain the desired results.

For purposes of providing a clearer picture of how interpretive attempts affect the public that sees them and to provide a framework in which to analyze the results of this study, questions regarding the educational material were included in the survey. These questions, in Part B of the questionnaire, dealt with the visitors' use of the materials, their perceptions of the information in the materials, and their perceptions of behavior changes in themselves due to exposure to these materials.

Whether the exposed sample had truly been exposed and the extent to which they had used the information was

obviously of great interest with regard to this study. Therefore, respondents were asked whether or not they had seen the sign and leaflet, and, having seen them, had they read the material. Seventy-two percent reported having seen the sign and 64% had read it. The figures for the leaflet were similar, although lower (Table 11). Obviously, when the effects of this study on knowledge and awareness are being discussed, it should be noted that over a quarter of the treatment group had not actually seen the material provided. Justifiably, the treatment results could be calculated for only those respondents who actually had been exposed. However, the idea behind setting up this experiment was to attempt to duplicate a real world situation.

Table 11. Proportion of treatment group who saw and read the sign and leaflet

	Saw Sign	Read Sign	Saw Leaflet	Read Leaflet
Number	46	41	39	33
Percentage	72	64	61	52

Resource managers considering the use of education as a tool must face the fact that a fairly large portion of their target audience will never see the information provided. Analysis of the effects of interpretive programs must be made with this understanding.

Of the visitors who saw the sign, 89% reported having read it. Of those who saw the leaflet, 85% reported having read it. There was no way to separate respondents who had skimmed the material briefly and those who had read the material in depth.

To obtain some idea of the amount of information retained, subjects were asked if they could remember anything that the sign or leaflet mentioned. Of those who read the sign, 81% said they could remember something it said, and, of those reading the leaflet, 85% could remember something it said.

When asked to explain specifically what they could remember for each media used, visitors were generally able to respond with a correct example. The example most often given for the message on the sign was that there were Mexican wildlife species in the area. This response was given by 38% of the respondents to this question, and was one of the main ideas presented in the text of the sign.

The response most often given to a similar question about the text of the leaflet was that there were Trogons in the area. This example was given by 17% of the respondents.

Table 12 contains a breakdown of the types of items visitors remembered from the leaflet.

Leaflets were available to whomever wanted one. Visitors were asked what they had done with the leaflet when they had finished looking at it, in order to determine what became of the leaflets. A majority of the respondents to this question said they had saved the leaflet to take as a souvenir or for future reading. Most of the remaining leaflets were returned to the box. Only one was discarded.

As a final check on the effectiveness of the sign and leaflet, visitors were asked directly whether they felt they had learned anything or had changed their behavior as a result of the study. Fifty-nine percent of the respondents to this question felt they had learned something, but only 22% felt their behavior had been affected.

Many responses were given detailing what visitors felt they had learned. These were almost entirely very factual statements, all but one dealing with wildlife biology. Several responses were given more than once. The most common of these was that there were protected rattlesnakes in the area (Appendix B).

When asked how their behavior had been altered, the majority of the respondents listed increased awareness of animals. Also given was a change in wildlife viewing behavior to avoid disturbing animals. One respondent felt

Table 12. Categories and proportions of answers received in response to the question, "Do you remember anything the leaflet said?"

Response Category	Number Giving Response	Percent of Total Responses
Mention of specific animals	34	58
Mention of behavior or biology of animals	12	20
General Replies	6	10
Mention of rules or wildlife viewing	4	7
Replies did not pertain to question	3	5
Total	59	100

he had obtained a better understanding of wildlife viewers as a result of the study materials.

Table 13. The proportion of responses in each of three categories showing how the sign and leaflet affected visitor behavior

	Increased Awareness of Wildlife	Change in Wildlife Viewing Behavior	Other	Total
Number	6	2	4	12
Percentage	50	17	33	100

DISCUSSION

The demographic data collected suggest that interpretive activities in the South Fork area should take into account that most visitors are highly educated and should be designed to include children. Management plans should keep in mind that birding is the primary use of the area during the summer months. It is interesting to note that, although other activities may be done in conjunction with birding, most visitors consider themselves to be birders first and campers, hikers or photographers only secondarily.

The statistical results showed that interpretation apparently had no effect on visitor knowledge of wildlife and wildlife viewing techniques. There are two possible explanations for this result. One is that there actually was no effect on knowledge. The other is that there was an effect, but for various reasons it did not show up in the experiment.

There is always a problem in trying to measure how much someone has learned. One question that should be asked is, is the the educational material provided, in fact, educational? Given the educational backgrounds of the subjects, it is possible that the test showed no effects because the respondents already knew the information provided. My feeling, based on responses to questions and on

the small number of correct responses, is that most visitors did not have prior knowledge, but it cannot be discounted entirely.

Problems with sample size and experimental design could also account for the lack of a difference in knowledge between the control and treatment groups. Not all visitors were sampled, as some left the area before they could be approached. Slight differences between control and treatment groups might become more apparent with larger sample sizes. Furthermore, not all of the exposed sample had really been exposed. Including the portion who had not seen the information in the exposed group may have masked real differences in scores between treatment and control groups.

Test items may not have been designed to measure the kind of learning that actually took place. It is difficult to anticipate what information will be assimilated by the learner, even in the most controlled situations.

Finally, other variables may have been interacting with those which were tested for. This is especially true of field experiments. In this study, only the presence or absence of educational material and the format by which it was presented could be controlled. Factors which may have affected study results and which were not under the control of the researcher included the respondents' backgrounds, and length of time the respondent had been in the area prior

to testing, whether the subject utilized the educational material, and, if so, the length of time spent reading it and the length of time that had passed since the subject had seen the material prior to testing, and interactions between subjects, and/or between subjects and the researcher.

I think Lawson (1960), p. 8) said it best when he wrote, "we can never prove by the methods of science that something does or does not affect learning, in an absolute sense, but only within the confines of our definition of learning." Possibly the definition of learning was made too narrowly in this case. Therefore, it cannot be conclusively stated that education of this type has no effect on visitor knowledge, only that this particular study did not show any effects.

No differences between treatment and control groups for awareness of animals were found. Again, as was the case for visitor knowledge, this might reflect the test used rather than the real situation. The assumption that prior knowledge of the presence of animals in the area would lead to increased awareness and sightings of those animals may be incorrect.

There were differences, however, in awareness of human behaviors. The respondents in the treatment group were more aware of their own and other visitors' behavior

disturbing wildlife than were respondents in the control group.

These differences may have been the result of the visitors becoming aware that wildlife in the area was unique, and therefore more in need of protection. Or, the visitors may have become more aware of human presence in the area. Similarly, visitors may have learned of specific human behaviors which could disturb wildlife and so have become more aware of those activities occurring.

Regardless of the reason for this increased awareness of human activities, the finding is one that should be of interest to resource managers considering education programs. If the goal of educating resource users is to alleviate use problems, then increasing visitors' awareness of those problems may be an important first step. The interaction between awareness and behavior is complicated, but it is hoped that increased awareness will lead to behavior changes that will make the job of managing resource users easier.

Visitors in both groups felt their own activities had disturbed wildlife more often than the activities of other visitors. It is unclear whether this is due to a difference in awareness, with subjects being more aware of their own activities and blocking out what other visitors are doing, or whether respondents are more comfortable

reporting on themselves than they are with reporting on others.

The final portion of this study investigated respondents' reactions to the material provided during the study. Results indicated that, as is always the case with voluntary participation in interpretive programs, some of the treatment group had not seen the material. However, of those who had seen the sign and leaflet, a majority could remember something of the texts. Interestingly enough, the figures were similar for memory of information from both the sign and the leaflet. This was unexpected, since the sign text was so much briefer than the leaflet, and therefore might be easier to remember.

Only a small number of visitors felt they had learned something from the sign or leaflet, or had changed their behavior as a result of the information they read. Possibly visitors did not want to admit that they had not already known the material or that their behavior changed. The need for a further study which investigates behavior in connection with interpretation is indicated. Effects of this study may extend beyond those measured in the campground, since most visitors who read the leaflet reported that they had kept it as a souvenir and so may have absorbed the material after leaving the study area. Agencies concerned with printing costs will be glad to know that it

appears that publications are actually being used by visitors.

The limited scope of this study and the problems inherent in any research on human subjects, especially that dealing with the effects of education, place limitations on the conclusions that can be drawn from this experiment. There are benefits from interpretive programs that were not investigated in this study. These include increased visitor enjoyment of outdoor recreation areas and changes in the public perception and knowledge of the roles of resource management agencies. Knowledge, awareness, behavior, enjoyment, and attitude toward resource agencies are all factors which should be taken into consideration when planning education programs.

Although further research in this field is needed before the usefulness of education as a management tool can be evaluated, this study has provided some interesting results for interpreters and others interested in educating the public. It should serve as a pilot project for longer and more in-depth investigation of the effectiveness of natural resource interpretation.

APPENDIX A
QUESTIONNAIRE, TEXT OF
SIGN, AND LEAFLET

SOUTH FORK CANYON WILDLIFE SURVEY
UNIVERSITY OF ARIZONA
SCHOOL OF RENEWABLE NATURAL RESOURCES

Part A- for all subjects

Hi! I'm working with the University of Arizona on a survey about wildlife and recreation in the South Fork area. The results may help the Forest Service in their planning for improved recreation opportunities here. The interview will take about 15 minutes of your time, and is completely voluntary. The information you provide will be kept anonymous and confidential. Would you be willing to help me out? Remember, this is voluntary. You may withdraw from the interview at any time.

Interviewer: D. Hill Date: _____ Location: South Fork CG.

Sex (of subject): M ___ F ___ Party type: _____ Party size: _____

Date of first visit to South Fork this trip: _____

1a. Do you live in this immediate area (Cave Creek, Portal, Rodeo)?

Yes ___ No ___

b. If no, where do you live? Arizona ___
Other State ___
Foreign ___

2. How did you hear about the South Fork area?

3a. What is the main activity you are (or will be) doing while here in South Fork?

Primary _____

Other _____

b. (If any activity listed above is camping) Why did you choose to camp here at South Fork campground rather than one of the other campgrounds in Cave Creek Canyon?

4. How would you rate the following factors, in terms of how they influence the quality of your experience in South Fork?

	<u>Very Good</u>	<u>Good</u>	<u>OK</u>	<u>Poor</u>	<u>Very Poor</u>
a. natural environment and wildlife	_____	_____	_____	_____	_____
b. campground facilities	_____	_____	_____	_____	_____
c. influence of other visitors on you	_____	_____	_____	_____	_____
d. Forest Service management of the area	_____	_____	_____	_____	_____

5. What kinds of wildlife, if any, have you seen on this trip or ever in South Fork Canyon? (If none, go to #8).

None _____

<u>General</u>	<u>Specific (Common or Scientific Name)</u>
_____ Birds	_____
_____ Reptiles	_____
_____ Fish	_____
_____ Mammals	_____

6a. Have you seen any Mexican wildlife here?

Yes ___ NO ___

b. If yes, which ones? Be specific.

7a. Have you seen any rare wildlife here?

Yes ___ No ___

b. If yes, which ones? Be specific.

8a. Were you attracted to South Fork because of the chance to see any particular animals?

Yes___ No___

b. If yes, which ones? Be specific.

c. Do you think South Fork is better than other parts of Cave Creek Canyon for viewing wildlife? If yes, explain why.

No___ Yes, _____

9. Do you know of any rules of etiquette or procedures for viewing wildlife?

No___ Yes, _____

10. Do you know of any signals animals use to show if they are alarmed or disturbed by something you are doing? If yes, what are they?

No___ Yes, _____

11. Have you noticed any human activities here in South Fork which appeared to disturb the wildlife? If yes, what are they?

No___ Yes, _____

12. Do you think your own activities in South Fork have disturbed the wildlife (will disturb the wildlife) in any way? If yes, explain.

No___ Yes, _____

13. There has been some talk of closing South Fork Road to motor vehicle use. If that were to happen, what would you do?

_____ Camp elsewhere in the canyon and hike to South Fork Campground.

_____ Camp elsewhere in the canyon and not visit South Fork.

_____ Come to the canyon on daytrips only and hike to South Fork.

_____ Come to the canyon on daytrips only and not visit South Fork.

_____ Camp elsewhere in the Chiricahuas, and not visit the canyon.

_____ Not visit the Chiricahuas at all.

_____ Other _____.

14. Do you have any comments about the management of this area, or this survey?
 No___ Yes, _____

Part B- for exposed sample only

- 15a. Did you notice the sign about wildlife in the campground? Yes___ No___
 b. If yes, did you read the sign? Yes___ No___
 c. If yes, do you remember anything it said?
 NO___ Yes, _____

- 16a. Did you see the leaflet about wildlife? Yes___ No___
 b. If yes, did you read the leaflet? Yes___ No___
 c. If yes, do you remember anything it said?
 No___ Yes, _____
 d. What did you do with the leaflet after you read it?
 _____ Put it back in the box.
 _____ Saved it.
 _____ Discarded it.
 _____ Other: _____.

- 17a. Do you think you learned anything from the sign or leaflet that you
 didn't already know? Yes, _____ No___
 b. Did the sign or leaflet affect your behavior in any way? Yes, _____
 _____ No___

18. Other comments _____
 _____.

For all Subjects:

19. Education of subject- highest grade completed:
 Elementary and High School: 1 2 3 4 5 6 7 8 9 10 11 12
 College: 1 2 3 4 5 6 7 8 +

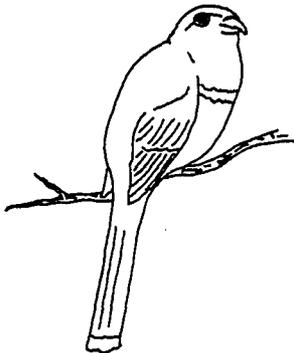
Text of the interpretive sign installed in South Fork Campground during the study.

Mexican Visitors

Some of the interesting and unusual animals you may see here are actually more common in Mexico. Their ranges barely extend into the United States. Please enjoy any animals you see from a distance, as our human activities may frighten them. Thank you!

MEXICAN WILDLIFE

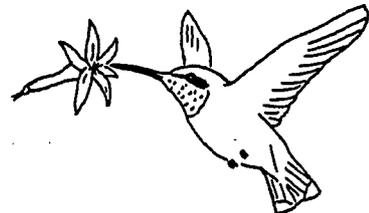
Located as they are, so close to Mexico, and being ecologically similar to some Mexican environments, the Chiricahua Mountains provide a "bridge" for Mexican wildlife entering the United States. The animals described in this leaflet, although fairly easily seen in the South Fork area, are of special interest because of their limited distribution in Arizona. This symbol * marks those animals listed in the Arizona Game and Fish publication, "Threatened and Unique Wildlife of Arizona."



BIRDS

"Arizona's bird of paradise", the Coppery-tailed Trogon (Trogon elegans)* is a striking parrot-sized bird. The brilliant male Trogon's emerald-green back and rose-red breast contrasts with the female's muted rose-pink breast and grey back. Trogons nest in cavities excavated in Sycamore trees by woodpeckers and flickers. Both male and female Trogons share in incubating the eggs and raising the young. Larvae, cicadas, and fruits (such as Canyon Grape) are gathered during hovering feeding flights. It is estimated that only 100 Trogons are to be found in the U.S., along stream canyons in S.E. Arizona. A loud K-k-k or Ko-a alarm call and raising and lowering of the tail indicate a disturbed Trogon.

Did you hear that squeaking noise? It's probably an agitated Blue-throated Hummingbird (Amphispiza bilineata)*. A large hummer with a whitetail-tip and sky-blue throat (males), these birds can often be seen along streams feeding on flower nectar and small insects, or terrorizing other hummers at feeders hung in campsites. A tiny lichen and cobweb cup serves as a nest.

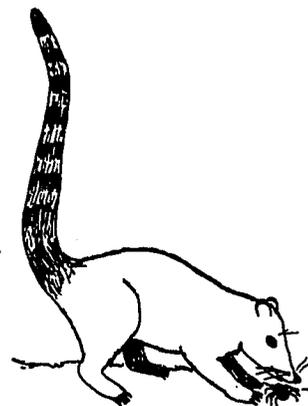


REPTILES

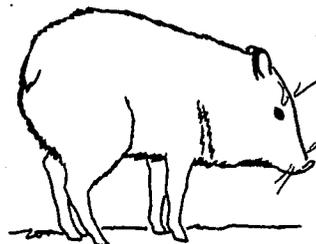
Protected rattlesnakes?! It may sound strange, but a few rattlesnakes are so limited in distribution in Arizona that they are protected by law. Two of these are the Banded Rock Rattlesnake (Crotalus lepidus klauberi)* and the Twin-spotted Rattlesnake (Crotalus pricei pricei)*. Both are small, mild-mannered dwellers of rocky outcroppings in the arid mountains of the Southwest. Dark bands 1/4 to 1/2" wide alternating with greyish areas, and a bright yellow tail-tip identify the Banded Rock Rattler, while a lengthwise row of dark paired spots mark the Twin-spot. Both have a temperature-sensitive pit between the eye and nostril (as do all pit vipers), which is used in locating their prey. Rattlesnakes make themselves useful by controlling the numbers of small rodents. A faint buzzing rattle sometimes (not always!) warns that you are too close.

MAMMALS

The long snout, indistinctly ringed tail carried erectly, and flat-footed walk identify the Coatimundi (*Nasua nasua*)*, a strange-looking animal at best. Bands of up to 20 animals roam the open forest by day, rooting for grubs and tubers, and searching for fruits, nuts, eggs, lizards, scorpions, and tarantulas. Spiders and scorpions are rolled around with the front paws to remove scales, hairs, and stings before eating. Inquisitive by nature, coatis are adept at opening trash cans and picnic baskets. Excellent climbers, their long tails are used for support and balance. A frightened coati will often dash up the nearest tree trunk for safety.



"Pigs"! Javelinas (*Pecari angulatus*) get this common name from their pig-like appearance. Often seen traveling at dawn and dusk, in groups of 2-5, their excellent sense of smell leads them to grubs, nuts, berries, fruits, cactus, trash, or picnic supplies, with an occasional cat or small dog for a change of pace. A gland on the pig's rump produces their distinctive musky odor. When excited or frightened, the mane of coarse hair extending from the shoulders down the back to the rump is erected. Javelinas may attack if cornered or provoked.



Apache Fox Squirrels (*Sciurus apache*)* are only found in the United States here in the Chiricahuas. These golden-orange tree squirrels nest in hollow trees or tree tops along canyon bottoms (look for large globular brushy masses in tree branches). Feeding on nuts, seeds, fruits, buds and young tree shoots, mushrooms, insects, eggs, and young birds, Fox Squirrels are usually quiet. If disturbed they may utter a sharp bark-like call, accompanied by vigorous tail shaking.



With these and all wildlife, please keep in mind the following suggestions for viewing or photographing:

1. Keep Your Distance! If the animal shows signs of alarm, move further away from it.
2. Leave dens and nests "as is". Removing vegetation or even just walking up to a nest or den may leave signs predators may follow.
3. Take A Break! During extended periods of viewing or photographing nests or dens, allow the adult animals time to feed the young undisturbed.
4. Sorry- this area is closed to the use of tape recorders to attract breeding birds because recordings may interfere with nesting/feeding behavior.
5. Easy Does It! Treat this area gently, and it will be here for you to enjoy on your next trip!

THANK YOU!

APPENDIX B

DATA TABLES

Raw Data from 1981 Cave Creek Study

Total questionnaires administered	126
Number questionnaires with information	64
Number questionnaires without information	62

Sex

	<u>With Information</u>	<u>Without Information</u>
Male	44	45
Female	20	17

Party Type

	<u>With Information</u>	<u>Without Information</u>
Family	38	35
Recreationist	14	18
School class	2	1
Research	9	6
Tour group	1	2

	<u>Number in Party</u>	
	<u>With Information</u>	<u>Without Information</u>
Family	162 (range 2-15)	91 (range 2-8)
Recreationist	22 (range 1-4)	31 (range 1-5)
School class	21 (range 10-11)	19 (range: one party only)
Research	24 (range 1-5)	10 (range 1-3)
Tour group	<u>13</u> (one party)	<u>16</u> (range 4-12)
Total	242	167

	<u>Average Number in Party</u>	
	<u>With Information</u>	<u>Without Information</u>
Family	4.3	2.6
Recreationist	1.6	1.7
School class	10.5	19.5
Research	2.7	1.7
Tour group	13.0	8.0

	<u>Where Visitors Are From</u>	
	<u>With Information</u>	<u>Without Information</u>
Immediate area	3	2
Arizona	25	27
Other state	35	33
Foreign	1	0

How Visitors Learned about South Fork

With Information

Relatives or self local to Southeastern Arizona	19
School class	10
Friends	9
Southwest Research Station	8
Lane's <u>Birder's Guide to Southeastern Arizona</u>	8
Other birders	2
Pettingill's birding book	2
Portal Ranger Station	2
Birding magazines	1
Newspaper	1
Ramsey Canyon	1
Audobon Society	1
Petersen's <u>12 Birding Hot Spots</u>	1
<u>Natural History Magazine</u>	1
Birding books	1
Forest Service	1
Taylor's <u>Hiking Guide to the Chiricahua Mountains</u>	1
Hiking club	1
Snail literature	1
Found South Fork on own	1

Without Information

Lane's <u>Birder's Guide to Southeastern Arizona</u>	14
Friends	14
Relatives or self local to Southeastern Arizona	8
School class	6
Audobon Society	4
Map of Southeastern Arizona	2
Chiricahua National Monument	2
Cave Creek Ranch	2
Newspaper	2
Petersen's <u>12 Birding Hot Spots</u>	2
Taylor's <u>Hiking Guide to the Chiricahua Mountains</u>	2
Davis and Russell's birding book	1
Sign with map near Ranger Station	1
T.V.	1
Native Plant Society	1
<u>Arizona Highways Magazine</u>	1
<u>Magazine</u>	1
Birders' books	1
Southwest Research Station	1
Desert Museum	1
Tour leader	1

How Visitors Learned about South Fork--ContinuedWithout Information

Bear Mountain Lodge (New Mexico)	1
Found South Fork on own	1

Primary Activity Engaged In in South Fork

	<u>With Information</u>	<u>Without Information</u>
Birding	33	38
Hiking	9	6
Picnicking	8	3
Camping	7	2
Research	4	4
Photography	2	3
Resting	1	1
Enjoying nature	0	3
Backpacking	0	2

Other Activities

	<u>With Information</u>	<u>Without Information</u>
Hiking	10	10
Camping	15	21
Photography	1	11
Picnicking	4	5
Birding	3	4
Collecting insects	3	0
Collecting herps	2	1
Swimming	1	0
Relaxing	1	1
Enjoying nature	1	1
Botany	1	1
Getting lost	1	0
Backpacking	1	0
Napping	1	0
Trapping mammals	0	1
Organizing data	0	1

What Kind of Wildlife Did You See?

<u>Type</u>	<u>With Information</u>	<u>Without Information</u>
General:		
Birds	49	52
Reptiles	4	3
Fish	2	0
Mammals	1	0
None	2	1
Specific:		
Trogons	18	22
Coatimundis	9	8
Javelina	8	4
Blue-throated Hummingbird	5	3
Apache Fox Squirrel	2	4
Fox Squirrel	2	1
Chiricahua Squirrel	1	0
Arizona Squirrel	1	0
Hummingbirds	4	0
Rattlesnakes	1	2
Squirrels	14	18
Junco	1	0
Nuthatch	2	3
Sulpher-bellied Flycatcher	7	6
Hepatic Tanager	2	4
Night Hawks	1	0
Blue Jay	1	0
Swallows	1	0
Woodpecker	2	1
Black-headed Grosbeak	3	4
Painted redstart	11	6
Bridled Titmouse	2	1
Robin	2	1
Hermit Thrush	2	2
Whiskered Owl	1	0
Rivoli's Hummingbird	1	0
Blue-grey Gnatcatcher	1	0
Western Tanager	1	3
Mountain Chickadee	1	0
Arizona Woodpecker	4	0
Grace's Warbler	2	3
Flamulated Owl	1	0
Eared Trogon	1	1

What Kind of Wildlife Did You See?--Continued

<u>Type</u>	<u>With Information</u>	<u>Without Information</u>
Specific:		
Canyon Wren	1	1
Scott's Oriole	1	1
Black-chinned Hummingbird	1	0
Mexican Jay	1	1
Tanagers	0	2
Whip-poor-will	0	1
Majority of local wildlife	1	0
Everything	1	0
Jays	0	2
Bushtit	0	1
Hutton's Vireo	0	1
Olivaceous Flycatcher	0	1
Western Flycatcher	0	1
Rufous-sided Tohee	0	1
Flycatchers	0	1
Western Kingbird	0	1
Red-faced Warbler	0	1
Flicker	0	1
Turkey	0	1
Bears	5	1
Black Bear	2	3
Deer	15	16
Whitetail Deer	7	5
Fox	1	0
Bat	1	0
Chipmunks	1	2
Mountain Lion	1	1
Mouse	1	0
Mole	1	0
Rabbits	1	1
Raccoons	1	1
Ringtail Cats	1	0
Rock Squirrel	3	0
Rodents	1	0
Golden-mantled Ground Squirrel	0	1
Cows	0	1
Grey Squirrel	0	1
Arizona Plateau Lizard	1	0
Black-trailed Rattlesnake	0	1
Diamond-back Rattlesnake	0	1
Gopher Snake	1	0

What Kind of Wildlife Did You See?--Continued

<u>Type</u>	<u>With Information</u>	<u>Without Information</u>
Specific:		
Lizards	30	20
Snails	1	0
Snakes	1	1
Spiny Lizards	3	0
Toad	1	0
Water Snake	1	0
Yarrow's Spiny Lizard	1	0
Ants	1	0
Bugs	1	0
Butterflies	7	5
Flies	2	0
Hawk Moth	1	0
Insects	1	1
Scarab Beetle	1	1
Swallow-tail Butterfly	0	1
Water Bugs	1	0
Worms	0	1
Total number of responses	217	181
Total number of wildlife types listed	71	59

Seen Any Mexican Wildlife Here?

<u>Type</u>	<u>With Information</u>	<u>Without Information</u>
Trogon	27	21
Coatimundi	5	3
Javelina	4	1
Apache Fox Squirrel	1	0
Blue-throated Hummingbird	3	2
Squirrel	1	1
Hummingbirds	0	1
Brown-throated Wren	1	0
Band-tailed Pigeon	1	0
Bear	1	0
Black-headed Grosbeak	0	1
Bridled Titmouse	1	1
Hepatic Tanager	1	0
Herps	1	0
Lizards	1	0
Mexican Chickadee	1	2
Mexican Jays	5	4
Mexican Junco	2	1
Most of the animals are	0	1
Painted Redstart	2	1
Other birds	3	1
Rivoli's Hummingbird	1	0
Snakes	0	1
Sulpher-bellied Flycatcher	2	2
Violet-crowned Hummingbird	1	0
Yarrow's Spiny Lizard	1	0
Total different animals listed	66	14
Total responses	66	43
Number animals listed per yes response	1.83 (66/36)	1.39 (43/31)

Seen Any Rare Wildlife Here?

	<u>With Information</u>	<u>Without Information</u>
Yes	24	29
No	39	32
Did not see any rare wildlife	1	1

Type:

Trogon	16	20
Blue-throated Hummingbird	1	0
Apache FoxSquirrel	1	1
Fox Squirrel	1	3
Chiricahua Red Squirrel	1	0
Banded Rock Rattlesnake	2	1
Twin-spotted Rattlesnake	0	1
Alligator Lizard	1	0
Arizona Woodpecker	1	2
Black-headed Grosbeak	1	0
Bridled Titmouse	1	0
Chipping Sparrow	0	1
Green Rat snake	0	1
Green Toad	1	0
Hooknose Snake	1	0
Mexican Chickadee	1	0
Mexican Jay	0	1
Mountain King Snake	1	1
Nutchatch	1	0
Painted Redstart	1	0
Ringtailed Cat	2	0
Snail	1	0
Striped Plateau Lizard	0	1
Sulpher-bellied Flycatcher	1	1
Violet-crowned Hummingbird	1	0
Weid's Crested Flycatcher	1	0
Total different animals listed	19	11
Total responses	38	34
Number listed per yes response	1.58	1.17
	(38/24)	(34/29)

Know Any Rules of Etiquette?

	<u>With Information</u>	<u>Without Information</u>
Yes	63	55
No	1	7

What?

Be quiet	32	30
Don't bother nests	13	9
Don't hassle animals	8	9
Disturb animals as little as possible	7	1
Don't use tape recorders	6	4
Don't get too close to animals	6	7
Don't throw rocks	4	4
Clean up after yourself	3	0
Leave if animal shows stress	3	2
Don't run	3	0
Sit still	3	1
Don't chase animals	3	1
Don't remove vegetation	3	0
Drive slowly	2	0
Don't kill animals	2	0
Don't bother anything	2	0
Give larger animals right of way	2	0
Stay on trail	2	1
Respect animals	2	1
Share findings with other birders	2	1
Make lists of birds seen	1	0
Only look, don't touch	1	0
Don't yell	1	1
Don't grab snakes	1	0
Collect for research only	1	0
Don't cause nest failures	1	0
Don't let it kill you	1	0
Don't handle young	1	0
Go out at dusk and dawn	1	0
Use common sense	1	2
Don't be conspicuous	1	0
Use long lenses on cameras	1	0
Don't be aggressive	1	0
Replace things when removed	1	0
Walk softly	1	0
Don't use strobe	1	0
Photograph from a distance	1	1
Don't climb nest trees	1	0

Know Any Rules of Etiquette?--Continued

	<u>With Information</u>	<u>Without Information</u>
What?		
Don't tell about rare findings	1	0
Don't feed animals	1	1
No dogs	1	1
Don't rustle trees or shake branches	1	1
Travel in small groups	1	0
Don't walk in front of other birders	1	0
Don't disturb the habitat	1	0
Don't litter	0	1
No recorded Trogon calls	0	1
Take only photos, leave nothing	0	1
Be conscious of ecology	0	1
Use binoculars	0	1
Just watch animals	0	1
Don't kill snakes	0	1
Don't handle nests	0	1
Don't collect wildlife	1	1
Be courteous	0	1
Get as close to animals as possible	0	1
Keep dogs on a leash	0	1
Don't disturb animals that are eating	0	1
Use minimal harassment	0	1
Share spotting scopes	0	1
Total responses	134	103
Number of different responses	46	55
Number answers given per yes reponse	2.13 (134/63)	1.87 (103/55)

Know Any Signals Disturbed Animals Use?

	<u>With Information</u>	<u>Without Information</u>
Yes	61	57
No	3	5

What?

Alarm calls	21	35
Bird alarm calls	14	9
Trogon alarm calls	5	1
Squirrel alarm calls	7	2
Flight	15	15
Deer flash tail	7	6
Agitated behavior	5	1
Rattlesnakes rattle	5	9
Birds decoy from nest	4	3
Raise tail	3	0
Birds scold	2	1
Pigs snort	2	0
Trogons raise tail	2	0
Paw and scratch ground	2	0
Birds fluff out feathers	1	2
Birds fly away	1	0
Coatis climb trees	1	0
Growls	1	1
Pigs stamp	1	0
Chip notes	1	0
Freeze position	1	0
Go into nest	1	0
Coati alarm calls	1	0
Deer run	1	1
Deer whistle	1	0
Birds raise crest	1	0
Snakes hiss	1	0
Javelinas put up back hair	1	1
Javelinas "dare" stance	1	0
Skunks raise tail	1	0
Stare	1	0
Release scent	1	0
Position	1	1
Bite you	1	1
Jump	1	0
Ears move	1	2
Bare teeth	1	0
Aggressive behavior	1	0
Bears run away	1	0

Know Any Signals Disturbed Animals User?--Continued

	<u>With</u> <u>Information</u>	<u>Without</u> <u>Information</u>
What?		
Hawks attack	1	0
Chipmunks chatter	1	0
Herps leave	1	1
Skunks spray	0	2
Wiggle tail	0	2
Raise hair	0	1
Coatis run	0	1
Redstarts display tail	0	1
Deer snort	0	1
Deer stamp	0	1
Look alert	0	2
Lizards bob	0	1
Look around	0	1
Total responses	122	105
Total different responses	42	28
Number responses per yes answer	2.0 (122/61)	1.84 (105/57)

Seen Any Human Activities Disturbing Wildlife?

	<u>With Information</u>	<u>Without Information</u>
Yes	27	8
No	37	54

What?

Noisy kids	9	1
Dogs	4	0
Barking dogs	3	0
Cars	3	0
Large numbers of people	2	2
Any human presence disturbs animals	2	0
Swimming near nest	2	0
Catching lizards	2	0
Birders harassing nest	1	0
Fence	1	0
Loud voices	1	0
Trumpets	1	0
Loud music	1	0
Photographing Trogon nest	1	0
Motorcycles	1	0
Shooting	1	0
Researchers	1	0
Loud noises	1	3
Generator on Forest Service pumper truck	1	0
Photographer climbing nest trees	1	0
Jets	0	1
Cat	0	1
Birders	0	1
Total responses	40	9
Number different responses	20	6
Number responses per yes answer	1.48 (40/27)	1.13 (9/8)

Did Your Own Activities Disturb Wildlife?

	<u>With Information</u>	<u>Without Information</u>
Yes	30	20
No	34	42
How?		
Any human presence does	17	13
Kids noisy	4	0
Scared off Trogon	3	0
Dogs	1	0
Deer ran off	1	0
Trumpet	1	0
Getting close to nests	1	0
Snail collecting	1	0
Black lighting changes insect behavior	1	0
Walking trails disturbs animals	1	0
Backed car into tree	1	0
Noise	1	0
Camping a minimal impact	0	1
Kept birds off nest	0	1
Upset lizards	0	1
Birds use energy to respond to your presence	0	1
Momentarily	0	1
Not much	0	1
Maybe	0	1
 Total responses	 33	 20
Number different responses	12	8
Number responses per yes answer	1.1 (33/30)	1.0 (20/20)

If South Fork Road Was Closed, What Would You Do?

	<u>With Information</u>	<u>Without Information</u>
Camp elsewhere in canyon, hike to S.F. on day trips	34	35
Camp elsewhere in canyon, not visit S.F.	8	3
Come to canyon on day trips, hike to S.F.	1	4
Come to canyon on day trips, not visit S.F.	2	3
Camp elsewhere in Chiricahuas, not visit Cave Creek	1	0
Not visit Chiricahuas	4	4
Other:		
Pack into S.F.	16	10
Stay at cabins, day hike to S.F.	1	1
Stay at Research Station, not visit S.F.	0	1
Stay at cabins, not visit S.F.	0	1
Don't know	0	1

Education

<u>Highest Grade Completed</u>	<u>With Information</u>	<u>Without Information</u>
High School:	1	0
10	1	0
11	0	0
12	4	4
College (Years of):		
1	5	3
2	6	4
3	5	2
4	9	17
5	7	7
6	12	11
7	6	4
8	4	4
+	5	6

QUESTIONS TO EXPOSED SAMPLE ONLY

Did You Notice the Sign?

Yes	46
No	18

Did You Read the Sign?

Yes	41
No	23

Do You Remember Anything It Said?

Yes	33
No	8

What?

There are Mexican wildlife in this area	17
Don't disturb Mexican wildlife	4
Mexican visitors	2
Visitors urged to take care	2
Mexican wildlife comes here because it is close to the border	2
Animals found here are more common in Mexico	2
Unique species here	1
This is the northern range for Mexican wildlife	1
Rare species are in this area	1
Many birds here are more common in Mexico	1
Human activities disturb wildlife	1
Rare Mexican animals are here	1
Don't frighten wildlife	1
It was about wildlife in this area	1
Mexican wildlife is unique to the Southwest	1
Enjoy the wildlife	1
Keep away from the animals	1
No tape recorders allowed	1
It was about wildlife	1
Be careful with the wildlife	1
Mexican mammals here	1
Title of sign attracted interest	1

Did You See the Leaflet?

Yes	39
No	25

Did You Read the Leaflet?

Yes	33
No	6

Do You Remember Anything It Said?

Yes	28
No	5

What?

There are Trogons here	10
There are endangered rattlesnakes here	7
There are coatis here	6
There are javelina here	3
There are squirrels here	3
There are blue-throated hummingbirds here	2
Javelinas eat dogs	2
It was about Mexican wildlife	2
It was about the animals that live here	1
It was about the rare birds here	1
It was about coati activities	1
It told about coati activities	1
Coatis are Mexican	1
It gave Apache Fox squirrel information	1
The mountains provide a bridge for wildlife	1
Coatis are more gregarious than javelina	1
Rattlesnakes are pit vipers	1
It told about Fox squirrel nests	1
It recommended not using tape recorders	1
It told about mammals, birds and reptiles of this area	1
It told about food habits of animals	1
There is an endemic red squirrel here	1
Javelinas eat dogs and cats	1
Trogons flash their tails when alarmed	1
It told about alarm behaviors	1
Trogons use an alarm call	1
Don't scare animals	1
Mexican wildlife are here because it is close to the border	1
Don't disturb Mexican wildlife	1
Move away from animals if you see or hear a distress signal	1
It had nice pictures of wildlife	1
I didn't read the rules	1
I read it last year	1

What Did You Do With the Leaflet?

Put it back in the box	8
Saved it	29
Discarded it	1
Mailed it to a relative	1
Saw it last year	1

Did You Learn Anything from the Leaflet or Sign?

Yes	27
No	19

What?

There are protected rattlesnakes in this area	6
What a Trogon looks like	2
Javelinas eat dogs and cats	2
About fox squirrels	2
Coatis are Mexican	2
About birds, squirrel, and javelina being local to the area	1
About rattlesnakes	1
What Trogons eat	1
Twin-spotted rattlesnake found here	1
Trogons rare in the U.S.	1
About coati behavior	1
Refinements of facts I already knew	1
Javelinas travel in packs of 2-5	1
About animals from Mexico	1
Birds here are native to Mexico	1
Blue-throated hummingbird found here	1
How to find a fox squirrel	1
About animals indigenous to this area	1
About Trogons	
Trogons live in cavities	1
Blue-throated hummingbirds are on the Threatened and Unique Species List	1
What noise hummingbirds make when agitated	1
Mexican wildlife is here because it is close to the border	1
What a Trogon alarm call sounds like	1
Tropical plants are found here	1
About birds in the area	1
What a coati is	1
Javelina and coatis are here	1

Did the Sign or Leaflet Affect Your Behavior?

Yes	10
No	36

How?

Made me more aware of the animals	3
Made me more cautious	2
Made me scared of the rattlesnakes	1
I watched more for Trogons	1
It encouraged me to be quieter	1
I looked more for animals	1
I didn't play tapes of bird calls	1
I understood birders better	1
It made me more aware of birds	1

Any Other Comments?

Keep the area open and police it	1
There is enough room here for people and animals	1
The sign is a good reminder	1
This is my favorite birding spot in the entire country	1
I have been to this area before	1
I would have followed the leaflet suggestions anyway	1
The sign needs to be more clear	1
I hope everyone reads the sign	1
Keep the area like it is	1
I have read the sign before--it has a map on it	1
I read about Cave creek in <u>Playboy</u> magazine	1
There needs to be more signs cautioning people about the wildlife	1
Use reservations to restrict the numbers of people in this area	1
Use international picture signs to restrict activities	1

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