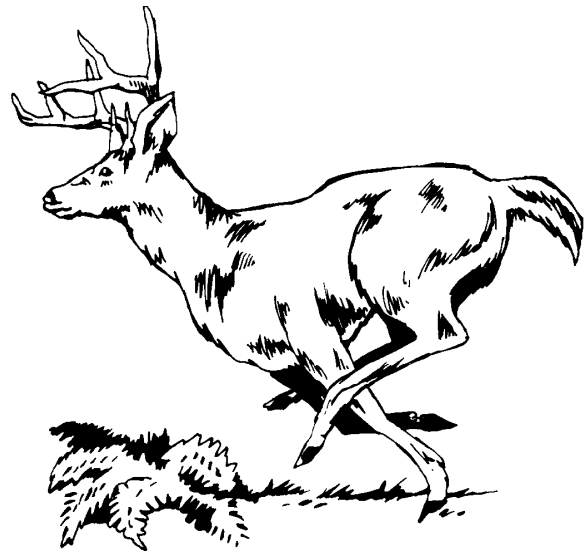


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# Tailoring Communication about Suburban Deer Management to Stakeholders' Concerns



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## **HUMAN DIMENSIONS RESEARCH UNIT PUBLICATION SERIES**

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## EXECUTIVE SUMMARY

Suburban deer management is both challenging and controversial. Hunting has proven impractical or unacceptable in many suburban areas. A variety of nontraditional methods for managing deer have been proposed instead of hunting. Among these techniques, deer contraception has received considerable attention.

The viability of contraception, however, is open to question. Consequently, agencies may want to disseminate accurate information about contraception and other management alternatives to inform public deliberation. We evaluated strategies for agency communication about suburban deer management. In particular, we investigated the effects of communicating different types of information.

Lauber and Knuth (1998) showed that suburban residents decide what deer management strategies to support on the basis of different criteria. We hypothesized that people would be most interested in information about the particular criteria they found important. We conducted research in Irondequoit, New York, the site of several past studies on attitudes toward suburban deer management. In our most recent study (Lauber and Knuth 1998), we measured citizens' attitudes toward and beliefs about different management techniques.

We used the results of this past study and our present study to test the following hypotheses:

- communication is most likely to influence attitudes about deer management techniques if it addresses the concerns which people think are most important;
- communication about the uncertainties of contraception will decrease acceptance of contraception; and
- previously unimportant concerns will increase in importance if people receive information which addresses those concerns.

We also explored whether and how attitudes and beliefs had changed since 1997.

### Methods

We conducted our research through two mail surveys. The first survey (Lauber and Knuth 1998) provided pre-test measurements of Irondequoit residents' attitudes, perceptions, and beliefs. The second survey provided post-test measurements.

The first survey was conducted in January 1997, and the second in September 1998. Both targeted residents of Irondequoit, New York. The first survey was timed to coincide with the initiation of a research effort to explore the efficacy of immunocontraception in the town. It also coincided approximately with the initiation of an annual bow hunt and the continued implementation of a selective culling program (which had been operative for several years).

A sample of 1,494 Irondequoit residents was randomly selected from telephone directory listings for the first survey. The sample was drawn from two strata: high deer density areas and low deer density areas. For the first survey, we achieved a 67.9% response rate in high deer density areas and a 55.3% response rate in low deer density areas.

Based on results of this survey we characterized respondents by how important it was to them that a management technique be: (1) effective; and (2) humane. We formed 12 strata from the cross-classification of respondents according to their perceptions of the importance of these two criteria. Within each stratum, we randomly assigned individuals to 3 experimental groups for the second survey:

- one would receive information about the effectiveness of contraception along with their second questionnaire;
- one would receive information about the humaneness of contraception along with their second questionnaire; and
- one would receive no contraception information along with their second questionnaire.

We were able to classify 784 respondents to the first mail survey according to this system. These respondents served as our experimental sample for our second survey. The second survey was implemented beginning in mid-September 1998 following the same procedures used in the implementation of the first survey.

We conducted two sets of analyses to:

- evaluate changes in attitudes, perceptions, and beliefs between 1998 and 1997; and
- assess the impacts of different types of information on attitudes, perceptions, and beliefs.

In assessing the impacts of different types of information on respondents, we were interested in determining whether: (1) effectiveness and/or humaneness information had an influence on respondents; and (2) whether that influence was moderated by the importance respondents place on effectiveness or humaneness. The dependent variable, therefore, was always a post-test measurement of respondents' attitudes, perceptions, or beliefs.

We used a general linear model or a logistic regression model (depending on whether the dependent variable was continuous or dichotomous categorical) to predict the dependent variables using both categorical and continuous predictor variables.

## **Results**

The response rate to the second mail survey was 65.3%. Respondents were more interested in and affected by deer than nonrespondents.

We found significant changes in the acceptability of several management techniques between 1997 and 1998.

- In high deer density areas, the acceptability of 5 nonreduction methods had increased: feeding deer in the winter, promoting the use of repellents, putting up deer-crossing signs, promoting the use of plants that deer dislike, and using roadside reflectors to keep deer away from roads.
- In low deer density areas, the acceptability of 3 nonreduction methods had increased: putting up deer-crossing signs, letting nature take its course, and promoting the use of plants that deer dislike.
- In low deer density areas, the acceptability of bow hunting had increased and the acceptability of contraception and trapping deer and transferring them to another natural area had decreased.

We asked respondents which one technique they believed was most appropriate and which one was least appropriate for Irondequoit.

- In both high and low deer density areas, the percentage of respondents choosing a nonreduction technique as most appropriate increased from 1997 to 1998, although a plurality still favored lethal methods each year.
- In low deer density areas, lethal methods were more likely in 1998 than in 1997 to be viewed as most appropriate and contraception was less likely to be viewed as most appropriate.

In 1998, respondents were more likely to respond to belief questions about contraception. In low deer density areas, we detected several changes in beliefs about contraception between 1997 and 1998. Respondents were less likely to believe:

- the deer population would become smaller if contraception were used in Irondequoit;
- contraception can prevent the growth of deer populations in natural settings; and
- most citizens in Irondequoit would support the use of deer contraception to manage deer.

Respondents were more likely to believe:

- contraception requires a lot of labor to carry out.

Taken together, these results imply a more cautious view about the capability of contraception to manage deer for a reasonable cost.

Receiving either humaneness or effectiveness information about contraception made it less likely that people would view contraception as the "most appropriate" management option. The impact of humaneness information varied; it had a larger effect on people who considered contraception as most appropriate in 1997. This differential effect may be attributable to the fact that the humaneness of contraception is one of its attractive characteristics. Those who viewed contraception as most appropriate in 1997 may have been influenced by its perceived humaneness. Receiving information that raised questions about the humaneness of contraception, therefore, had a larger impact on these individuals than on others.

We also tested whether information made it more likely for people to change their opinions about contraception. People who received humaneness information were more likely than others to change their opinion about contraception, but only if they thought humaneness was an important consideration in deer management. This finding supports a central hypothesis underlying this study – that information is more likely to influence people's attitudes about deer management if it addresses the kinds of concerns that they think are important.

We also tested the hypothesis that people who receive information addressing a particular concern will have that concern increase in importance. Effectiveness information did increase the importance of effectiveness to people, but only for those for whom effectiveness was not already an important concern. This result suggests that agency communication can indeed raise the stature of certain concerns in the eyes of the public.

### **Management and Research Implications**

These findings have important implications for the management of deer in Irondequoit and the management of natural resources, in general.

- Residents' attitudes toward management techniques are not fixed. As attitudes change, some techniques will become more feasible and others less feasible.
- Communication can influence attitudes. Management agencies, therefore, do not have to respond to the human dimension of management as an exogenous variable over which they have no control. They can play an active role in managing the human dimension of suburban wildlife conflicts through communication.
- Understanding the public's concerns about deer management can lead to more effective and influential communication. Determining what public concerns are and distributing information about those concerns is most likely to influence public perceptions of deer management techniques. The content of BOW deer management communication should be examined to determine whether it addresses the important concerns held by interested stakeholders.
- In many cases, managers will not have the detailed background information on the variety of citizens' concerns that was available in Irondequoit. Therefore, agencies will need to make systematic efforts to identify and characterize these concerns before developing key messages to be communicated to the public.
- It also may be important to communicate about concerns that citizens do not think are important initially because information can increase the perceived importance of these concerns.

Suggestions for future research include:

- Explore the longevity of the impacts of information on attitudes. Given that our experimental intervention and post-test assessment were paired, the effects of information may have been particularly strong.
- Use qualitative methods to help us understand how and why respondents' attitudes changed. In-depth interviews would help us determine: (1) why citizens' attitudes toward management techniques changed; and (2) why communication influenced attitudes. This understanding could lead to suggestions of ways to tailor information more closely to agency objectives.
- Explore the impacts of tailoring information to stakeholders' interests in actual communication campaigns (rather than a mail survey, as in this case). Such research would help us to determine whether the effects we observed in a contrived experiment would also occur in response to an actual communication campaign.

## TABLE OF CONTENTS

Executive Summary .....	i
Table of Contents .....	vi
List of Tables .....	vii
List of figures .....	viii
Background .....	1
Methods.....	4
Survey Development and Implementation.....	4
Analysis.....	6
Evaluating Changes Between 1997 and 1998.....	6
Impacts of Information.....	7
Results and Discussion .....	8
Comparison of Respondents and Nonrespondents .....	8
Evaluating Changes between 1997 and 1998 .....	10
Acceptability of Management Techniques.....	10
Appropriateness of Management Techniques.....	12
Evaluation Criteria .....	14
Trust in Information Sources .....	14
Beliefs about Contraception.....	14
Impacts of Information.....	25
Acceptability of Contraception .....	25
Acceptability of Other Management Strategies .....	26
Continuous Variables:.....	29
Continuous Variables:.....	30
Appropriateness of Contraception .....	36
Importance of Different Criteria .....	43
Conclusions and Implications .....	49
Management Implications.....	49
Research Implications .....	50
Literature Cited .....	52
Appendix A: Second Mail Survey Instrument.....	53
Appendix B: Effectiveness and Humaneness Information .....	60
Effectiveness Information.....	61
Humaneness Information .....	62
Appendix C: Explanation of Tables.....	63



## LIST OF TABLES

Table 1. Mean strength of deer-related concerns of respondents and nonrespondents.....	9
Table 2. Acceptability of deer management techniques to respondents in 1997 and 1998. ....	11
Table 3. Percent of respondents choosing categories of technique as "most appropriate" in 1997 and 1998.....	13
Table 4. Percent of respondents choosing categories of technique as "least appropriate" in 1997 and 1998.....	13
Table 5. Importance of criteria for evaluating deer management strategies to respondents in 1997 and 1998.....	15
Table 6. Respondents' trust in sources of information about deer management in 1997 and 1998. .....	16
Table 7. Agreement or disagreement of respondents with statements about the effectiveness of contraception.....	17
Table 8. Agreement or disagreement of respondents with statements about the speed with which contraception would work.....	19
Table 9. Agreement or disagreement of respondents with statements about the cost of contraception.....	20
Table 10. Agreement or disagreement of respondents with statements about the safety of contraception.....	21
Table 11. Agreement or disagreement of respondents with statements about the disruptiveness of contraception.....	22
Table 12. Agreement or disagreement of respondents with statements about the humaneness of contraception.....	23
Table 13. Agreement or disagreement of respondents with other belief statements about contraception.....	24
Table 14. General linear model predicting the acceptability in 1998 of promoting the use of fences to keep deer away from property. ....	27
Table 15. General linear model predicting the acceptability in 1998 of educating drivers to avoid deer on the road.....	27
Table 16. General linear model predicting the acceptability in 1998 of promoting the use of plants that deer are less likely to eat.....	28
Table 17. General linear model predicting the acceptability in 1998 of promoting the use of deer whistles on cars to keep deer out of roadways.....	29
Table 18. General linear model predicting the acceptability in 1998 of using road-side reflectors to keep deer away from the road at night.....	30
Table 19. Logistic regression model predicting the probability of calling contraception "most appropriate" in 1998.....	40
Table 20. Logistic regression model predicting the probability of respondents changing their opinion about the appropriateness of contraception between 1997 and 1998. ....	44
Table 21. General linear model predicting the importance of effectiveness in 1998.....	46

## LIST OF FIGURES

Figure 1. Impact of "humaneness of contraception" information on the acceptability of promoting the use of fences to keep deer away from property. ....	31
Figure 2. Impact of "humaneness of contraception" information on the acceptability of educating drivers to avoid deer on the road.....	32
Figure 3. Impact of "humaneness of contraception" information on the acceptability of promoting the use of plants that deer are less likely to eat.....	33
Figure 4. Impact of "humaneness of contraception" information on the acceptability of promoting the use of deer whistles on cars to keep deer out of roadways.....	34
Figure 5. Impact of "humaneness of contraception" information on the acceptability of using road-side reflectors to keep deer away from the road at night.....	35
Figure 6. Impact of "effectiveness of contraception" information on the acceptability of promoting the use of deer whistles on cars to keep deer out of roadways.....	37
Figure 7. Impact of "effectiveness of contraception" information on the acceptability of using road-side reflectors to keep deer away from the road at night.....	38
Figure 8. Impact of contraception information on the appropriateness of contraception for respondents who did not view contraception as most appropriate in 1997.....	41
Figure 9. Impact of contraception information on the appropriateness of contraception for respondents who viewed contraception as most appropriate in 1997.....	42
Figure 10. Impact of "humaneness of contraception" information on probability of respondents changing their opinion about the appropriateness of contraception.....	45
Figure 11. Impact of "effectiveness of contraception" information on perceived importance of effectiveness.....	47
Figure 12. Impact of "humaneness of contraception" information on perceived importance of effectiveness.....	48

## BACKGROUND

Suburban deer management is both challenging and controversial. Deer populations may grow to be quite large in suburban areas, which often combine good quality deer habitat with adequate food supplies. Recreational hunting, managers' primary tool for controlling deer herds, may not be practical in suburban areas, however. A lack of public support for hunting, the fragmentation of land ownership into multiple parcels, and a lack of cooperation between the different levels of government that must work together in suburban areas can pose barriers to hunting. For these reasons, a variety of nontraditional methods for managing deer have been proposed or used in suburban areas, including selective culling, trapping deer and transferring them to other areas, trapping and euthanizing deer, and contraception. Any methods which involve killing deer, however, are often opposed by some citizens.

Because of the controversial nature of lethal management methods, contraception has been the focus of particular attention as a management tool. Some citizens view contraception as an effective and humane management alternative (Kilpatrick and Walter, 1997; Stout et al., 1997; Lauber and Knuth, 1998). Various forms of contraception exist. Immunocontraception is one of the most promising (Muller et al., 1997). Immunocontraceptive drugs stimulate the immune systems of deer to produce antibodies to their own reproductive hormones or protein. These drugs have been shown to be highly effective at preventing reproduction in captive deer.

The viability of contraception as a management tool is open to question, however (Muller et al., 1997). For contraception to be effective, each deer must receive multiple doses of contraceptive drugs. Repeatedly administering drugs to the same deer in a free-roaming population has not yet been shown to be feasible. Questions also remain about whether immunocontraception has any negative physiological or behavioral effects on deer.

Contraception is a social as well as a biological challenge. In most suburban areas, deer contraception has both supporters and opponents, and many of these citizens are active politically. Although some research has been done on citizens' attitudes toward contraception (Lauber and Knuth 1998), much is not understood about these attitudes. One important question for managers is whether attitudes toward contraception are stable or whether they change with time, information, and/or experience.

It is difficult for management agencies to make decisions about suburban deer management in this type of social environment. Agencies try to be responsive to the public, but also want to base their decisions on viewpoints that are thoroughly considered and rooted in sound information. Members of the public may not be aware of the limitations of novel management techniques, such as contraception.

Attempts to inform the public about suburban deer management, therefore, are often a critical part of agencies' management activities. However, relatively little is known about how communication influences public attitudes toward deer management. Does communication change attitudes toward deer management? Are all citizens likely to be influenced by the communication of the same messages? We used this study to explore appropriate strategies for

effective agency communication about suburban deer management. In particular, we investigated the impacts of communicating different types of information about deer management to the public.

Lauber and Knuth (1998) showed that suburban residents make decisions about what deer management strategies to support on the basis of different criteria. Some rely primarily on considerations such as how effective strategies are for reducing the deer population, how quickly they will have an impact, how much they cost, and whether they will protect human safety. Others think additional considerations are important, too, including whether deer are treated humanely, how disruptive different strategies are to the community, and the effects of these strategies on nontarget wildlife and pets.

Given our awareness of these differences, we questioned how citizens would respond if agency communication about deer management did or did not address their own most important concerns. We hypothesized that citizens were more likely to be influenced by agency communication if it addressed their concerns. If true, this result would have important implications for how management agencies communicate with the public as well as implications for understanding what the concerns are.

Other researchers have shown that both the nature of messages communicated to the public and the characteristics of stakeholders can indeed have a significant impact on stakeholders' attitudes toward environmental management options. Vining (1987) demonstrated that very subtle differences in the information presented to people can result in different opinions expressed about how to address resource management problems. Reiling et al. (1988) concluded that communication can influence attitudes toward resource management policies, but showed that the same information can affect different stakeholders differently.

More recent work has explored the impacts of balanced, two-sided information on attitudes toward management strategies. This work is based on the belief that trying to persuade the public of the merits of a particular management option may not always be appropriate for a public agency. Rather, Bright and Manfredi (1997) argued that in some cases it was more appropriate for agencies to communicate both the advantages and disadvantages of different management options.

McComas and Scherer (1999) explored how balanced information influenced opinions expressed on surveys about waste management strategies. People who received balanced information expressed opinions that were more certain and more positive toward management options than people who received no information. Balanced information had a greater impact on those whose opinions were weakly held.

Bright and Manfredi (1997) concluded that balanced, two-sided information influenced the extremity, but not the direction, of attitudes toward forest management alternatives. They also found that these effects were mediated by the personal relevance that forest management issues had for respondents. People for whom forest management issues were of great personal relevance responded differently than people for whom these issues were of little relevance.

Bright and Manfreda (1997) hypothesized that people pay more attention to information if an issue is relevant to them, and that this influences their response to the information.

In this study, we were also interested in how perceived relevance influenced people's response to information, but we focused on a different kind of relevance. Rather than focusing on the relevance of an issue to people, we focused on the relevance the type of information presented about that issue. Given that people had different types of concerns about deer management, it followed that they would find different kinds of information about management relevant. We hypothesized that people would respond to information differently if it was more relevant to their particular concerns.

Another effect of communicating about different concerns to people is that for some, the relevance of these concerns could increase. In other words, if a concern was not initially important to a person, receiving information about that concern could cause it to increase in importance. Indeed, Kasper et al. (1988) reported that communication can make people aware of risks and increase their concerns about those risks.

We explored these questions through a study set in Irondequoit, New York, where we have conducted a series of studies on public attitudes toward suburban deer management in the past. In our most recent previous study in 1997 (Lauber and Knuth 1998), we used a mail survey to measure:

- citizens' attitudes toward different deer management techniques;
- their beliefs about contraception; and
- their perceptions of the trustworthiness of government agencies and nongovernmental organizations involved with deer management in Irondequoit.

In our current study, we conducted a second mail survey and utilized the results of this past one to:

- explore how citizens' attitudes, beliefs, and perceptions related to suburban deer management had changed since 1997; and
- test how the communication of different key messages influences these attitudes, beliefs, and perceptions, including whether
  - communication which focuses on an individual's concerns is more likely to influence that individual's attitudes toward contraception and other management techniques;
  - communication which describes the uncertainties about contraception leads to a less favorable view of contraception; and
  - communication which focuses on concerns that are not important to individuals will cause those concerns to increase in importance.

## METHODS

### Survey Development and Implementation

We conducted our research through two mail surveys. The first survey (Lauber and Knuth 1998) provided pre-test measurements of Irondequoit residents' attitudes, perceptions, and beliefs. The second survey (Appendix A) included a subset of questions from the original survey and provided post-test measurements. In conducting the second survey, we prepared 3 versions of the mail questionnaire. Two of these versions contained information about contraception on the first page (Appendix B), the distribution of which served as our experimental intervention. The third version contained no information and served as a control. Both versions containing information provided state of the art research-based information describing what was known and not known about contraception. These two versions provided information that focused on different types of concerns about deer management, however.

Items measured in both surveys were:

- perceptions of the acceptability of 17 different deer management methods;
- which one method each respondent believed was "most appropriate" and "least appropriate" for Irondequoit;
- perceptions of the importance of different criteria for evaluating deer management options;
- beliefs about contraception; and
- trust in various sources of information about deer management.

The first survey was conducted in January 1997. The second was conducted in September 1998. Both targeted residents of Irondequoit, New York, where the management of a large suburban deer herd has been an important concern for many years. The first survey was timed to coincide with the initiation of a research effort to explore the efficacy of immunocontraception in the town. It also coincided approximately with the initiation of an annual bow hunt and the continued implementation of a selective culling program (which had been operative for several years).

A sample of 1,494 Irondequoit residents was randomly selected from telephone directory listings for the first survey. Survey Sampling, Inc. provided the sample. The sample was drawn from two strata. Some 602 names were drawn from parts of the town that had been identified as having high densities of deer, and 892 names were drawn from parts of the town that had been identified as having low densities of deer.

We followed Dillman's (1978) and Brown et al.'s (1989) methods for implementing mail surveys. Questionnaires were sent out early in January 1997. A series of up to 3 reminder letters were sent to people who did not return their questionnaires; the second reminder letter was accompanied by an additional copy of the questionnaire. The response rate from residents in high deer density areas was 67.9%. The response rate from residents in low deer density areas was 55.3%.

The first survey provided us with: (1) a pre-test measurement of Irondequoit residents' attitudes, perceptions, and beliefs; and (2) the ability to categorize respondents according to the types of concerns they had about deer management. With regard to this second point, we categorized each respondent according to how important it was to them that a management technique be:

- effective; and
- humane.

This categorization was based on two scales, each formed by taking the mean response to several survey questions. The effectiveness scale was composed of the questions: "How important is to you that a deer management method in Irondequoit . . .

- is effective at reducing deer-related problems?
- is effective at reducing the deer population?
- has been proven to work in similar situations?

The humaneness scale was composed of the questions: "How important is it to you that a deer management method in Irondequoit . . .

- minimizes the suffering of deer?
- minimizes harmful side effects on deer?
- maintains a healthy deer population?

These two scales represented criteria that many people in Irondequoit used to evaluate deer management options. Perceptions of the importance of these criteria were not strongly correlated; people who found one of these criteria important did not necessarily find the other one important.

We classified people according to these criteria in the design of our second survey. We formed 12 strata from the cross-classification of respondents according to their answers to these scales. Within each stratum, we randomly assigned people to 3 experimental groups:

- one which would receive information about the effectiveness of contraception along with their second questionnaire;
- one which would receive information about the humaneness of contraception along with their second questionnaire; and
- one which would receive no information along with their second questionnaire.

We were able to classify 784 respondents to the first mail survey according to this system. These respondents served as our experimental sample for our second survey. This design ensured that people with varying degrees of concern about the effectiveness of contraception would receive information about its effectiveness. The same was true for those with varying degrees of concern about humaneness.

The second survey was implemented beginning in mid-September 1998 following the same procedures as were used in the implementation of the first survey. The second survey sample consisted of respondents to the first survey.

## **Analysis**

We conducted two sets of analyses, in order to:

- evaluate changes in attitudes, perceptions, and beliefs between 1989 and 1997; and
- assess the impacts of different types of information on attitudes, perceptions, and beliefs.

For some analyses in both sets, respondents were classified according to the type of technique they thought was most appropriate for Irondequoit. For these analyses, the 17 techniques from which respondents could choose among were grouped into five types about which perceptions were correlated:

- lethal methods (including using sharpshooters to kill deer at bait sites, bow hunting, and capturing and euthanizing deer);
- contraception;
- trap and transfer methods (in which deer would be transferred to either other natural areas or to a venison farm);
- nonreduction methods (methods that were not intended to reduce the deer population – including deterrents, education, supplemental feeding of deer, and taking no action); and
- the restoration of predators.

## **Evaluating Changes Between 1997 and 1998**

We had two choices about how to approach these analyses. We could:

- use all data from each survey to estimate the parameters of the entire Irondequoit population and compare these two sets of estimates; or
- compare changes in only those respondents who responded to both surveys without assuming that these respondents represented the entire Irondequoit population.

The first approach is only appropriate if the data collected in each survey represents the entire Irondequoit population or could be adjusted to be representative. We had assumed this was true of the data collected in our first mail survey, although we had evidence that respondents to that survey were more interested in and affected by deer than nonrespondents (Lauber and Knuth 1998). We hypothesized a second survey of the respondents to the first survey would lead to a group of respondents who were even more interested in and affected by the population. If this were the case, we would not want to compare estimates of population parameters based on all the data from both surveys because these data sets would be biased to different degrees. We



tested our hypothesis by comparing responses to our first mail survey from those who responded to both surveys (respondents) and those who responded only to the first survey (nonrespondents).

As reported in the Results section, not all of the differences between respondents and nonrespondents were large, but these differences show a consistent bias in our respondents toward those more interested in deer management and more concerned about the problems deer cause. To draw comparisons between 1997 and 1998, therefore, we did not use all of the people who responded to each survey, since these groups of people were not comparable. Rather we used only those people who responded to both of our mail surveys. Comparisons we make between 1997 and 1998 thus apply only to those most interested in and concerned about deer. Although this is a bias, we believe it still serves as a valuable indicator of trends in attitudes toward deer management within Irondequoit.

In testing for differences between 1997 and 1998, we first split respondents into those from high deer density areas and those from low deer density areas. We used paired t-tests to test for changes in responses to relevant questions.

### **Impacts of Information**

Our analyses of the impacts of distributing information about contraception to Irondequoit residents focused on two types of dependent variables: continuous variables and dichotomous categorical success/failure variables.

Continuous Variables. Continuous variables included those measured on 4- and 5-point scales. Perceptions of the acceptability of management techniques were measured on a 4-point scale ranging from 1 ("not at all acceptable") to 4 ("very acceptable"). The importance of criteria for judging management techniques was measured on a similar 4-point scale ranging from "not at all important" to "very important." Beliefs about contraception were measured on a 5-point scale; respondents were presented with statements about contraception and they could choose an answer between 1 ("strongly disagree") and 5 ("strongly agree"). Respondents' trust in sources of information about contraception were measured on a similar 5-point scale ranging from "strongly distrust" to "strongly trust."

In most statistical tests we conducted, we were interested in determining whether: (1) the receipt of effectiveness and/or humaneness information had an influence on respondents; and (2) whether that influence was moderated by the importance the respondents placed on effectiveness or humaneness in evaluating management options. The dependent variable, therefore, was always a post-test measurement of some respondents' attitudes, perceptions, or beliefs (e.g., the perceived acceptability of contraception). We used a general linear model to predict the dependent variables using both categorical and continuous predictor variables.

We included two categorical predictor variables in our analyses. These variables indicated whether or not respondents had received effectiveness information and whether or not they had received humaneness information. We also included two continuous predictor variables indicating the importance of effectiveness and the importance of humaneness to respondents as criteria for evaluating management options. We allowed for an interaction between the

information variables and the importance variables because these would tell us whether the impact of information was influenced by the importance of the considerations reflected in the information to respondents. Finally, we included pre-test measurements of the characteristic of respondents we were trying to predict as a control variable. On a few occasions, we included other terms in the models, and these are described separately for each analysis.

In constructing the models, we included all terms initially and deleted insignificant terms ( $P > 0.05$ ) one at a time. The final models, with insignificant terms deleted, are the ones we report. We made a few exceptions to this general approach. We included constants whether or not they were significant. If an interaction term was significant, we included both base terms that made up the interaction whether or not they were significant. On some occasions, nearly significant terms were included in the model.

Dichotomous Variables. We modeled two dichotomous variables that were success/failure variables: whether or not contraception was considered the most appropriate deer management option for Irondequoit in 1998; and whether opinions had changed about whether contraception was the most appropriate option between 1997 and 1998. Positive responses to either variable (i.e., the belief that contraception was most appropriate, or a change in opinion about contraception) were classified as "successes" and negative responses were classified as "failures." We used logistic regression to predict the probability of successes for each of these variables. The terms we included in the models and our approach to model construction paralleled our procedures for constructing general linear models.

## RESULTS AND DISCUSSION

### Comparison of Respondents and Nonrespondents

The response rate to the second mail survey was 65.3%. We found that respondents were not significantly more interested than nonrespondents in: (1) watching deer near their home; (2) photographing deer; (3) hunting deer; (4) feeding deer; or (5) seeing deer in Irondequoit.

According to a wide variety of other measures, however, our hypothesis that respondents were more interested in and affected by deer was supported. Respondents were significantly more likely than nonrespondents to have seen deer while on their property ( $\chi^2(1) = 9.18$ ,  $P = 0.002$ ). Some 82.8% of respondents had seen deer while on their property, compared to 74.4% of nonrespondents.

Respondents were also more concerned about a wide variety of deer-related problems (Table 1). The only problems respondents were not more concerned about were Lyme disease and deer approaching or threatening people. Respondents also were more likely to have experienced problems with deer ( $\chi^2(1) = 17.74$ ,  $P = 0.000$ ). While 62.7% of respondents reported problems with deer in the past 5 years, only 48.0% of nonrespondents did.

**Table 1.** Mean strength of deer-related concerns of respondents and nonrespondents.

Problem	Nonrespondents		Respondents	
	Mean Concern	SEM	Mean Concern	SEM
Deer-car accidents <sup>1</sup>	3.52	0.04	3.65	0.03
Damage to crops and fruit orchards <sup>1</sup>	2.94	0.06	3.10	0.05
Damage to vegetable gardens <sup>1</sup>	2.83	0.06	3.07	0.05
Damage to yard plantings <sup>1</sup>	2.90	0.06	3.14	0.05
Lyme disease	3.27	0.06	3.40	0.04
Damage to parks and natural areas <sup>1</sup>	2.80	0.06	3.01	0.05
Deer threatening people	2.57	0.07	2.51	0.06

<sup>1</sup>Means differ significantly,  $P < 0.05$ .

Respondents were more interested than nonrespondents in learning about deer management ( $t(696) = -4.20, P = 0.000$ ) and participating in deer management decisions ( $t(683) = -2.95, P = 0.000$ ) as measured on a scale of 1 to 4 on which 1 meant "not at all interested" and 4 meant "very interested." The mean interest of respondents in learning about deer management was 2.87 (SEM = 0.05), and the mean interest of nonrespondents was 2.53 (SEM = 0.06). The mean interest of respondents in participating in deer management decisions was 2.64 (SEM = 0.05), while the mean interest of nonrespondents was 2.39 (SEM = 0.07).

Respondents also wanted a larger deer population reduction, on average, than nonrespondents. On a 5-point scale on which a response of 1 indicated a preference for a large decrease in the population and a response of 5 indicated a preference for a large increase, the mean response of respondents was 1.72 (SEM = 0.04). The mean response of nonrespondents was significantly higher at 1.90 (SEM = 0.05) ( $t(742) = 2.86, P = 0.004$ ). The population reduction was also more important to respondents. On a scale of 1 to 4 on which 1 meant "not at all important" and 4 mean "very important," the population reduction was moderately important (mean = 3.11, SEM = 0.04) to respondents. It was significantly less important to nonrespondents (mean = 2.93, SEM = 0.06,  $t(728) = -2.59, P = 0.010$ ).

## **Evaluating Changes between 1997 and 1998**

### **Acceptability of Management Techniques**

We found significant changes in the acceptability of a number of management techniques between 1997 and 1998 (Table 2). In high deer density areas, the acceptability of 5 of the nonreduction methods had increased: feeding deer in the winter, promoting the use of repellents, putting up deer-crossing signs, promoting the use of plants that deer dislike, and using roadside reflectors to keep deer away from roads. In low deer density areas, the acceptability of 3 of the nonreduction methods had increased: putting up deer-crossing signs, letting nature take its course, and promoting the use of plants that deer dislike. The acceptability of bow hunting had increased and the acceptability of contraception and trapping deer and transferring them to another natural area had decreased in low deer density areas.

From this study, we are not able to ascertain the reasons for these changes. However, the increased acceptability of nonreduction techniques appears to be a general pattern in both low and high deer density areas. In fact, acceptability did not decrease, even insignificantly, for any of the nonreduction techniques. Various changes in Irondequoit could have led to these differences: (1) people could have experienced a reduction in deer-related problems; (2) people could have found alternative techniques less acceptable (such as contraception in low deer density areas); or (3) people could have more information about the effectiveness or other characteristics of these nonreduction techniques. The reasons for these differences will not be clear without further study.

**Table 2.** Acceptability of deer management techniques<sup>1</sup> to respondents in 1997 and 1998.

Technique	High Deer Density Areas				Low Deer Density Areas			
	January 1997		September 1998		January 1997		September 1998	
	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
<b>Lethal Techniques</b>								
Bow hunting	2.92	0.08	2.97	0.08	<b>2.66</b>	<b>0.09</b>	<b>2.83<sup>2</sup></b>	<b>0.09</b>
Bait and shoot	2.82	0.08	2.80	0.08	2.48	0.09	2.44	0.08
Drug, capture, and kill with lethal injection	2.07	0.08	1.94	0.07	1.61	0.07	1.61	0.07
Live trap and kill deer	2.03	0.08	1.91	0.08	1.62	0.07	1.67	0.07
<b>Contraception</b>								
	3.01	0.07	3.02	0.07	<b>3.29</b>	<b>0.08</b>	<b>3.03<sup>2</sup></b>	<b>0.08</b>
<b>Trap and Transfer Techniques</b>								
Trap and transfer to natural area	2.64	0.08	2.51	0.08	<b>2.91</b>	<b>0.08</b>	<b>2.76<sup>2</sup></b>	<b>0.08</b>
Trap and transfer to venison farm	2.41	0.08	2.40	0.08	2.47	0.09	2.42	0.08
<b>Nonreduction Techniques</b>								
Promote use of fences	2.40	0.08	2.46	0.08	2.67	0.08	2.77	0.09
Feed deer in winter	<b>1.86</b>	<b>0.07</b>	<b>2.05<sup>2</sup></b>	<b>0.08</b>	2.33	0.08	2.33	0.09
Promote use of repellents	<b>2.46</b>	<b>0.08</b>	<b>2.68<sup>2</sup></b>	<b>0.08</b>	2.83	0.08	2.92	0.08
Educate drivers	2.74	0.08	2.87	0.08	3.12	0.08	3.24	0.07
Put up deer-crossing signs	<b>2.60</b>	<b>0.07</b>	<b>2.83<sup>2</sup></b>	<b>0.07</b>	<b>3.00</b>	<b>0.08</b>	<b>3.26<sup>2</sup></b>	<b>0.07</b>
Let nature take its course	1.73	6.72	1.74	0.07	<b>2.07</b>	<b>0.08</b>	<b>2.19<sup>2</sup></b>	<b>0.08</b>
Promote use of plants deer dislike	<b>2.54</b>	<b>0.08</b>	<b>2.78<sup>2</sup></b>	<b>0.08</b>	<b>2.82</b>	<b>0.08</b>	<b>3.08<sup>2</sup></b>	<b>0.08</b>
Promote use of whistles on cars	2.53	0.07	2.67	0.08	3.03	0.08	3.10	0.07
Use road-side reflectors	<b>2.57</b>	<b>0.08</b>	<b>2.79<sup>2</sup></b>	<b>0.08</b>	3.13	0.08	3.24	0.07
Reintroduce predators	1.79	0.07	1.81	0.07	1.73	0.07	1.82	0.08

<sup>1</sup>1 = not at all acceptable; 2 = slightly acceptable; 3 = moderately acceptable; 4 = very acceptable.

<sup>2</sup>Significant difference between means in 1997 and 1998, t-test, P < 0.05.

Other changes occurred only in low deer density areas. The acceptability of two techniques currently being used in Irondequoit, bow hunting and contraception, changed in these areas. The acceptability of bow hunting increased. Perhaps experience with this program has convinced some residents that it is more acceptable than they previously believed. The reverse was true for contraception. It is possible that some of the difficulties in successfully administering a contraception program have become clear as contraception experiments have continued in the community, and that its acceptability has decreased for that reason. Again, further research is needed to determine the reasons for change.

The fact that changes in the acceptability of some techniques occurred in low deer density areas but not high deer density areas is of interest. One possible explanation for this difference is that people in high deer density areas have more experience with deer and greater interest in deer management (Lauber and Knuth, 1998). They may, therefore, be more educated about deer management or be more likely to have thought through the advantages and disadvantages of various techniques. As Irondequoit gains experience with particular techniques, however, people in low deer density areas get more exposure to these techniques and their advantages and disadvantages, and their perceptions of these techniques may change. These changes are less likely for those in high deer density areas only because the people in these areas are more aware of deer management issues to begin with. Indeed, it is worth noting that changes in the perceptions of the acceptability of bow hunting, contraception, and trapping deer and transferring them to another natural area in low deer density areas all made the acceptability of these techniques in low deer density areas more similar to their acceptability in high deer density areas.

### **Appropriateness of Management Techniques**

We asked respondents which one technique they believed was most appropriate and which one was least appropriate for Irondequoit. We classified their responses according to the type of technique they thought was most appropriate: lethal methods, contraception, trap and transfer methods, nonreduction methods, and the restoration of predators. We included a sixth category of "uncertain" for people who did not designate a technique as most appropriate or least appropriate.

In both high and low deer density areas, the percentage of respondents choosing a nonreduction technique as most appropriate for Irondequoit increased from 1997 to 1998, although a plurality still favored lethal methods in each year (Tables 3 and 4). In low deer density areas, lethal methods were more likely in 1998 than in 1997 to be viewed as most appropriate and contraception was less likely to be viewed as most appropriate. In high deer density areas, nonreduction methods were less likely in 1998 than in 1997 to be viewed as least appropriate, and in 1998 equal percentages in high deer density areas viewed lethal methods and nonreduction methods as being least appropriate.

This pattern is consistent with what we observed in the acceptability ratings. Nonreduction methods are being viewed more favorably. In low deer density areas, contraception is being viewed less favorably and lethal methods are being viewed more favorably.

**Table 3.** Percent of respondents choosing categories of technique as "most appropriate" in 1997 and 1998.

Criterion	High Deer Density Areas		Low Deer Density Areas	
	January	September	January	September
	1997	1998	1997	1998
	%	%	%	%
Lethal Methods	44.5	39.6	<b>21.5</b>	<b>30.0<sup>1</sup></b>
Contraception	25.3	23.8	<b>31.2</b>	<b>20.6<sup>1</sup></b>
Trap & Transfer	16.6	14.3	19.8	13.4
Nonreduction Methods	<b>7.9</b>	<b>13.2<sup>1</sup></b>	<b>12.1</b>	<b>23.1<sup>1</sup></b>
Restoration of Predators	1.1	1.1	1.6	1.2
Uncertain	4.5	7.9	13.8	11.7

<sup>1</sup>Significant differences between percentages in 1997 and 1998, chi-square test,  $P < 0.05$ .

**Table 4.** Percent of respondents choosing categories of technique as "least appropriate" in 1997 and 1998.

Criterion	High Deer Density Areas		Low Deer Density Areas	
	January	September	January	September
	1997	1998	1997	1998
	%	%	%	%
Lethal Methods	30.6	32.5	39.3	40.9
Contraception	4.5	7.2	4.0	4.0
Trap & Transfer	3.8	3.4	5.3	7.7
Nonreduction Methods	<b>45.3</b>	<b>32.5<sup>1</sup></b>	26.3	23.1
Restoration of Predators	11.3	16.6	13.4	13.0
Uncertain	4.5	7.9	11.7	11.3

<sup>1</sup>Significant differences between percentages in 1997 and 1998, chi-square test,  $P < 0.05$ .

## **Evaluation Criteria**

We detected a few differences in the importance respondents placed on various criteria in evaluating deer management options (Table 5). In high deer density areas, minimizing the suffering of deer was less important on average to respondents in 1998 vs. 1997. In low deer density areas, minimizing the use of bows and firearms and choosing techniques that were supported by the public were less important. The decrease in the importance of minimizing the use of bows and firearms in low deer density areas is consistent with their increased acceptance of bow hunting and lethal methods in general.

## **Trust in Information Sources**

We found no difference in how much respondents trusted different sources of information about contraception in either low deer density or high deer density areas (Table 6).

## **Beliefs about Contraception**

We presented respondents with a variety of statements about contraception and asked them to rate their agreement with these statements (1 = "strongly disagree" to 5 = "strongly agree"). In comparing responses in 1997 and 1998, we compared both mean responses and response rates (not all respondents answered every question) (Tables 7-13). Comparing means provided us with an indication of the nature of beliefs about contraception in Irondequoit. Comparing response rates provided us with an indication of how knowledgeable respondents felt about contraception.

The only change in beliefs in high deer density areas from 1997 to 1998 was that respondents were more likely to believe that contraception could be very traumatic for deer because of the way that drugs are administered (Table 12). However, we detected no overall decrease in the acceptability or perceived appropriateness of contraception in high density areas, suggesting that this was not a major consideration in evaluating contraception. Indeed, this conclusion is consistent with our earlier finding that respondents from high deer density areas reported less concern about minimizing the suffering of deer in deer management.

Only 4 belief questions had response rates that were significantly different in 1998 in high deer density areas (Tables 11 and 12). All 4 of the response rates were higher in 1998. One question dealt with the humaneness of contraception and the other 3 were concerned with the disruptiveness of contraception. Although all the other differences between response rates in 1997 and 1998 were not significant, for 22 out of 24 of these questions the response rate was higher in 1998. This result seems higher than would occur by chance. Indeed, the mean response rate to these 24 questions in 1998 (58.4%) was significantly higher than the mean in 1997 (54.5%) (paired t-test,  $t(923)=-7.77$ ,  $P = 0.000$ ).



**Table 5.** Importance of criteria for evaluating deer management strategies<sup>1</sup> to respondents in 1997 and 1998. (Continued on next page.)

Criterion	High Deer Density Areas				Low Deer Density Areas			
	January 1997		September 1998		January 1997		September 1998	
	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
Effectiveness:								
Effective at reducing deer population	3.57	0.05	3.60	0.05	3.43	0.06	3.45	0.06
Effective at reducing deer-related problems	3.58	0.05	3.60	0.04	3.40	0.06	3.47	0.06
Proven to work in similar situations	3.33	0.06	3.37	0.06	3.29	0.06	3.29	0.06
Produces quick results	3.00	0.06	2.96	0.06	2.93	0.07	2.99	0.07
Cost:								
Minimizes own financial costs	3.18	0.06	3.09	0.06	3.29	0.06	3.29	0.06
Does not require increased taxes	3.03	0.06	3.00	0.06	3.48	0.05	3.40	0.06
Does not require spending public funds	2.39	0.07	2.30	0.06	2.84	0.07	2.86	0.07
Humane:								
Maintains healthy deer population	2.96	0.07	2.94	0.07	3.14	0.07	3.14	0.07
Minimizes suffering of deer	<b>3.46</b>	<b>0.05</b>	<b>3.26<sup>2</sup></b>	<b>0.06</b>	3.63	0.05	3.53	0.06
Minimizes harmful side effects on deer	3.05	0.07	3.05	0.07	3.35	0.06	3.35	0.06
Violence:								
Does not involve killing deer	2.12	0.08	2.23	0.08	2.59	0.08	2.72	0.08
Minimizes use of firearms and bows	2.44	0.08	2.42	0.08	<b>2.78</b>	<b>0.08</b>	<b>2.63<sup>2</sup></b>	<b>0.08</b>
Political support:								
Supported by the public	2.72	0.06	2.65	0.07	<b>3.16</b>	<b>0.06</b>	<b>2.97<sup>2</sup></b>	<b>0.07</b>
Does not violate existing laws and regulations	2.91	0.07	2.87	0.07	3.04	0.07	3.10	0.07

<sup>1</sup>1 = not at all acceptable; 2 = slightly acceptable; 3 = moderately acceptable; 4 = very acceptable.

<sup>2</sup>Significant difference between means in 1997 and 1998, t-test, P < 0.05.

**Table 5.** (Continued.)

Criterion	High Deer Density Areas				Low Deer Density Areas			
	January 1997		September 1998		January 1997		September 1998	
	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
Other:								
Minimizes human health and safety risks	3.77	0.03	3.74	0.04	3.71	0.04	3.68	0.05
Minimal effects on other wildlife	3.21	0.06	3.18	0.06	3.33	0.06	3.28	0.06
Minimizes potential harm to pets	3.17	0.06	3.25	0.06	3.26	0.06	3.37	0.06
Minimizes disruption	2.94	0.06	2.96	0.06	3.13	0.06	3.17	0.06
Experiments to compare effectiveness of techniques	2.63	0.07	2.67	0.07	2.73	0.07	2.72	0.07
Provides hunting opportunities	2.12	0.07	2.12	0.07	2.34	0.08	2.35	0.08

**Table 6.** Respondents' trust in sources of information about deer management<sup>1</sup> in 1997 and 1998.

Source of Information	High Deer Density Areas				Low Deer Density Areas			
	January 1997		September 1998		January 1997		September 1998	
	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
NYSDEC	3.68	0.08	3.82	0.07	3.76	0.09	3.85	0.07
Monroe County	3.18	0.08	3.18	0.07	3.21	0.09	3.20	0.08
Town of Irondequoit	3.18	0.08	3.27	0.07	3.27	0.09	3.40	0.08
City of Rochester	2.64	0.08	2.75	0.08	2.84	0.10	2.84	0.08
SUNY ESF	3.99	0.07	4.03	0.06	4.17	0.07	4.17	0.06
Cornell Cooperative Extension	4.16	0.07	4.16	0.06	4.24	0.07	4.26	0.06

<sup>1</sup>1 = strongly distrust; 2 = distrust; 3 = neutral; 4 = trust; 5 = strongly trust.

**Table 7.** Agreement or disagreement of respondents with statements about the effectiveness of contraception<sup>1</sup>. (Continued on next page.)

Criterion	High Deer Density Areas						Low Deer Density Areas					
	January 1997			September 1998			January 1997			September 1998		
	Mean	SEM	RR <sup>2</sup>	Mean	SEM	RR	Mean	SEM	RR	Mean	SEM	RR
(If used in Irondequoit) the deer population would be smaller	3.53	0.09	74.7	3.41	0.09	81.1	3.93	0.08	74.9	<b>3.69<sup>3</sup></b>	<b>0.09</b>	81.8
(Contraception) can prevent the growth of deer populations in natural settings	3.40	.11	62.6	3.22	.10	69.1	3.74	.11	60.3	<b>3.40<sup>3</sup></b>	<b>.10</b>	67.6
(Contraception) uses drugs that have been proven to prevent reproduction in deer	3.69	.10	50.9	3.62	.10	56.2	3.91	.11	47.8	3.93	0.10	55.1
(If used in Irondequoit), the number of deer-related problems would not change	2.60	0.09	72.5	2.62	0.09	77.7	2.49	0.10	63.2	2.53	0.10	69.6
(Contraception) can not reduce the size of deer populations unless other deer management techniques are also used.	3.54	.13	49.8	3.49	.12	54.0	3.19	.15	41.3	3.26	.13	<b>50.2<sup>4</sup></b>
(Contraception) is currently an experimental technique which needs more testing	3.64	.11	55.5	3.73	.11	61.1	3.61	.13	47.0	3.83	.11	<b>56.3<sup>4</sup></b>

<sup>1</sup>1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.

<sup>2</sup>Response rate.

<sup>3</sup>Significant difference between means in 1997 and 1998, t-test, P < 0.05.

<sup>4</sup>Significant difference between response rates in 1997 and 1998, chi-square test, P < 0.05.

**Table 7.** (Continued.)

Criterion	High Deer Density Areas						Low Deer Density Areas					
	January 1997			September 1998			January 1997			September 1998		
	Mean	SEM	RR	Mean	SEM	RR	Mean	SEM	RR	Mean	SEM	RR
(Contraception) will not work on large, free-roaming populations of deer	3.49	.11	58.9	3.64	.11	57.4	3.31	.14	46.6	3.45	.12	50.6
(Contraception) has been shown to reduce the size of free-roaming deer populations	2.59	.13	39.2	2.43	.13	41.9	3.23	.16	29.6	2.76	.15	<b>39.3<sup>4</sup></b>

<sup>4</sup>Significant difference between response rates in 1997 and 1998, chi-square test,  $P < 0.05$ .

**Table 8.** Agreement or disagreement of respondents with statements about the speed with which contraception would work<sup>1</sup>.

Criterion	High Deer Density Areas						Low Deer Density Areas					
	January 1997			September 1998			January 1997			September 1998		
	Mean	SEM	RR <sup>2</sup>	Mean	SEM	RR	Mean	SEM	RR	Mean	SEM	RR
(If used in Irondequoit) the size of the deer population would not be affected for many years	3.23	.10	65.7	3.31	0.09	70.9	2.88	.11	57.1	2.99	.11	62.8
(If used in Irondequoit) the number of deer-related problems would quickly decrease	2.19	0.09	73.6	2.12	0.08	80.4	2.57	0.09	60.7	2.44	0.10	<b>69.6<sup>3</sup></b>

<sup>1</sup>1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.

<sup>2</sup>Response rate.

<sup>3</sup>Significant difference between response rates in 1997 and 1998, chi-square test, P < 0.05.

**Table 9.** Agreement or disagreement of respondents with statements about the cost of contraception<sup>1</sup>.

Criterion	High Deer Density Areas						Low Deer Density Areas					
	January 1997			September 1998			January 1997			September 1998		
	Mean	SEM	RR <sup>2</sup>	Mean	SEM	RR	Mean	SEM	RR	Mean	SEM	RR
(Contraception) is a relatively inexpensive technique for managing deer	2.38	.12	50.2	2.34	.12	50.9	3.18	.15	40.5	2.84	.14	43.3
(Contraception) requires a lot of labor to carry out	3.95	0.09	57.4	4.03	0.08	61.9	3.84	.11	50.2	<b>4.04<sup>3</sup></b>	<b>0.10</b>	56.7
(Contraception) needs costly materials to carry out	3.43	.12	43.0	3.40	.11	45.7	3.24	.16	34.4	3.27	.12	<b>43.3<sup>4</sup></b>

<sup>1</sup>1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.

<sup>2</sup>Response rate.

<sup>3</sup>Significant difference between means in 1997 and 1998, t-test,  $P < 0.05$ .

<sup>4</sup>Significant difference between response rates in 1997 and 1998, chi-square test,  $P < 0.05$ .

**Table 10.** Agreement or disagreement of respondents with statements about the safety of contraception<sup>1</sup>.

Criterion	High Deer Density Areas						Low Deer Density Areas					
	January 1997			September 1998			January 1997			September 1998		
	Mean	SEM	RR <sup>2</sup>	Mean	SEM	RR	Mean	SEM	RR	Mean	SEM	RR
(If used in Irondequoit), the way that the drugs would be given to deer would pose no health or safety threats to humans	3.89	0.09	52.8	3.95	0.08	58.5	3.65	.13	43.7	3.67	.11	52.2
(Contraception) requires drugs that might be dangerous for humans	2.42	.14	32.5	2.57	.15	33.2	2.95	.18	29.6	2.66	.15	36.0
(Contraception) uses drugs that have been adequately tested for human safety	3.54	.14	30.9	3.46	.15	31.7	3.86	.16	29.1	3.60	.16	34.0
(Contraception) makes meat from treated deer unsafe for humans to eat	2.08	.15	24.5	2.41	.17	26.8	2.94	.22	20.2	2.66	.17	<b>30.8<sup>3</sup></b>

<sup>1</sup>1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.

<sup>2</sup>Response rate.

<sup>3</sup>Significant difference between response rates in 1997 and 1998, chi-square test, P < 0.05.

**Table 11.** Agreement or disagreement of respondents with statements about the disruptiveness of contraception<sup>1</sup>.

Criterion	High Deer Density Areas						Low Deer Density Areas					
	January 1997			September 1998			January 1997			September 1998		
	Mean	SEM	RR <sup>2</sup>	Mean	SEM	RR	Mean	SEM	RR	Mean	SEM	RR
(If used in Irondequoit) there would be little disruption to residents' everyday lives	3.81	0.08	75.5	3.85	0.07	<b>83.0<sup>3</sup></b>	3.82	0.08	69.2	3.84	0.08	74.5
(If used in Irondequoit) most residents would not notice the work being carried out.	3.84	0.08	74.0	3.94	0.07	<b>83.4<sup>3</sup></b>	4.01	0.08	68.4	4.06	0.08	75.7
(If used in Irondequoit) the number of deer wandering across roads and private property would increase	2.13	0.09	73.6	2.26	0.08	79.6	1.96	0.09	65.2	2.23	0.09	72.1
(If used in Irondequoit) the work would make little noise	4.07	0.08	63.0	4.03	0.06	<b>72.1<sup>3</sup></b>	4.09	0.09	58.3	4.09	0.07	65.2
(If used in Irondequoit), people giving drugs to the deer might trespass on private property	3.02	0.09	67.5	2.96	0.09	67.2	3.03	.10	58.3	3.14	.10	62.8

<sup>1</sup>1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.

<sup>2</sup>Response rate.

<sup>3</sup>Significant difference between response rates in 1997 and 1998, chi-square test, P < 0.05.



**Table 12.** Agreement or disagreement of respondents with statements about the humaneness of contraception<sup>1</sup>.

Criterion	High Deer Density Areas						Low Deer Density Areas					
	January 1997			September 1998			January 1997			September 1998		
	Mean	SEM	RR <sup>2</sup>	Mean	SEM	RR	Mean	SEM	RR	Mean	SEM	RR
(Contraception) is a humane way to manage deer	3.87	0.09	71.3	3.85	0.09	76.6	3.96	.10	67.6	3.86	0.09	72.5
(Contraception) could be very traumatic for deer because of how the deer are given contraceptive drugs	2.35	.13	38.5	<b>2.77<sup>3</sup></b>	<b>.12</b>	<b>49.8<sup>4</sup></b>	2.73	.17	34.8	3.02	.14	<b>47.8<sup>4</sup></b>
(Contraception) might lead to harmful side effects on deer	2.48	.14	33.2	2.60	.12	36.2	2.85	.17	31.6	3.23	.15	37.7

<sup>1</sup>1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.

<sup>2</sup>Response rate.

<sup>3</sup>Significant difference between means in 1997 and 1998, t-test,  $P < 0.05$ .

<sup>4</sup>Significant difference between response rates in 1997 and 1998, chi-square test,  $P < 0.05$ .

**Table 13.** Agreement or disagreement of respondents with other belief statements about contraception<sup>1</sup>.

Criterion	High Deer Density Areas						Low Deer Density Areas					
	January 1997			September 1998			January 1997			September 1998		
	Mean	SEM	RR <sup>2</sup>	Mean	SEM	RR	Mean	SEM	RR	Mean	SEM	RR
(Contraception) makes meat from treated deer unsafe for other wildlife to eat	1.85	.14	27.2	2.06	.15	29.8	2.51	.19	23.1	2.52	.17	<b>32.4<sup>3</sup></b>
(If used in Irondequoit) it would lead to fewer opportunities for recreational hunting in New York	1.92	0.09	72.5	1.91	0.08	79.2	2.20	.11	66.8	2.31	.11	<b>75.3<sup>3</sup></b>
Most citizens in Irondequoit would support the use of deer contraception to manage deer	3.44	.10	67.5	3.57	0.09	74.0	3.88	0.10	64.0	<b>3.55<sup>4</sup></b>	<b>.11</b>	66.4

<sup>1</sup>1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.

<sup>2</sup>Response rate.

<sup>3</sup>Significant difference between response rates in 1997 and 1998, chi-square test,  $P < 0.05$ .

<sup>4</sup>Significant difference between means in 1997 and 1998, t-test,  $P < 0.05$ .

In low deer density areas, we detected several changes in beliefs about contraception between 1997 and 1998. Respondents were less likely to believe:

- the deer population would become smaller if contraception were used in Irondequoit (Table 7);
- contraception can prevent the growth of deer populations in natural settings (Table 7); and
- most citizens in Irondequoit would support the use of deer contraception to manage deer (Table 13).

They were more likely to believe:

- contraception requires a lot of labor to carry out (Table 9).

Taken together, these results imply a more cautious view in general about the capability of contraception to manage deer for a reasonable cost. They are consistent with our earlier results that respondents from low deer density areas were less likely in 1998 to perceive contraception as acceptable and appropriate for Irondequoit.

Respondents from low deer density areas were significantly more likely in 1998 than in 1997 to answer a variety of belief questions about contraception, focusing on its reliability, its effectiveness, its cost, the safety of meat from treated deer, and the likelihood of contraception being traumatic to deer. In addition, respondents were nonsignificantly more likely to answer all 19 of the other belief questions in 1998. The average response rate for these 19 questions in 1998 (59.8%) was significantly higher than the average response rate in 1997 (54.0%) (paired t-test,  $t(18) = -15.88$ ,  $P = 0.000$ ).

## **Impacts of Information**

### **Acceptability of Contraception**

We tested whether either information type influenced respondents' perceptions of the acceptability of contraception in 1998. We used a general linear model to try to predict the acceptability of contraception in 1998 using:

- the acceptability of contraception in 1997;
- the perceived importance of effectiveness in evaluating management options;
- the perceived importance of humaneness in evaluating management options;
- whether respondents received effectiveness information; and
- whether respondents received humaneness information.

We also included interaction terms between the perceived importance of each information type and the receipt of that type of information.

The only significant predictor of the acceptability of contraception in 1998 was the acceptability of contraception in 1997. This result provides no indication that the receipt of either type of information about contraception influenced perceptions of the acceptability of contraception.

### **Acceptability of Other Management Strategies**

We also tested whether the receipt of information about contraception influenced perceptions of the acceptability of other management strategies. We reasoned that more information about contraception could make other strategies more or less attractive. We tested for this influence using general linear models analogous in composition to the one used to test for the influence of information on the acceptability of contraception.

We found that the receipt of information had a significant effect on the perceptions of several nonreduction methods: promoting the use of fences to keep deer away from property, educating drivers about how to avoid deer on the road, promoting the use of plants that deer are less likely to eat, promoting the use of deer whistles on cars to keep deer out of roadways, and using roadside reflectors to keep deer away from the road at night (Tables 14-18).

Humaneness information had a similar effect on perceptions of the acceptability of all 5 of these nonreduction methods (Figures 1-5). Humaneness information also interacted with the perceived importance of humaneness in a similar way. People who had different perceptions of the importance of humaneness were influenced by humaneness information in different ways. Humaneness information had a slight positive effect on perceptions of the acceptability of these nonreduction methods if people thought humaneness was important. It had a larger negative effect on perceptions of acceptability if people thought humaneness was unimportant.

We had no initial hypotheses about how humaneness information about contraception would influence perceptions of the acceptability of other management strategies. Because the pattern of effects we found, however, was consistent across 5 nonreduction techniques, it is worth speculating about the nature of the relationship. We believe that both the humaneness information and the effectiveness information we distributed about contraception might raise questions in people's minds about the appropriateness of contraception as a management technique. This information reflected current expert opinion about contraception, which is that contraception is a promising but experimental technique. Our interpretation of our results is based on the assumption that this information did indeed raise questions about the appropriateness of contraception. If such were the case, this information could have increased the acceptability of nonreduction techniques to those for whom humaneness was important since these were alternatives to contraception that people tended to view as humane.

**Table 14.** General linear model predicting the acceptability in 1998 of promoting the use of fences to keep deer away from property. (See Appendix C for explanation.)

Model Terms	B	P
Constant	0.82	0.114
<b>Continuous Variables:</b>		
Acceptability in 1997	0.52	0.000
Importance of humaneness	0.36	0.003
Importance of effectiveness	-0.18	0.030
<b>Categorical Variables:</b>		
Humaneness information		0.035
Did not receive information	0.98	
Received information	0.00	
Humaneness information/importance interaction		0.024
Did not receive information	-0.31	
Received information	0.00	

**Table 15.** General linear model predicting the acceptability in 1998 of educating drivers to avoid deer on the road. (See Appendix C for explanation.)

Model Terms	B	P
Constant	0.69	0.065
<b>Continuous Variables:</b>		
Acceptability in 1997	0.46	0.000
Importance of humaneness	0.32	0.004
<b>Categorical Variables:</b>		
Humaneness information		0.066
Did not receive information	0.87	
Received information	0.00	
Humaneness information/importance interaction		0.055
Did not receive information	-0.25	
Received information	0.00	

**Table 16.** General linear model predicting the acceptability in 1998 of promoting the use of plants that deer are less likely to eat. (See Appendix C for explanation.)

Model Terms	B	P
Constant	0.54	0.125
<b>Continuous Variables:</b>		
Acceptability in 1997	0.44	0.000
Importance of humaneness	0.41	0.000
<b>Categorical Variables:</b>		
Humaneness information		0.048
Did not receive information	0.85	
Received information	0.00	
Humaneness information/importance interaction		0.017
Did not receive information	-0.31	
Received information	0.00	

**Table 17.** General linear model predicting the acceptability in 1998 of promoting the use of deer whistles on cars to keep deer out of roadways. (See Appendix C for explanation.)

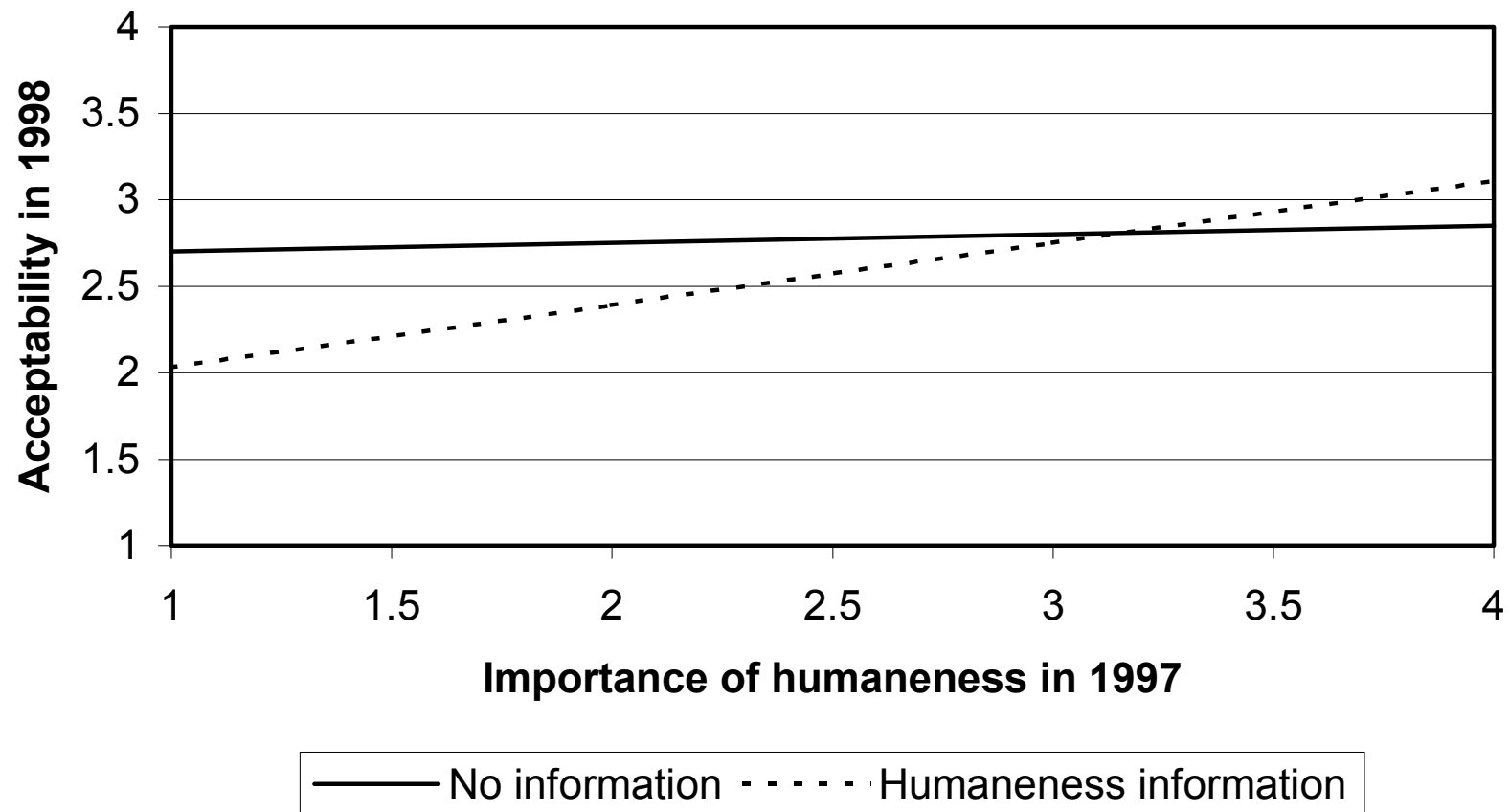
Model Terms	B	P
Constant	1.15	0.047
<b>Continuous Variables:</b>		
Acceptability in 1997	0.50	0.000
Importance of humaneness	0.52	0.000
Importance of effectiveness	-0.29	0.019
<b>Categorical Variables:</b>		
Humaneness information		0.015
Did not receive information	1.07	
Received information	0.00	
Effectiveness information		0.007
Did not receive information	-1.48	
Received information	0.00	
Humaneness information/importance interaction		0.001
Did not receive information	-0.43	
Received information	0.00	
Effectiveness information/importance interaction		0.020
Did not receive information	0.37	
Received information	0.00	

**Table 18.** General linear model predicting the acceptability in 1998 of using road-side reflectors to keep deer away from the road at night. (See Appendix C for explanation.)

Model Terms	B	P
Constant	1.44	0.015
<b>Continuous Variables:</b>		
Acceptability in 1997	0.51	0.000
Importance of humaneness	0.37	0.001
Importance of effectiveness	-0.28	0.022
<b>Categorical Variables:</b>		
Humaneness information		0.013
Did not receive information	1.13	
Received information	0.00	
Effectiveness information		0.025
Did not receive information	-1.24	
Received information	0.00	
Humaneness information/importance interaction		0.006
Did not receive information	-0.37	
Received information	0.00	
Effectiveness information/importance interaction		0.041
Did not receive information	0.33	
Received information	0.00	

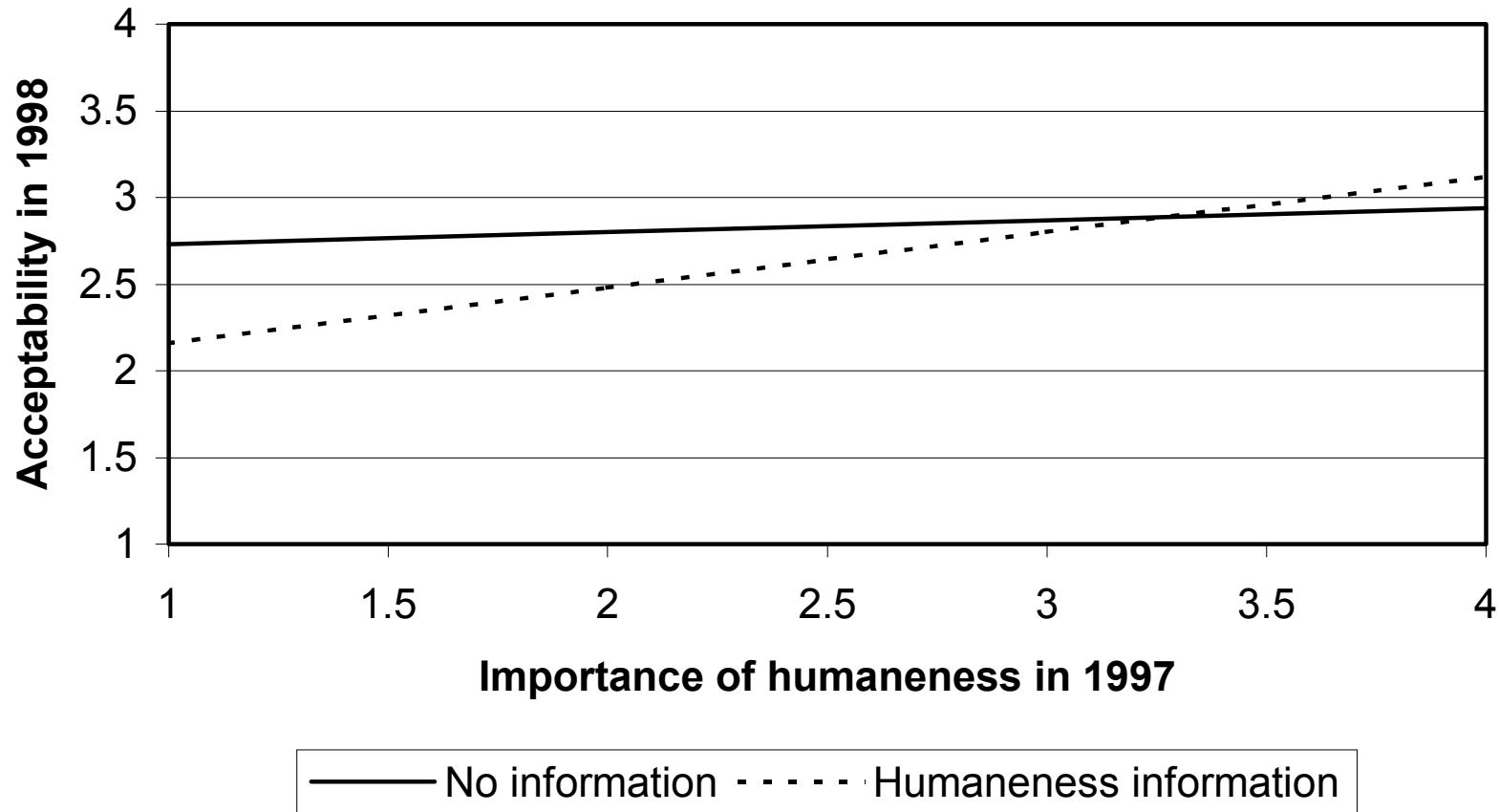


**Figure 1.** Impact of "humaneness of contraception" information on the acceptability of promoting the use of fences to keep deer away from property<sup>a</sup>. (1 = low; 4 = high on both axes.) Terms not represented in this figure are set to the midpoints of their ranges.



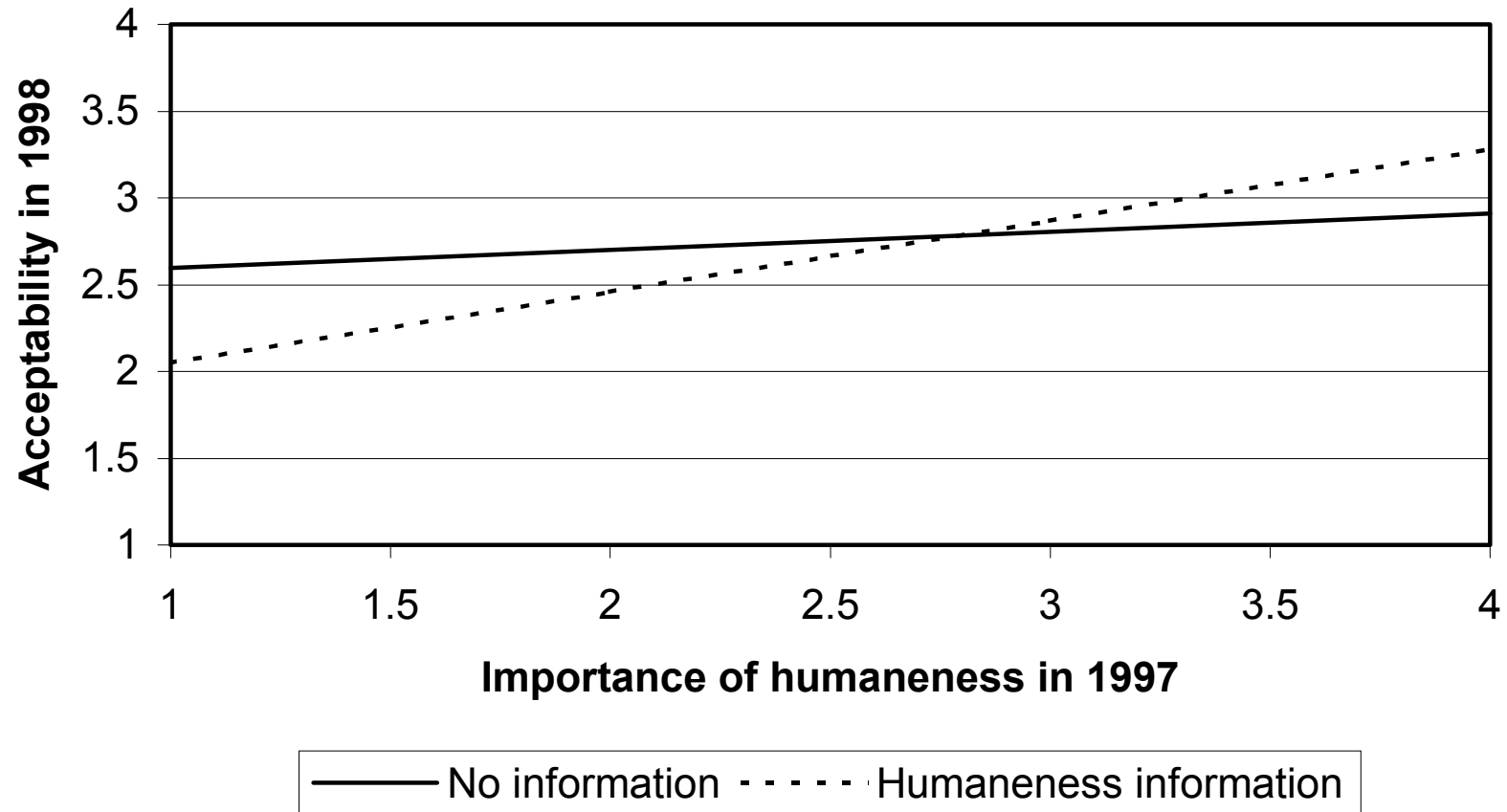
<sup>a</sup> If the "information line" is above the "no information line," receiving information increases the acceptability of contraception. If below, it decreases the acceptability of contraception. The impact of information varies with the how concerned respondents are with humaneness.

**Figure 2.** Impact of "humaneness of contraception" information on the acceptability of educating drivers to avoid deer on the road<sup>a</sup>. (1 = low; 4 = high on both axes.) Terms not represented in this figure are set to the midpoints of their ranges.



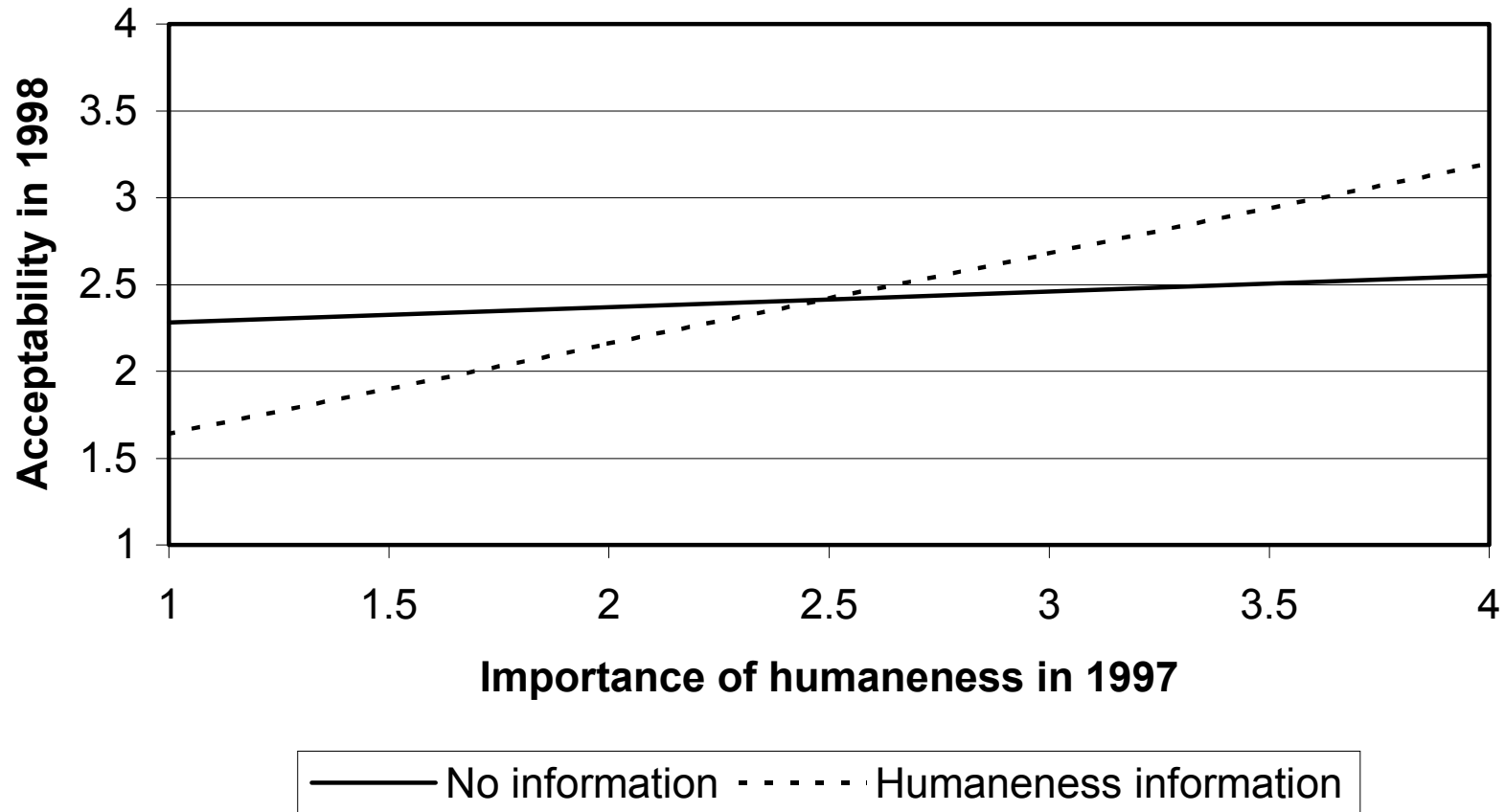
<sup>a</sup> If the "information line" is above the "no information line," receiving information increases the acceptability of contraception. If below, it decreases the acceptability of contraception. The impact of information varies with the how concerned respondents are with humaneness.

**Figure 3.** Impact of "humaneness of contraception" information on the acceptability of promoting the use of plants that deer are less likely to eat<sup>a</sup>. (1 = low; 4 = high on both axes.) Terms not represented in this figure are set to the midpoints of their ranges.



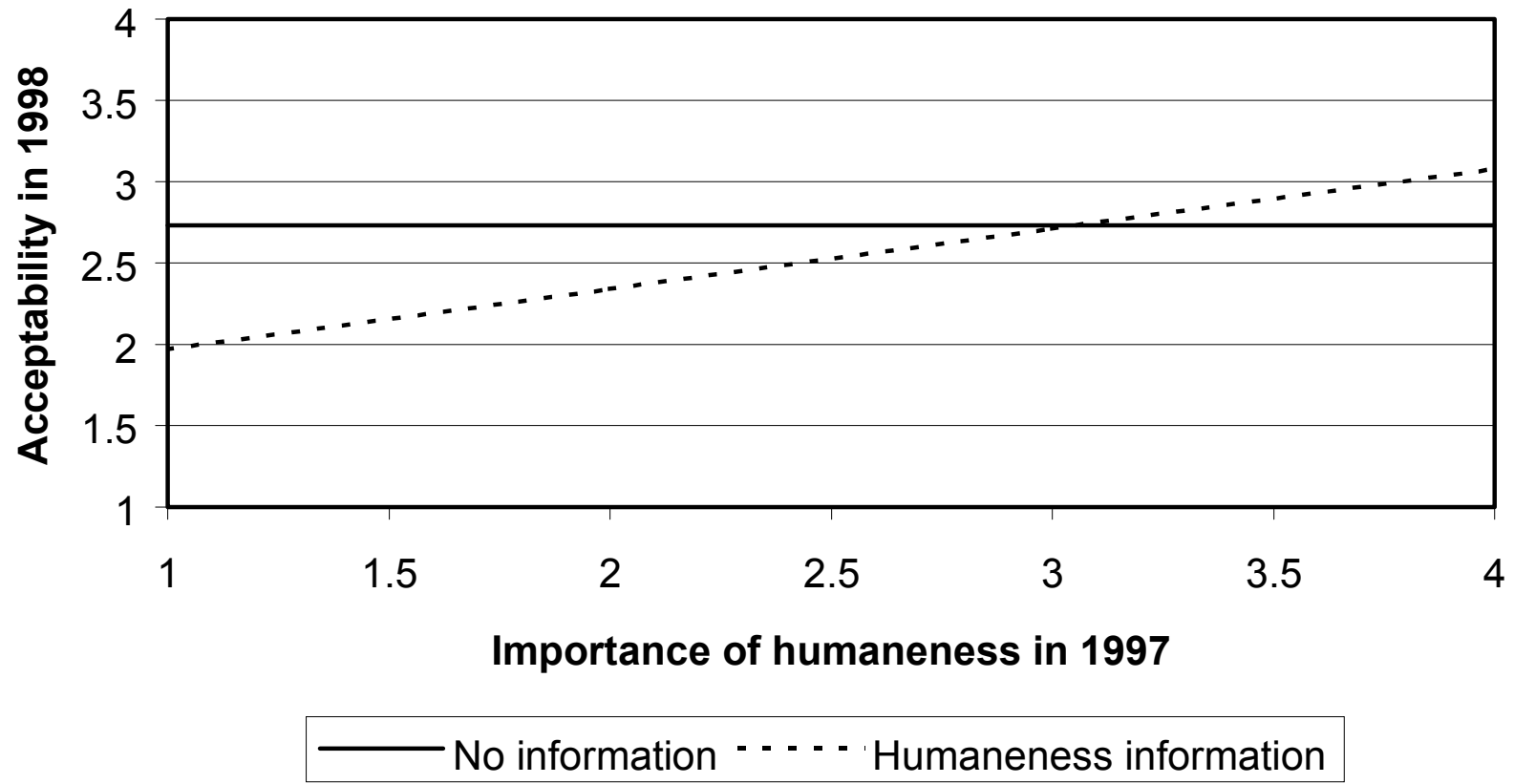
<sup>a</sup> If the "information line" is above the "no information line," receiving information increases the acceptability of contraception. If below, it decreases the acceptability of contraception. The impact of information varies with the how concerned respondents are with humaneness.

**Figure 4.** Impact of "humaneness of contraception" information on the acceptability of promoting the use of deer whistles on cars to keep deer out of roadways<sup>a</sup>. (1 = low; 4 = high on both axes.) Terms not represented in this figure are set to the midpoints of their ranges.



<sup>a</sup> If the "information line" is above the "no information line," receiving information increases the acceptability of contraception. If below, it decreases the acceptability of contraception. The impact of information varies with the how concerned respondents are with humaneness.

**Figure 5.** Impact of "humaneness of contraception" information on the acceptability of using road-side reflectors to keep deer away from the road at night<sup>a</sup>. (1 = low; 4 = high on both axes.) Terms not represented in this figure are set to the midpoints of their ranges.



<sup>a</sup> If the "information line" is above the "no information line," receiving information increases the acceptability of contraception. If below, it decreases the acceptability of contraception. The impact of information varies with the how concerned respondents are with humaneness.

Explaining why this information would decrease the acceptability of nonreduction methods among those for whom humaneness was unimportant is more problematic. Perhaps these people tended to lump all "humane" management techniques, both contraception and nonreduction methods, into one category. Information which raised questions about contraception might also raise questions about nonreduction methods and lessen the acceptability of these methods. These interpretations are highly speculative, however.

For two of the nonreduction techniques, using deer whistles on cars and using roadside reflectors, effectiveness information also had an impact (Tables 16 and 17). The type of impact that effectiveness information had was the same for both (Figures 6 and 7). The acceptability of these techniques was higher if contraception effectiveness information was received and if effectiveness was not an important concern to respondents. This pattern was not straightforward to interpret. Because it only involved two of the nonreduction techniques, it did not represent a widespread pattern and we chose not to speculate about whether it reflected an underlying phenomenon of interest.

### **Appropriateness of Contraception**

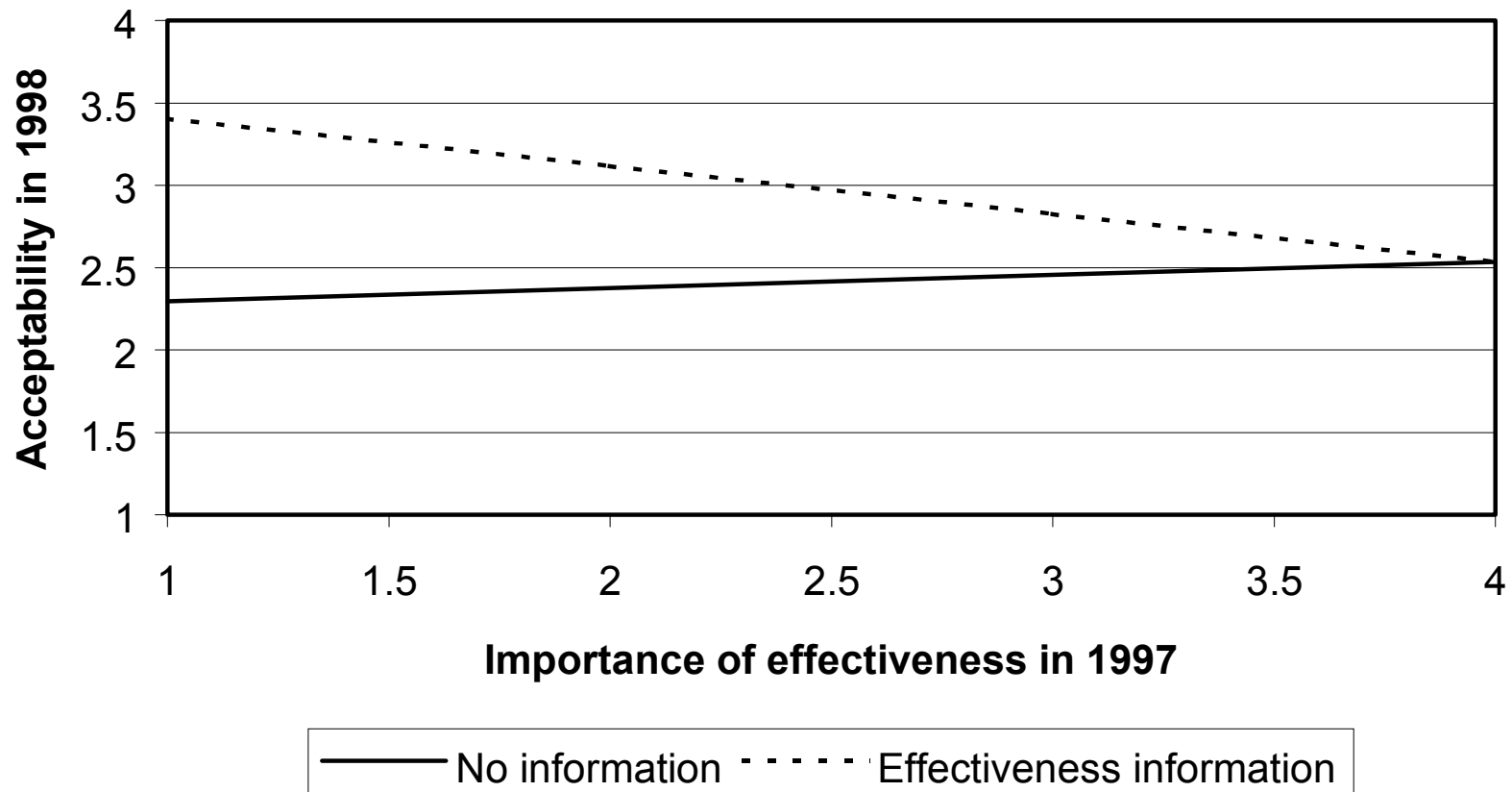
Although receiving information showed no influence on citizens' perceptions of the acceptability of contraception, other indications of attitudes toward contraception exist. We asked respondents which deer management technique they thought was "most appropriate" for Irondequoit. This indicator of attitudes toward management techniques was more discriminating than our acceptability measure. Respondents could rate as many techniques as they wanted "very acceptable," but could only identify one technique as "most appropriate." Thus, the percentage of citizens who called contraception most appropriate serves as another valuable indicator of attitudes toward contraception.

We used a logistic regression model to predict the probability that people would call contraception most appropriate in 1998. The initial set of predictive terms we included in the model were analogous to those we had included in the general linear models used to predict acceptability:

- whether contraception was called most appropriate in 1997;
- the perceived importance of effectiveness in evaluating management options;
- the perceived importance of humaneness in evaluating management options;
- whether respondents received effectiveness information; and
- whether respondents received humaneness information.

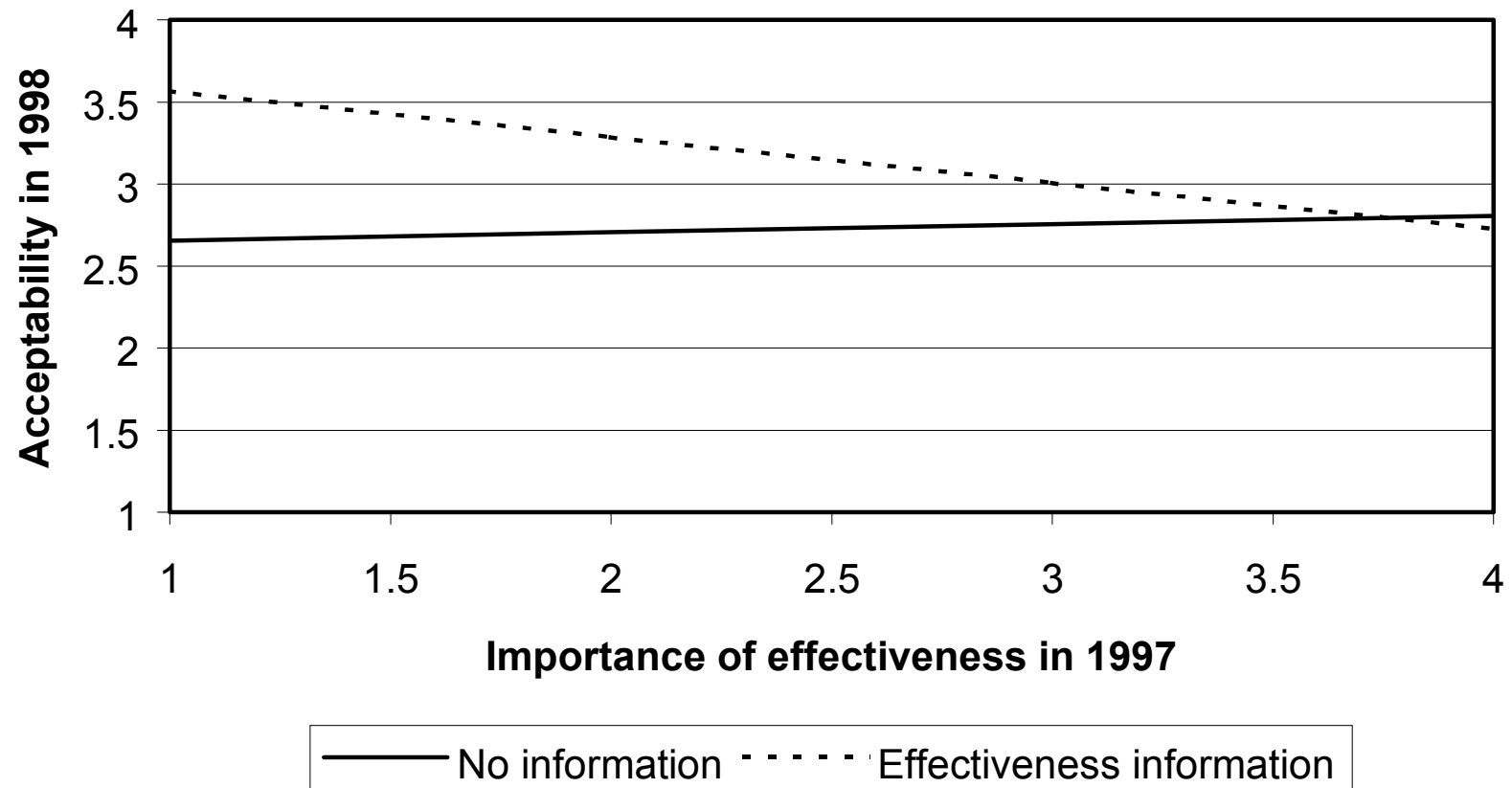
As in the general linear models, we also included interaction terms between the perceived importance of each information type and the receipt of that type of information. In addition, we included two additional interaction terms between the receipt of each type of information and whether contraception had been called most appropriate in 1997. We theorized that information might influence people differently if they had believed contraception was most appropriate initially.

**Figure 6.** Impact of "effectiveness of contraception" information on the acceptability of promoting the use of deer whistles on cars to keep deer out of roadways<sup>a</sup>. (1 = low; 4 = high on both axes.) Terms not represented in this figure are set to the midpoints of their ranges.



<sup>a</sup> If the "information line" is above the "no information line," receiving information increases the acceptability of contraception. If below, it decreases the acceptability of contraception. The impact of information varies with the how concerned respondents are with effectiveness.

**Figure 7.** Impact of "effectiveness of contraception" information on the acceptability of using road-side reflectors to keep deer away from the road at night<sup>a</sup>. (1 = low; 4 = high on both axes.) Terms not represented in this figure are set to the midpoints of their ranges.



<sup>a</sup> If the "information line" is above the "no information line," receiving information increases the acceptability of contraception. If below, it decreases the acceptability of contraception. The impact of information varies with the how concerned respondents are with effectiveness.



The logistic regression model was highly significant (Table 19) ( $\chi^2(5) = 82.17$ ,  $P = 0.000$ ). The model showed that receiving either type of information lowered the probability that respondents would view contraception as most appropriate. This finding was not unexpected because we believed that the information distributed identified a number of uncertainties about the impacts of contraception.

We found a significant interaction between the receipt of humaneness information and whether people had viewed contraception as most appropriate in 1997. In other words, the impact of receiving humaneness information depended on whether the recipient had viewed contraception as most appropriate initially. For those who did not view contraception as most appropriate in 1997, the receipt of humaneness information had little effect; the receipt of effectiveness information had a greater impact (Figure 8). For those who did view contraception as most appropriate in 1997, however, receiving humaneness information had a greater impact than receiving effectiveness information (Figure 9).

Our interpretation of this difference is that the humaneness of contraception has always been one of its attractive characteristics. Those who viewed contraception as most appropriate in 1997 may have been partly influenced by its perceived humaneness. Receiving information that raised questions about the humaneness of contraception, therefore, had a larger impact on these individuals than those who did not perceive contraception as most appropriate initially.

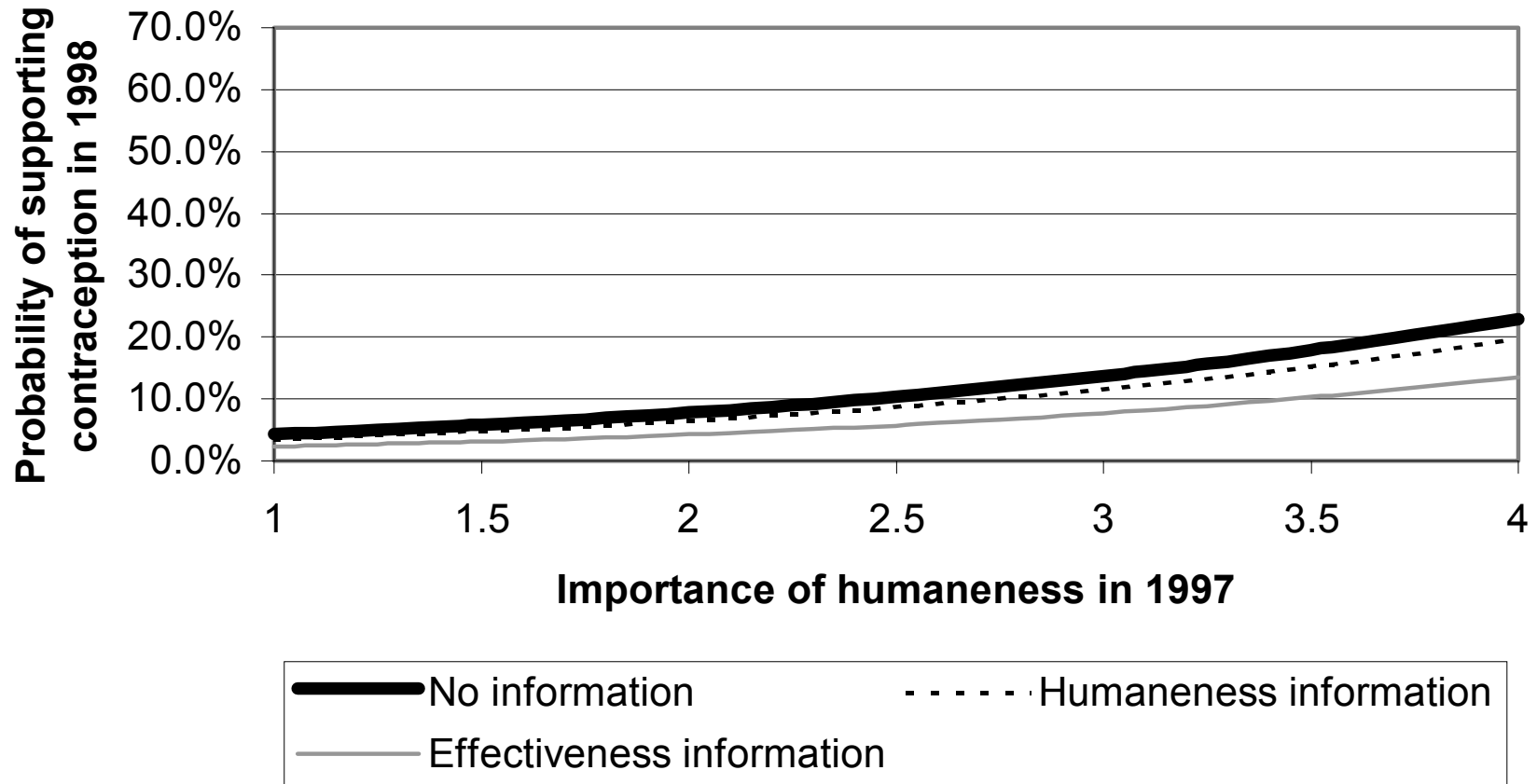
Despite the significance of this model, we did not find significant interactions between receiving either type of information and believing that the concerns addressed by that type of information were important. In other words, receiving effectiveness information did not have a larger impact on those who thought the effectiveness of management methods were important. The same was true for humaneness information. This model failed to support our hypothesis that targeting stakeholders' specific interests in communication about deer management was more likely to influence perceptions about deer management.

The model described above, however, only tested whether information influenced perceptions of the appropriateness of contraception. A significant interaction between information and interests would only be detected if information influenced all stakeholders in the same way. However, the same information might have made contraception seem more appropriate to some stakeholders and less appropriate to others. If people were more likely to change their opinion about contraception (either positively or negatively) after receiving information about it, this finding would show that such information was influential. In order to determine whether information may have influenced different stakeholders differently, therefore, we used a second logistic regression model to test whether receiving information made it more likely for people to change their opinions about contraception. We labeled a person as having changed his or her opinion about contraception if that person viewed contraception as most appropriate in either 1997 or 1998, but not both.

**Table 19.** Logistic regression model predicting the probability of calling contraception "most appropriate" in 1998. (See Appendix C for explanation.)

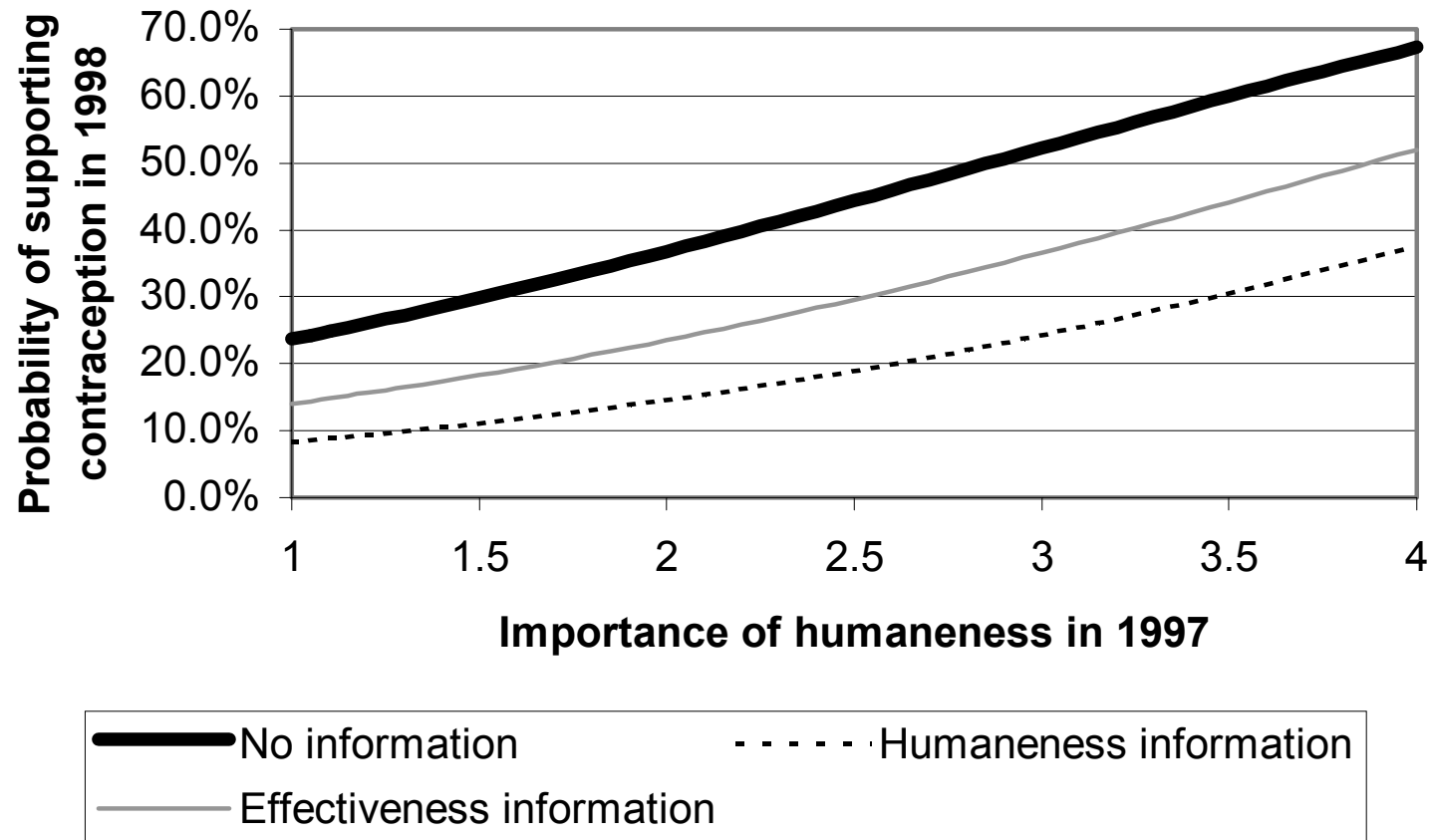
Model Terms	B	P
Constant	-3.67	0.000
<b>Continuous Variables:</b>		
Importance of humaneness	0.63	0.001
<b>Categorical Variables:</b>		
Appropriateness of contraception in 1997		0.037
Not most appropriate	-0.90	
Most appropriate	0.00	
Humaneness information		0.003
Did not receive information	1.23	
Received information	0.00	
Effectiveness information		0.029
Did not receive information	0.64	
Received information	0.00	
Humaneness information/appropriateness of contraception interaction		0.047
Contraception not most appropriate and did not receive information	-1.03	
Either contraception most appropriate or received information	0.00	

**Figure 8.** Impact of contraception information on the appropriateness of contraception for respondents who did not view contraception as most appropriate in 1997<sup>a</sup>. (1 = low; 4 = high on X-axis.) Terms not represented in this figure are set to the midpoints of their ranges.



<sup>a</sup> The distance of the "information lines" below the "no information line" indicates how much each type of information lowers the probability that respondents will view contraception as "most appropriate." The impact of information varies with the how concerned respondents are with humaneness.

**Figure 9.** Impact of contraception information on the appropriateness of contraception for respondents who viewed contraception as most appropriate in 1997<sup>a</sup>. (1 = low; 4 = high on X-axis.) Terms not represented in this figure are set to the midpoints of their ranges.



<sup>a</sup> The distance of the "information lines" below the "no information line" indicates how much each type of information lowers the probability that respondents will view contraception as "most appropriate." The impact of information varies with the how concerned respondents are with humaneness.

This logistic regression model (Table 20) shows that effectiveness information did not influence the likelihood of respondents changing their opinions about the appropriateness of contraception, but humaneness information did. Furthermore, we found a significant interaction between the effect of receiving humaneness information and respondents' interest in humaneness (Figure 10). People who received humaneness information were more likely than others to change their opinion about contraception, but only if they thought humaneness was an important consideration in deer management. This finding supports a central hypothesis underlying this study – that information is more likely to influence people's attitudes about deer management if it addresses the kinds of concerns that they think are important.

### **Importance of Different Criteria**

Another important hypothesis we tested was whether receiving information addressing a certain type of concern about deer management could make that type of concern more important to respondents. We reasoned that the information could make people aware of the importance of a particular concern to which they had not previously given attention. We tested the influence of receiving information on the perceived importance of effectiveness or humaneness in 1998 using a general linear model. Terms included in both models were:

- the perceived importance of effectiveness in 1997;
- the perceived importance of humaneness in 1997;
- whether respondents received effectiveness information; and
- whether respondents received humaneness information.

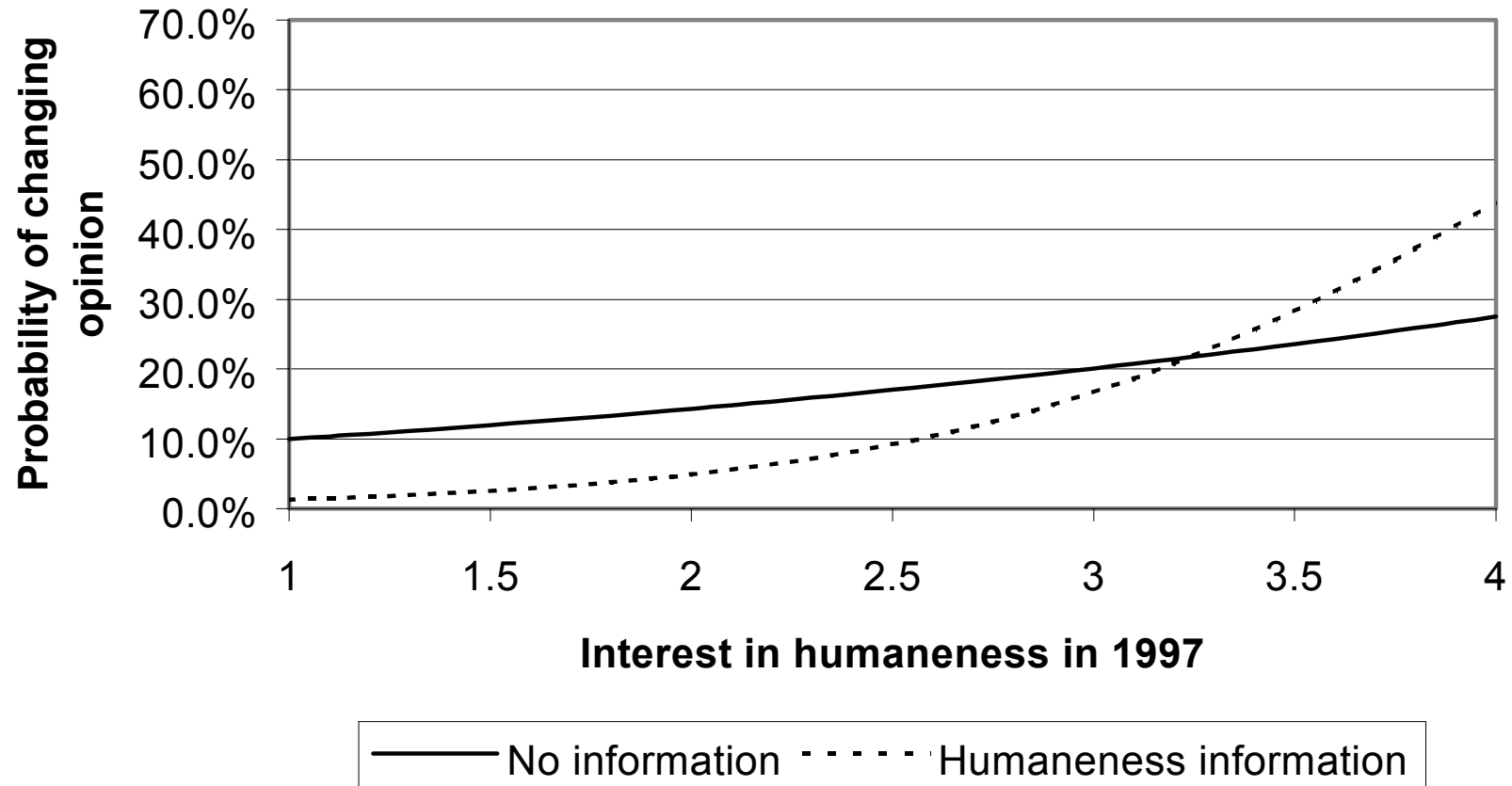
We also included interaction terms between the perceived importance of each consideration and the receipt of that type of information.

We found no significant model that predicted respondents' perceived importance of humaneness in 1998. We did find such a model for the perceived importance of effectiveness in 1998, however (Table 21). Receiving effectiveness information did indeed increase the importance of effectiveness, but only for those for whom effectiveness was not already an important concern (Figure 11). This result suggests that agency communication can indeed raise the stature of certain concerns in the eyes of the public, if those concerns are not already important to the public. On the other hand, receiving humaneness information decreased the importance of effectiveness as a consideration, but only for those for whom humaneness was not important (Figure 12). This effect was not strong, but it may indicate that communicating information about certain concerns can make other concerns relatively less important.

**Table 20.** Logistic regression model predicting the probability of respondents changing their opinion about the appropriateness of contraception between 1997 and 1998. (See Appendix C for explanation.)

Model Terms	B	P
Constant	-5.69	0.000
<b>Continuous Variables:</b>		
Importance of humaneness	1.36	0.000
<b>Categorical Variables:</b>		
Humaneness information		0.040
Did not receive information	3.08	
Received information	0.00	
Humaneness information/interest in humaneness interaction		0.21
Did not receive information	-0.95	
Received information	0.00	

**Figure 10.** Impact of "humaneness of contraception" information on probability of respondents changing their opinion about the appropriateness of contraception<sup>a</sup>. (1 = low; 4 = high on X-axis.) Terms not represented in this figure are set to the midpoints of their ranges.



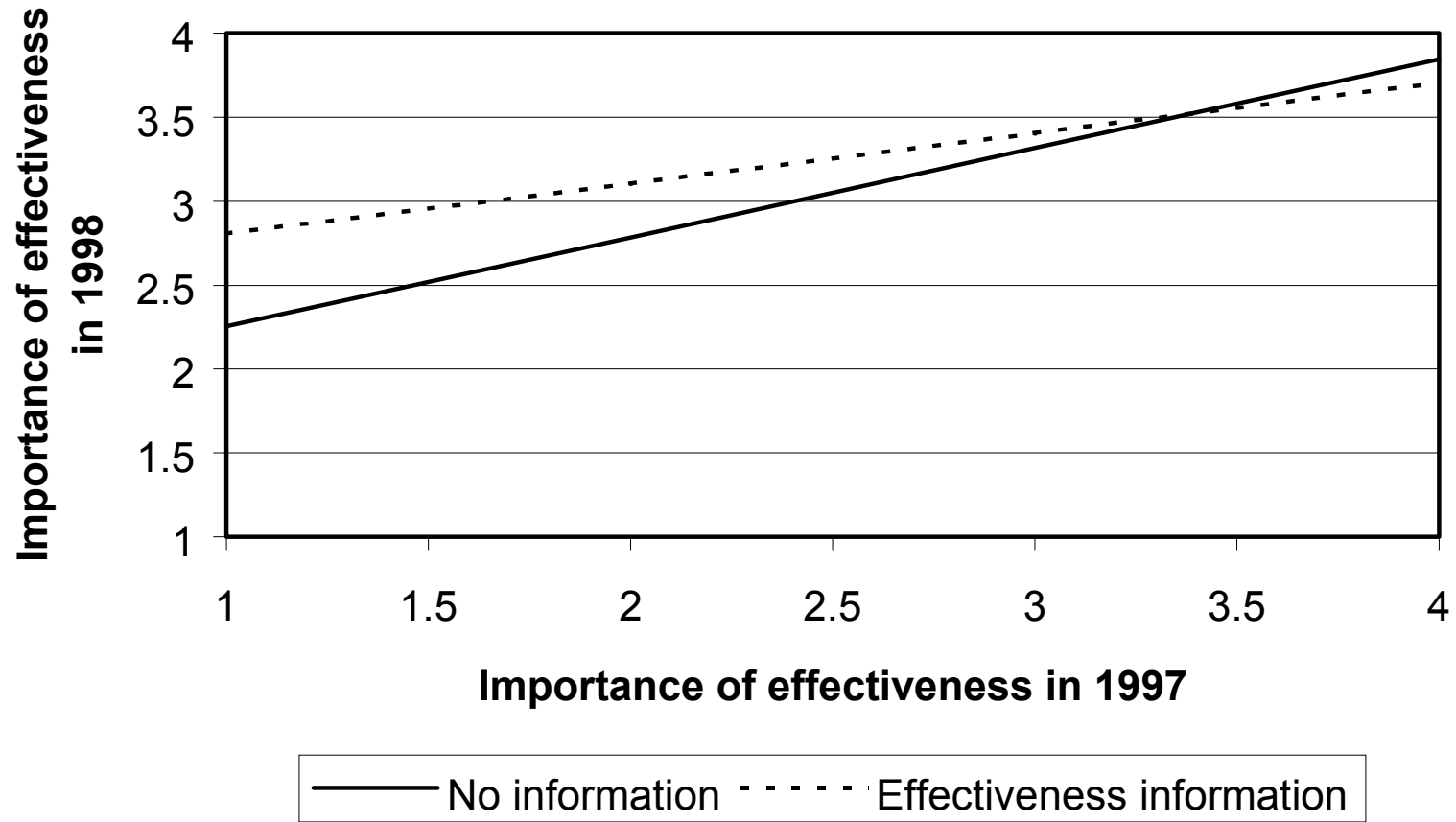
<sup>a</sup> If the "information line" is above the "no information line," receiving information increases the likelihood that respondents will change their opinion about contraception. If below, it decreases the likelihood. The impact of information varies with the how concerned respondents are with effectiveness.

**Table 21.** General linear model predicting the importance of effectiveness in 1998. (See Appendix C for explanation.)

Model Terms	B	P
Constant	2.22	0.000
<b>Continuous Variables:</b>		
Importance of effectiveness in 1997	0.30	0.000
Importance of humaneness in 1997	0.05	0.342
<b>Categorical Variables:</b>		
Humaneness information		0.032
Did not receive information	0.51	
Received information	0.00	
Effectiveness information		0.014
Did not receive information	-0.78	
Received information	0.00	
Humaneness information/importance interaction		0.046
Did not receive information	-0.14	
Received information	0.00	
Effectiveness information/importance interaction		0.011
Did not receive information	0.23	
Received information	0.00	

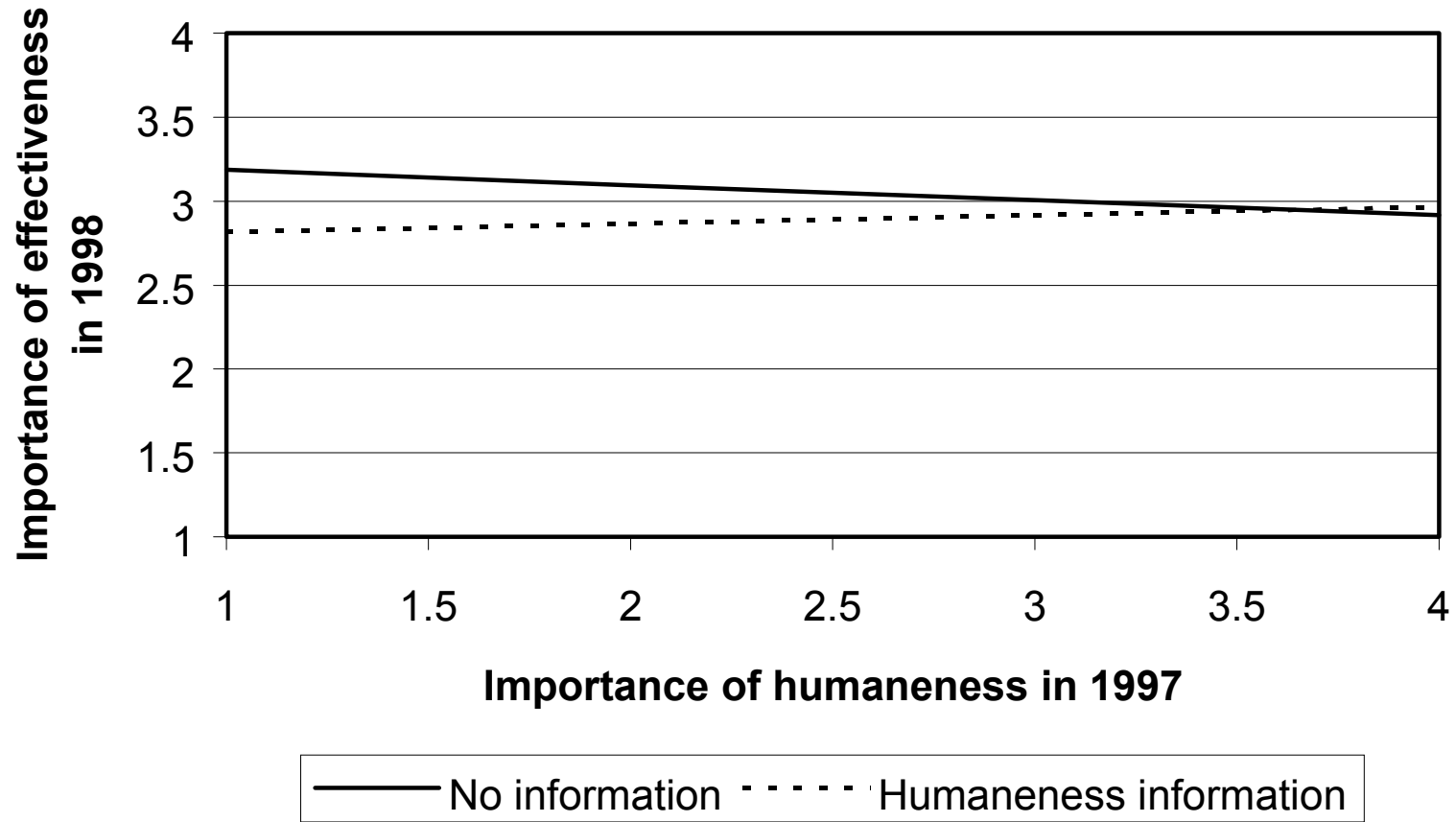


**Figure 11.** Impact of "effectiveness of contraception" information on perceived importance of effectiveness<sup>a</sup>. (1 = low; 4 = high on both axes.) Terms not represented in this figure are set to the midpoints of their ranges.



<sup>a</sup> If the "information line" is above the "no information line," receiving information increases respondents concern about effectiveness. If below, it decreases this concern. The impact of information varies with the how concerned respondents were with effectiveness before the experiment.

**Figure 12.** Impact of "humaneness of contraception" information on perceived importance of effectiveness<sup>a</sup>. (1 = low; 4 = high on both axes.) Terms not represented in this figure are set to the midpoints of their ranges.



<sup>a</sup> If the "information line" is above the "no information line," receiving information increases respondents concern about effectiveness. If below, it decreases this concern. The impact of information varies with the how concerned respondents are with humaneness.

## CONCLUSIONS AND IMPLICATIONS

In this study, we found that attitudes toward deer management techniques changed over a short period of time in Irondequoit. The acceptability of two techniques being used in Irondequoit changed in low deer density areas. Bow hunting became more acceptable. Contraception became less acceptable. This finding suggests that direct experience with techniques can change perceptions of those techniques. Beliefs about contraception, and the certainty with which those beliefs were held, also changed during this period.

Communication had an important influence on how attitudes, perceptions, and beliefs changed:

- it made people less likely to view contraception as appropriate;
- it made people more likely to change their opinions about contraception; and
- it made people appreciate the importance of a variety of concerns about management techniques.

Of particular interest was our finding that the influence of information on people's attitudes depended on the type of information:

- People were more likely to be influenced by messages that addressed their particular concerns about deer management.
- They were less likely to be influenced by messages that addressed concerns that they thought were unimportant.

### Management Implications

These findings have important implications for the management of deer in Irondequoit and the management of natural resources in general

- Residents' attitudes toward management techniques are not fixed. They do not form a component of the management environment to which management agencies have no choice but to adapt. Rather, attitudes change as other components of the management environment change, making some techniques become more feasible and others less feasible over time.
- Communication can influence attitudes. Management agencies, therefore, do not have to respond to the human dimension of management as an exogenous variable over which they have no control. The communication of research-based information about management techniques can influence perceptions of those techniques. Agencies have the option of playing an active role in managing the human dimension of suburban wildlife conflicts through communication, just as they routinely manage biological dimensions. Indeed, coordinated actions which address both the biological and human dimensions are more likely to be successful than actions which address the biological dimension alone.

- Understanding the public's concerns about deer management can lead to more effective and influential communication. Suburban residents may have different concerns about management techniques than wildlife managers. Determining what those concerns are and distributing information about those concerns is most likely to influence public perceptions of deer management techniques.

Taken together, our results suggest that taking a proactive approach to communicating about deer management in Irondequoit could benefit the Bureau of Wildlife (BOW). People in Irondequoit will be affected by the communication they receive about deer management techniques. If BOW plays an active role in disseminating information about these techniques, it can help to inform the community's decision-making process.

The content of BOW communication should be examined to determine whether it addresses the important concerns held by interested stakeholders. In managing suburban deer herds, it is likely that BOW will be particularly concerned about certain objectives, such as reducing deer-related problems, providing recreational hunting opportunities, minimizing costs, and protecting human health and safety. In developing key messages to communicate to the public, it would be natural for BOW communication to focus on these concerns. However, it is also important for BOW communication to address citizens' concerns that BOW may not share. If citizens will base their opinions about management techniques on particular characteristics of those techniques, it is better for them to have BOW's best information about those characteristics rather than information from other sources that is inaccurate, misleading, or based on conjecture.

These same recommendations apply to natural resource management decision making in general. However, in many cases, managers will not have the detailed background information on the variety of citizens' concerns that was available in Irondequoit. Therefore, agencies will also need to make systematic efforts to identify and characterize these concerns through surveys, public meetings, the solicitation of letters, or some other mechanism. It is critical that managers recognize the need to question their assumptions about what characteristics of management alternatives are important. Other stakeholders may have a very different perspective and may base their publicly-expressed opinions on their particular concerns.

Alternatively, it also may be important to communicate about concerns that citizens do not think are important initially because information can increase the perceived importance of these concerns. Citizens may come to recognize that the effectiveness, humaneness, or some other characteristic of a management method is indeed an important consideration even if they had not thought that initially. Thus, agency communication may be successful at raising the stature of variables that staff members believe should be considered in management decision making.

## **Research Implications**

One limitation of our work was that the information we delivered to respondents about contraception and our assessment of the effects of that information were very closely paired. Both were incorporated into the same questionnaire. The effects of the information that we

detected may be partly attributable to this linkage. It would be valuable to explore the longevity of the effects we observed in our sample of respondents.

Qualitative methods would be useful to gather more in-depth information about how and why our respondents' attitudes changed. We detected a decrease in the acceptability of contraception and an increase in the acceptability of bow hunting among respondents from low deer density areas (regardless of whether they had received information from us). We speculated that these changes may have been due to the ongoing experience Irondequoit has had with these techniques. In-depth interviews with selected respondents would help us to assess whether our speculation was correct and to identify the particular aspects of the community's experience with these techniques which influenced public opinion. Such information would be invaluable in addressing suburban deer management issues in Irondequoit and elsewhere.

Similarly, in-depth interviews could help us understand response to our communication intervention more thoroughly. Did stakeholders who did not share a particular concern indeed perceive information about that concern as irrelevant to them? Did they perceive that information as biased because it did not address their concerns? Understanding why people responded to the information we distributed in particular ways could help us to suggest ways to tailor that information more closely to agency objectives.

The communication intervention we relied on was minimal and contrived. Including information as part of a survey is not a typical way for agencies to communicate with the public. Any actual communication program would likely rely on a combination of methods using different media to reach the public. Consequently, exploring the impacts of tailoring the information agencies distribute to stakeholders' interests in actual communication campaigns would be worthwhile. This approach would help us to determine whether the effects we observed in a contrived experiment would also occur in response to an actual communication campaign. Such research would ultimately be more useful to agencies because the results could be expected to mimic more closely the response they would get to their communication efforts. Such a study could also help to determine how public response would differ to different communication strategies.

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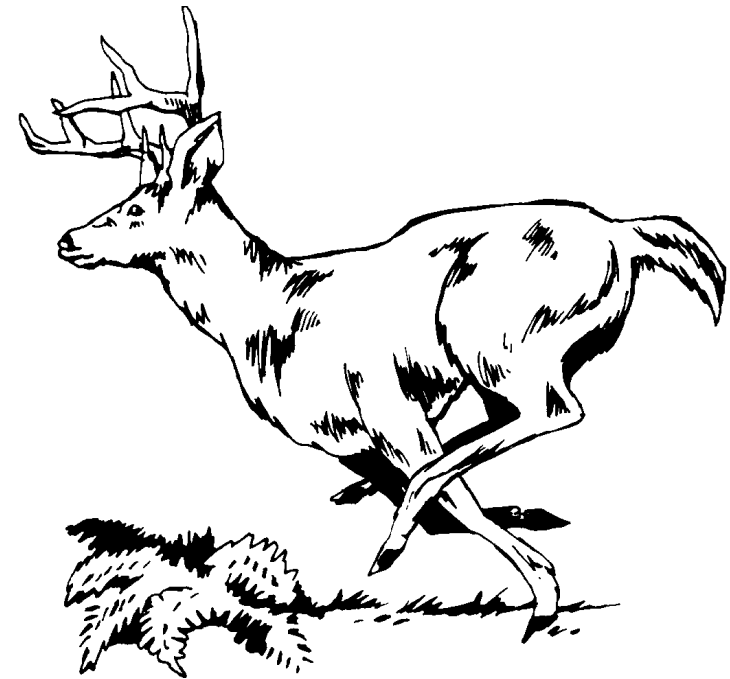
**APPENDIX A**  
**SECOND MAIL SURVEY INSTRUMENT**

# DEER MANAGEMENT

IN

## IRONDEQUOIT:

A SURVEY OF CITIZENS



Human Dimensions Research Unit  
Department of Natural Resources  
College of Agriculture and Life Sciences  
Cornell University, Ithaca, NY 14853



# **DEER MANAGEMENT IN IRONDEQUOIT:**

## **A SURVEY OF CITIZENS**

Research conducted by the  
Human Dimensions Research Unit  
in the  
Department of Natural Resources  
College of Agriculture and Life Sciences  
Cornell University

Sponsored by  
the Bureau of Wildlife  
in  
the New York State Department of Environmental Conservation  
and conducted in cooperation with  
the State University of New York College  
of Environmental Science and Forestry

This questionnaire is part of a study to assist the New York State Department of Environmental Conservation with making decisions about deer management. Please complete this questionnaire at your earliest convenience, seal it, and drop it in any mailbox (no envelope needed); return postage has been provided. **Your responses will remain confidential and will never be associated with your name.**

**THANK YOU FOR YOUR ASSISTANCE!**

Printed on recycled paper  
(This paper will be recycled again after results are tabulated.)

1. Several techniques have been suggested for managing deer in Irondequoit. How acceptable to you personally are each of the following government actions as part of a response to the problems people experience with deer in Irondequoit? (Please circle one number for each item.)

1=Not At All Acceptable  
2=Slightly Acceptable  
3=Moderately Acceptable

4=Very Acceptable  
5=Don't Know

	<u>Not At All Acceptable</u>		<u>Very Acceptable</u>	<u>Don't Know</u>	
a. Promote use of fences to keep deer away from property (yards, plants, etc.)	1	2	3	4	5
b. Use contraception (birth control) for deer	1	2	3	4	5
c. Feed deer during winter	1	2	3	4	5
d. Promote use of nonharmful chemical repellents	1	2	3	4	5
e. Trap deer and transfer them to another natural area	1	2	3	4	5
f. Use sharpshooters to kill deer at bait sites (bait and shoot)	1	2	3	4	5
g. Educate drivers about how to avoid deer on the road	1	2	3	4	5
h. Allow regulated bow and arrow hunting by licensed hunters	1	2	3	4	5
i. Reintroduce natural predators of deer	1	2	3	4	5
j. Put up deer-crossing signs on roads	1	2	3	4	5
k. Trap deer and transfer them to a venison farm	1	2	3	4	5
l. Drug, capture, and kill deer with lethal injections	1	2	3	4	5
m. Let nature take its course without human interference	1	2	3	4	5
n. Promote use of plants on private property that deer are less likely to eat	1	2	3	4	5
o. Promote use of deer whistles on cars to keep deer out of roadways	1	2	3	4	5
p. Use road-side reflectors to keep deer away from the road at night	1	2	3	4	5
q. Capture deer in baited live traps and kill them	1	2	3	4	5

2. Which two deer management options listed in Question 1 do you think are the most appropriate strategies for reducing problems people experience with deer in Irondequoit? (Please write the letters of the options you think are most appropriate.)

\_\_\_\_\_ Most appropriate deer management strategy  
\_\_\_\_\_ Second most appropriate deer management strategy

3. Which two deer management options listed in Question 1 do you think are the least appropriate strategies for reducing problems people experience with deer in Irondequoit? (Please write the letter of the option you think is least appropriate.)

\_\_\_\_\_ Least appropriate deer management strategy  
\_\_\_\_\_ Second least appropriate deer management strategy

4. **People have different reasons for preferring particular deer management methods. How important is each of the following reasons to you when you consider how deer should be managed in Irondequoit?**  
(Please circle one number for each item.)

1=Not At All Important                      4=Very Important  
2=Slightly Important                      5=Don't Know  
3=Moderately Important

How important is it to you that a deer management method in Irondequoit:

	Not At All <u>Important</u>		Very <u>Important</u>		Don't <u>Know</u>
a.	1	2	3	4	5
b.	1	2	3	4	5
c.	1	2	3	4	5
d.	1	2	3	4	5
e.	1	2	3	4	5
f.	1	2	3	4	5
g.	1	2	3	4	5
h.	1	2	3	4	5
i.	1	2	3	4	5
j.	1	2	3	4	5
k.	1	2	3	4	5
l.	1	2	3	4	5
m.	1	2	3	4	5
n.	1	2	3	4	5

How important is it to you that a deer management method in Irondequoit:

	Not At All <u>Important</u>		Very <u>Important</u>		Don't <u>Know</u>
o.	1	2	3	4	5
p.	1	2	3	4	5
q.	1	2	3	4	5
r.	1	2	3	4	5
s.	1	2	3	4	5
t.	1	2	3	4	5

5. **Several different organizations are involved in deer management in Irondequoit. How much do you trust the information you receive about deer management in Irondequoit from each of the following sources?**  
(Please circle one number for each item.)

1=Strongly Distrust                      4=Trust                                      6=Don't Know  
2=Distrust                                      5=Strongly Trust  
3=Neutral

	Strongly <u>Distrust</u>		Strongly <u>Trust</u>		Don't <u>Know</u>
a.	1	2	3	4	5
b.	1	2	3	4	5
c.	1	2	3	4	5
d.	1	2	3	4	5
e.	1	2	3	4	5
f.	1	2	3	4	5

**Contraception (birth control for deer) has been suggested as a way to reduce the deer population in Irondequoit. Questions 6-7 are concerned with what you believe to be true about deer contraception. If you feel you do not know enough about deer contraception to be able to answer any of these items, please circle “Don’t Know” for that item and proceed to the next item.**

**6. We are interested in your beliefs about deer contraception in general. Please indicate how strongly you agree or disagree with the following belief statements. (Please circle one number for each item.)**

1=Strongly Disagree      4=Agree      6=Don’t Know  
 2=Disagree              5=Strongly Agree  
 3=Neutral

I believe that deer contraception . . .

		Strongly Disagree			Strongly Agree	Don’t Know	
a.	Will not work on large, free-roaming populations of deer.	1	2	3	4	5	6
b.	Involves giving drugs to only <u>female</u> deer.	1	2	3	4	5	6
c.	Requires a lot of labor to carry out.	1	2	3	4	5	6
d.	Uses drugs that have been proven to prevent reproduction in deer.	1	2	3	4	5	6
e.	Requires only one treatment to make deer infertile for life.	1	2	3	4	5	6
f.	Requires the use of firearms (e.g. dart guns) to treat individual deer.	1	2	3	4	5	6
g.	Is currently an experimental technique which needs more testing.	1	2	3	4	5	6
h.	Is a humane way to manage deer.	1	2	3	4	5	6
i.	Involves giving drugs to only <u>male</u> deer.	1	2	3	4	5	6

I believe that deer contraception . . .

		Strongly Disagree			Strongly Agree	Don’t Know	
j.	Can prevent the growth of deer populations in natural settings.	1	2	3	4	5	6
k.	Requires treating deer orally through treated feed.	1	2	3	4	5	6
l.	Is a relatively inexpensive technique for managing deer.	1	2	3	4	5	6
m.	Has been shown to reduce the size of free-roaming deer populations.	1	2	3	4	5	6
n.	Makes meat from treated deer unsafe for humans to eat.	1	2	3	4	5	6
o.	Makes meat from treated deer unsafe for other wildlife to eat.	1	2	3	4	5	6
p.	Can not reduce the size of deer populations unless other deer management techniques are also used.	1	2	3	4	5	6
q.	Needs costly materials to carry out.	1	2	3	4	5	6
r.	Requires drugs that might be dangerous for humans.	1	2	3	4	5	6
s.	Requires deer to be treated with drugs repeatedly to maintain infertility.	1	2	3	4	5	6
t.	Could be very traumatic for deer because of how the deer are given contraceptive drugs.	1	2	3	4	5	6
u.	Might lead to harmful side effects on deer.	1	2	3	4	5	6
v.	Involves giving drugs to both male and female deer.	1	2	3	4	5	6
x.	Uses drugs that have been adequately tested for human safety	1	2	3	4	5	6

7. **We are interested in your beliefs about the potential impacts on the Irondequoit community of adopting deer contraception as an ongoing deer management strategy. Please indicate how strongly you agree or disagree with the following statements. (Please circle one number for each item.)**

1=Strongly Disagree      4=Agree                      6=Don't Know  
 2=Disagree                5=Strongly Agree

3=Neutral

I believe that if contraception were used to manage deer in Irondequoit:

		<u>Strongly Disagree</u>			<u>Strongly Agree</u>	<u>Don't Know</u>	
a.	The deer population would become smaller.	1	2	3	4	5	6
b.	The number of deer wandering across roads and private property would increase.	1	2	3	4	5	6
c.	The way that the drugs would be given to deer would pose no health or safety threats to humans.	1	2	3	4	5	6
d.	The size of the deer population would not be affected for many years.	1	2	3	4	5	6
e.	The number of deer-related problems would quickly decrease.	1	2	3	4	5	6
f.	There would be little disruption to Irondequoit residents' everyday lives.	1	2	3	4	5	6
g.	People giving the drugs to the deer might trespass on private property.	1	2	3	4	5	6
h.	Most Irondequoit residents would not notice the work being carried out.	1	2	3	4	5	6
i.	The number of deer-related problems would not change.	1	2	3	4	5	6
j.	The work would make little noise.	1	2	3	4	5	6
k.	Most citizens in Irondequoit would support the use of deer contraception to manage deer.	1	2	3	4	5	6
l.	It would lead to fewer opportunities for recreational hunting in New York.	1	2	3	4	5	6

Please use the space below for any additional comments you may wish to make.

**Thank You For Your Time and Effort!**

**To return this questionnaire, simply seal it (postage has been provided) and drop it in the nearest mailbox.**

**APPENDIX B**

**EFFECTIVENESS AND HUMANENESS INFORMATION**

## Effectiveness Information

### *Birth Control for Deer?*

For many years, the Town of Irondequoit has been concerned about a large local deer herd. People there have complained about problems caused by the deer. Deer cross roads and are hit by cars, eat plants in people's yards, and damage local natural areas.

Some people want the town to reduce the deer herd using contraceptive, or birth control, methods. One type of birth control that has been tried on deer is called *immunocontraception*. Currently, scientists are testing this method in Irondequoit and at the Seneca Army Depot.

The scientists can treat deer with contraceptive drugs using a dartgun or by capturing deer and injecting them. There are different types of immunocontraceptive drugs, but all are experimental. Researchers must get special permits to use them. The work in Irondequoit and at Seneca Army Depot will help answer many questions about immunocontraception. Some of these questions are about how effective it would be at controlling the local deer herd.

Currently, what is known about immunocontraception includes:

- Immunocontraceptive drugs can prevent reproduction in individual deer.
- Many deer in a herd must be treated with these drugs to stop the population from growing. Otherwise, the untreated deer will continue to reproduce and the population will grow.
- Treating many of the deer in a herd is difficult. Deer are hard to find because they can hide in the woods. Once the deer are found, they must be caught or darted.
- For the drug being used in Irondequoit to be effective, deer must be treated twice during late summer or early fall. They must be treated once each year after that, too. Scientists must be able to find and treat the same deer over and over again for this method to be effective.
- The deer in Irondequoit are free-ranging. Immunocontraception has *not* yet been able to reduce the number of deer in free-ranging herds. The tests in Irondequoit will help to find out whether immunocontraception can reduce the size of free-ranging deer herds.
- Scientists may find a way to treat enough deer to reduce the herd. If they do, the herd will only become smaller as adult deer die off from other causes. This could take years.

Scientists hope that their work in Irondequoit and at Seneca Army Depot will provide more information about immunocontraception in the future.

Please answer the questions in this questionnaire to tell us what YOU think about contraception and deer management.

## Humaneness Information

### *Birth Control for Deer?*

For many years, the Town of Irondequoit has been concerned about a large local deer herd. People there have complained about problems caused by the deer. Deer cross roads and are hit by cars, eat plants in people's yards, and damage local natural areas.

Some people want the town to reduce the deer herd using contraceptive, or birth control, methods. One type of birth control that has been tried on deer is called *immunocontraception*. Currently, scientists are testing this method in Irondequoit and at the Seneca Army Depot.

The scientists can treat deer with contraceptive drugs using a dartgun or by capturing deer and injecting them. There are different types of immunocontraceptive drugs, but all are experimental. Researchers must get special permits to use them. The work in Irondequoit and at Seneca Army Depot will help answer many questions about immunocontraception. Some of these questions are about whether it would cause any harm to deer that were treated.

Currently, what is known about immunocontraception includes:

- Contraception does not involve intentionally killing deer.
- However, up to 5% of treated deer may die. Some die from the stress of being captured and handled. Others may die if they are hurt when they are darted.
- Deer normally breed for a few months each fall. During this time, female deer are receptive to males. With some types of immunocontraceptive drugs, female deer stay receptive to males about 2 months longer than normal. When this happens, breeding continues until the middle of the winter.
- During their breeding season, male deer spend a lot of time chasing females. This uses a lot of energy for both males and females. It also takes some of the time that they could otherwise spend feeding. Because some immunocontraceptive drugs prolong breeding, it puts deer under more stress. It may even put them at greater risk of starving during severe winters.
- Some types of immunocontraceptive drugs may cause the antlers of treated male deer to freeze and break off as winter approaches. Scientists do not know whether this causes pain or other problems for male deer.

Scientists hope that their work in Irondequoit and at Seneca Army Depot will provide more information about immunocontraception in the future.

Please answer the questions in this questionnaire to tell us what YOU think about contraception and deer management.



**APPENDIX C**  
**EXPLANATION OF TABLES**

The columns in the tables are defined as follows:

### **B – Coefficients of Model Terms**

For continuous variables:

- a positive coefficient shows that the dependent variable increases as the variable associated with this coefficient increases; and
- a negative coefficient shows that the dependent variable decreases as the variable associated with this coefficient increases.

For categorical variables:

- 2 values exist for each variable;
- the dependent variable is higher for the value of the variable associated with the larger coefficient.

### **P – P-Values**

This column provides the significance levels (probability of a Type I error) for each term.