

Attitudes of the Michigan public and wildlife agency personnel toward lethal wildlife management

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Abstract Identifying attitudes of the public and wildlife agency personnel is important to implementing management policies, particularly in controversial situations. In spring 1999 we designed a mail survey to assess attitudes of Michigan residents toward a broad array of natural resource issues. We sent surveys to Michigan residents (56% response) and to all employees of the Michigan Department of Natural Resources' Wildlife Division (76% response) in order to compare public and personnel responses. The survey portion reported here assesses support for lethal wildlife management in Michigan. We identified 7 situations in which lethal wildlife management can be used: to control wildlife diseases, ensure species survival, preserve the ecological health of an area, control wildlife damage, ensure public safety, manage population levels of wild animals, and provide opportunities for people to gather food. Wildlife agency personnel were more supportive of lethal wildlife management in all situations presented than were members of the public. However, a majority of the public supported each lethal management situation as well. The largest area of disagreement between the 2 groups was in support for lethal management to obtain food. We also assessed differences by demographic and background characteristics. The general public support for lethal management we found suggests that it may be possible for managers to implement lethal wildlife management with few conflicts. However, since public support for lethal wildlife management varies by management situation, managers need to consider public attitudes in specific lethal management situations.

Key words agency, attitudes, lethal control, managers, Michigan, opinion, public, wildlife

In much of the United States, human-wildlife conflicts and other wildlife-related problems have become more common in recent years, leading managers to emphasize public opinion research about possible management solutions (Decker and Chase 1997). The rise in wildlife problems has been attributed to several factors, including management practices favoring certain species (Conaway 1992), growing human populations, and urban expansion into areas that were formerly wildlife habitat (Curtis and Richmond 1992). Not surprisingly, wildlife managers have often focused on controlling wildlife populations as a way to decrease these

problems (Curtis et al. 1993). Wildlife population control has utilized both lethal and nonlethal methods. Human-dimensions researchers have found that a majority of the public generally prefers nonlethal means of controlling problem species, such as birth control or removal of animals to another area (e.g., Schmidt et al. 1997, Reiter et al. 1999). However, several studies have indicated that lethal control methods may be acceptable to the public if they feel the situation warrants their use (Schmidt et al. 1997, Loker et al. 1999).

Because members of the public and agency personnel often differ greatly in their perceptions of

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particular management actions (Peyton and Langenau 1985, Leuschner et al. 1989, Vining and Ebreo 1991, Messmer et al. 1997, Lauber and Knuth 2000), it is important to identify where opinions diverge when potentially controversial policies, such as lethal wildlife management, are being considered. Although managers ultimately institute wildlife policies, identifying and reconciling disparities between public and agency personnel perceptions of lethal wildlife management is essential to policy implementation. Relying solely on managers to determine lethal management policy in the public interest is likely to lead to disputes if managers do not accurately gauge public desires. Researchers have found that natural resource managers are not always accurate in gauging public opinion and response to management decisions, even for those stakeholder groups with which they are most familiar (Hendee and Harris 1970, Saltiel and Irby 1998). Further, Muth et al. (1998) found some disagreement among wildlife managers themselves about the appropriateness of various management policies. Identifying and reconciling disagreement within the agency will allow wildlife agencies to develop a single, cohesive management policy that will be essential in leading the direction of wildlife control in the future (Muth et al. 1998).

While few studies have examined agency personnel acceptance of lethal wildlife management, more detailed information is available for the public. Several studies have found public support for lethal wildlife management when people are faced directly with wildlife problems such as human injury (Manfredo et al. 1998, Wittmann et al. 1998), wildlife damage (Schmidt et al. 1997, Wittmann et al. 1998, Manfredo et al. 1999), and wildlife diseases. Not surprisingly, public safety consistently emerges as one of the most important factors in support for lethal management (Kilpatrick and Walter 1997, Schmidt et al. 1997, Reiter et al. 1999). Potential for wildlife disease transmission to humans or other species also seems to be an important factor in public acceptance of lethal wildlife management. The public has been found to be supportive of lethal management to control diseases in a variety of species (Kilpatrick and Walter 1997, Wittmann et al. 1998), and Colorado residents found trapping acceptable to control wildlife diseases, even though they were not supportive of trapping in general (Manfredo et al. 1999).

Even when people are not directly affected by wildlife problems, lethal methods may be used to

protect other species or habitats. Few studies have explored public acceptance of lethal control measures to protect wildlife species and ecosystems, despite increasing abundance of some wildlife species and the resulting impacts on ecosystems. For example, browsing by white-tailed deer (*Odocoileus virginianus*), which are considered overabundant throughout much of the United States, has negatively impacted forest regeneration (Alverson and Waller 1997) and biodiversity (McShea and Rappole 1997, see Christoffel and Craven 2000). In such cases, managers have turned to lethal control measures to protect wildlife species and ecosystems. Several recent studies conducted in the United States have found public support for lethal management (specifically, the use of regulated hunting) to control overabundant wildlife populations (Duda et al. 1998).

Study hypotheses

The purpose of this study was to assess attitudes of the public and wildlife agency personnel toward lethal wildlife management in 7 situations: ensuring public safety, controlling wildlife damage, controlling wildlife diseases, ensuring species survival, preserving ecological health, managing wildlife population levels, and gathering food. Based on substantive reasoning and findings from similar studies, we hypothesized that wildlife personnel would be more supportive of lethal wildlife management than would members of the public in each of the situations assessed. Among both groups, we anticipated that the greatest support existed for protection of public safety, controlling wildlife damage, and controlling wildlife diseases. We also expected that men, older people, those with lower levels of education and income, those growing up in more rural areas, property owners, more frequent hunters and anglers, those who have experienced wildlife problems, and those who are more supportive of consumptive recreation would be more supportive of lethal wildlife management overall. Finally, we hypothesized that agency personnel in wildlife management positions would be more supportive of lethal management than would those in nonmanagement positions, such as administrators and secretarial staff.

Methods

We developed a mail survey to assess attitudes toward natural resource issues in general and lethal

wildlife management issues in particular in Michigan, USA. To evaluate public and agency opinions, we contacted members of the Michigan public and employees of the Wildlife Division of the Michigan Department of Natural Resources (MDNR).

Public survey

We mailed the survey to a representative sample of 2,000 Michigan residents in February 1999 (see Mertig and Koval 1999, Koval 2002). We purchased names and addresses from Survey Sampling, Inc. (Fairfield, Conn.), a company specializing in drawing representative samples from public telephone listings. Following recommendations by Dillman (1978), we used a series of mailings to encourage response to the survey. As an incentive to complete the survey, we entered respondents into a prize drawing for one of several gift cards to a national discount store. We sent a brief follow-up survey to all public nonrespondents in an attempt to identify sources of nonresponse bias.

Wildlife agency survey

In May 1999 we sent all 186 MDNR Wildlife Division employees a survey identical to that sent to the public. To increase response and to ease fears of individual identification, we coded agency surveys only by broad job classification to ensure that individual respondents were unknown to the researchers. Using broad codes precluded multiple individualized mailings; however, we believed that personnel interest in the survey topic would generate sufficient response and make additional mailings unnecessary.

Variable measurement

We developed several statements to assess support for lethal wildlife management in 7 real-life situations. Since other researchers have found strong support for using lethal management to protect people from direct wildlife threats, we posed the following 3 questions: as long as it is properly controlled, is it acceptable to kill individual wild animals in order to 1) control wildlife diseases, 2) control wildlife damage, and 3) ensure public safety?

To measure support for lethal management in situations where overabundant species may be a threat to other species or habitats, we asked the following 2 questions: as long as it is properly controlled, is it acceptable to kill individual wild animals in order to 4) ensure species survival and 5) preserve the ecological health of an area?

Lethal methods may also be used to maintain or manage population levels of species that are not overabundant or problematic, but have potential to become so. To measure this, we asked: as long as it is properly controlled, is it acceptable to kill individual wild animals in order to 6) manage population levels of wild animals?

Finally, while wildlife managers use hunting or trapping to achieve such management goals as reducing wildlife populations or controlling damage, subsistence hunting and trapping are legitimate management objectives in themselves, since large public constituencies desire access to wildlife resources for these purposes. To measure support for subsistence hunting or trapping, we asked: as long as it is properly controlled, is it acceptable to kill individual wild animals in order to 7) provide opportunities to gather food?

After the 7 situational items, we posed one additional statement to determine a respondent's acceptance of killing individual animals under any circumstance: 8) it is *never* acceptable to kill individual wild animals.

For each statement, respondents were asked to choose 1 of 3 possible responses: yes, no, or unsure. Situations were coded ordinally for bivariate analysis, with higher numbers reflecting support for lethal management. We constructed a scale assessing degree of support for lethal management using responses to the 8 statements. Respondents must have answered at least 1 of the 8 items to receive a score on the scale. The score was determined by summing the number of situations from the 7 situational items in which they felt lethal management was acceptable (i.e., a "yes" response). Respondents who felt it was not acceptable to kill an individual animal under any circumstance were given a score of zero on the scale. The Lethal Wildlife Management (LWM) Scale, therefore, ranged from 0-7, with a higher score reflecting more support for lethal wildlife management overall. We also collected information on several independent explanatory variables: gender, age, education, income, childhood residence, property ownership, frequency of participation in hunting and fishing, previous experience with wildlife problems, support for consumptive recreation, and, for agency personnel only, management position (Appendix).

Data analysis

We analyzed data using SPSS 10.0.7 for Windows software for social statistics (SPSS, Inc. 2000).

Because of a large gender bias in the public sample and because gender has a well-documented effect on wildlife attitudes and recreation participation (e.g., Kellert and Berry 1987), we applied weights for descriptive analyses of the public sample to more accurately reflect the proportions of men and women in the Michigan population. We assessed comparisons among sample means using ANOVA and compared differences between proportions using Pearson's chi-square tests. To determine whether level of support for lethal management differed between situations, we ranked the percentages of "yes" responses in each situation from highest to lowest and treated them as Bernoulli proportions (Lindgren 1976). We compared the Bernoulli proportion for each situation to that of the next highest proportion on the list and used pairwise Z-test statistics to compare approval rates for the lethal management situations within each group. We used Principal Components Analysis and Cronbach's alpha to assess overall LWM scale dimensionality and reliability, respectively. We used simple and multiple linear regression analyses to evaluate the effect of explanatory variables on the LWM Scale (Tabachnick and Fidell 2001).

Results

The final public response rate was 56% ($n=952$, sampling error $\pm 3\%$) after deletion of bad addresses and those ineligible to respond. Seventy-six percent ($n = 142$) of wildlife agency personnel returned completed surveys.

Sample characteristics

Public respondents were somewhat older on average than were agency personnel (Table 1). Agency personnel were more highly educated and earned higher incomes than did members of the public. Members of the public were about twice as likely as agency personnel to have spent all or most of their childhood living in urban or metropolitan areas. Both groups were similar in terms of property ownership. Agency personnel

participated in hunting and fishing more often than did members of the public. Overall, wildlife agency personnel scored higher on a scale measuring support for consumptive recreation than did the public. Similar proportions of both groups had experienced problems with wildlife in the last 5 years.

Support for lethal wildlife management

Wildlife agency personnel were more likely than the public to support lethal wildlife management in all situations evaluated, though the public was also fairly supportive in all cases as well (Table 2). The difference in level of support for lethal management ranged from 10–33%, with greatest disparity in support with regard to providing opportunities to gather food. Both groups were opposed to the statement, "It is *never* acceptable to kill individual wild animals." When we ranked responses from highest to lowest in terms of support for lethal wildlife management, Bernoulli proportions revealed no significant differences in agency personnel support for the use of lethal management in consecutively ranked situations. For the public, differences existed between levels of support for controlling wildlife diseases and ensuring species survival, managing wildlife populations and controlling wildlife damage, and between controlling wildlife damage and gathering food.

LWM scale

The LWM scale achieved a Cronbach's alpha of 0.77, reflecting a high level of reliability or consistency

Table 1. Results of explanatory variables used to assess public and wildlife agency personnel sample group attitudes toward lethal wildlife management in Michigan, 1999.

Statistic	Public ^a	<i>n</i>	Agency	<i>n</i>	Test statistic	df	<i>P</i>
% Male	48	910	72	138	$\chi^2 = 28.652$	1	<0.001
Mean age	52	891	44	135	$F = 33.850$	1,025	<0.001
% With college degree+	31	909	68	138	$F = 67.832$	1,046	<0.001
% With household income $\geq$ \$40,000	53	815	77	132	$F = 17.103$	946	<0.001
% Growing up in an urban or metro area	41	909	22	139	$F = 23.865$	1,047	<0.001
% Owning property	79	906	83	139	$\chi^2 = 0.799$	1	0.371
% Frequently hunting	17	907	55	142	$F = 144.369$	1,048	<0.001
% Frequently fishing	20	911	32	142	$F = 22.404$	1,053	<0.001
% Experiencing wildlife problems	55	952	61	142	$\chi^2 = 1.470$	1	0.225
Mean support for consumptive recreation	25.5	939	30.8	142	$F = 105.77$	1,080	<0.001

^a Public results were weighted to reflect proportions of men and women in the Michigan population.

Table 2. Level of support for lethal wildlife management situations by the public and wildlife agency personnel in Michigan, 1999.

Situation	Statistic	Public ^a	Agency	χ^2	df	P
Control wildlife diseases ^b	% Yes	89	99	15.229	1	<0.001
	% No	4	0			
	% Unsure	7	1			
	n	935	142			
Ensure species survival	% Yes	76	94	23.901	2	<0.001
	% No	10	1			
	% Unsure	13	4			
	n	923	142			
Preserve ecological health	% Yes	72	96	36.904	2	<0.001
	% No	10	0			
	% Unsure	18	4			
	n	920	141			
Control wildlife damage	% Yes	61	89	42.833	2	<0.001
	% No	18	2			
	% Unsure	21	9			
	n	928	142			
Ensure public safety	% Yes	76	92	18.162	2	<0.001
	% No	12	2			
	% Unsure	11	6			
	n	927	142			
Manage population levels	% Yes	68	95	43.583	2	<0.001
	% No	17	2			
	% Unsure	15	3			
	n	932	142			
Provide opportunities to gather food	% Yes	56	89	54.836	2	<0.001
	% No	21	3			
	% Unsure	23	9			
	n	921	140			
It is never acceptable to kill individual wild animals ^c	% Yes	3	0	31.561	1	<0.001
	% No	79	99			
	% Unsure	18	1			
	n	901	139			

^a Public results were weighted to reflect proportions of men and women in the Michigan population.

^b "No" and "Unsure" responses were combined for this situation to meet requirements of the chi-square test.

^c "Yes" and "Unsure" responses were combined for this situation to meet requirements of the chi-square test.

among the situations. Principal Components Analysis found the scale to be unidimensional, extracting one factor that explained 43% of the variance in situations. We assessed scale reliability and dimensionality using the public sample. Wildlife agency personnel scored higher on the LWM scale (i.e., they approved of killing individual wild animals in more cases) than did the public ($F=79.537$, $df=1083$, $P<0.001$). On average, the public approved of killing individual animals in 5 of the 7 situations, while agency personnel approved in all situations.

effect, explaining 11% of the variance when taken alone.

Discussion

Sample characteristics

Gender bias in the wildlife agency was not unexpected, as it reflected proportions of men and women working for the agency. Gender bias among the public was likely related to 1) a larger proportion of men than women listed in telephone

Among the public, men, those who participated more frequently in hunting and fishing, those who had experienced problems with wildlife in the last 5 years, and those who were supportive of consumptive recreation were more supportive of lethal wildlife management in bivariate analysis (Table 3). Multivariate analysis revealed that only gender and support for consumptive recreation remained significant. All independent variables together explained 22% of the variation. Support for consumptive recreation had a somewhat stronger effect than did gender. In fact, support for consumptive recreation alone explained 18% of the variance in support for lethal wildlife management.

In bivariate analysis, wildlife agency personnel who were older, hunted more frequently, were more supportive of consumptive recreation, and were in management positions were all more likely to support lethal wildlife management. Hunting frequency dropped out in multivariate analysis; only age, support for consumptive recreation, and management position had significant effects. All independent variables combined explained about 24% of the variation. Management position had the strongest

Table 3. Standardized simple and multiple regression coefficients and *R*-squared values for predicting Lethal Wildlife Management Scale value from background characteristics by sample groups in Michigan, 1999. *P*-values are presented parenthetically.

Explanatory variable	Public		Agency	
	Bivariate	Multivariate	Bivariate	Multivariate
Gender	0.264 (<0.001)	0.152 (<0.001)	0.164 (0.063)	0.028 (0.811)
Age	0.031 (0.390)	0.038 (0.286)	0.224 (0.011)	0.221 (0.023)
Education	-0.012 (0.734)	0.040 (0.298)	0.122 (0.168)	0.001 (0.990)
Income	0.060 (0.099)	0.033 (0.411)	0.091 (0.303)	-0.074 (0.462)
Childhood residence	-0.064 (0.079)	0.016 (0.647)	-0.161 (0.069)	-0.152 (0.082)
Property ownership	0.056 (0.119)	-0.036 (0.305)	0.045 (0.615)	-0.096 (0.306)
Hunting frequency	0.203 (<0.001)	-0.087 (0.058)	0.180 (0.042)	-0.056 (0.713)
Fishing frequency	0.190 (<0.001)	0.045 (0.254)	0.006 (0.947)	-0.130 (0.202)
Wildlife problems	0.105 (0.004)	0.044 (0.176)	0.127 (0.150)	0.139 (0.100)
Consumptive recreation	0.428 (< 0.001)	0.426 (<0.001)	0.260 (0.003)	0.218 (0.043)
Management (agency)			0.335 (<0.001)	0.318 (0.004)
<i>n</i>	764	764	129	129
Model <i>R</i> ²		0.218		0.238
Adjusted Model <i>R</i> ²		0.207		0.166

directories (the source of the sample) and 2) a greater level of interest in the subject of the survey among men than women.

The age difference found between the 2 groups was not surprising, given that people retire from the agency as they get older. While agency personnel had higher education levels than the public, public respondents were more highly educated than would be expected based on United States Census Bureau (2000) results, as is typical in social research (Dillman 1978).

This survey appears to have overestimated hunting and angling populations in Michigan as compared to statewide estimates (United States Department of Interior and Department of Commerce 2002). Measurement may have been a factor in this result, as respondents were asked to report participation in hunting and fishing in "a typical year." Asking the question this way could have led to a greater proportion of hunters and anglers than would be found based on actual participation in a single year. Hunters and anglers also may have been more likely to respond to the survey due to a greater interest in natural resource issues than could be the case for many others in the public.

Support for lethal wildlife management

Support for lethal wildlife management was remarkably high within both the public and wildlife agency personnel groups. Majorities of both groups believed that all situations presented

acceptable conditions for use of lethal methods. Still, differences between public and agency personnel support for lethal management in each situation should not be discounted, as they may indicate areas of potential discord. As expected, wildlife agency personnel overwhelmingly supported lethal management regardless of the situation. Reasons behind using lethal wildlife management seemed to be much more important for members of the public in determining acceptance of such management policies.

Lethal management to control wildlife diseases received the highest level of public support and was among the highest for wildlife agency personnel. Although this was not expected, it was not surprising, given current conditions in Michigan. In recent years, Michigan has been facing a complex problem involving bovine tuberculosis (*Mycobacterium bovis*; BTB) that has affected the health of Michigan's livestock and white-tailed deer herds (Bovine TB Eradication Project 2002). Even though the chance is remote, humans can also contract BTB. White-tailed deer are believed to be a reservoir host of the disease in Michigan, and much of the management to control BTB has focused on controlling deer in areas where herds have been affected. Media reports have heightened public awareness of the BTB problem, as well as methods being used to control BTB in Michigan's deer herd. Further exploration into public motivations for supporting lethal methods to control wildlife diseases is necessary. Our results indicated that using lethal methods to control BTB may not be controversial for the public in general, despite concerns among specific stakeholder groups (e.g., hunters).

Support for lethal management to protect public safety was somewhat lower than expected for the public. This does not reflect a lack of interest in protecting public safety, as indicated by the strong support by both public and agency personnel groups. Our results indicated that public safety was simply less of a concern than other issues in

Michigan—in particular, controlling wildlife diseases.

Contrary to expectations and despite increasing incidents and costs associated with wildlife damage noted by researchers in recent years (e.g., Connelly et al. 1987), public support for lethal management to control wildlife damage was low relative to other situations. A majority of the public still supported lethal management in this situation, however. Several factors might account for the lower level of support for lethal management in wildlife damage situations. Some people may see wildlife damage as a cost of choosing to live near wildlife. Such costs may be acceptable if people perceive benefits from having wildlife near their homes (e.g., wildlife viewing). Also, the focus here on a general situation may not accurately reflect attitudes and concerns of those experiencing wildlife damage, particularly in areas of severe damage. Researchers have found that as damage severity increases, so does support of lethal management to control nuisance wildlife (Wittmann et al. 1998, Loker et al. 1999, West and Parkhurst 2002). Finally, people may prefer non-lethal means of controlling wildlife damage. Further research is necessary to discover what factors play a role in public acceptance of lethal management to control wildlife damage.

As expected, members of the public were much less supportive of wildlife population control with lethal means than were agency personnel. However, the public still supported lethal management in this situation. Wildlife managers are responsible for setting population goals for game species and often use hunting or trapping to reach goals. It was not surprising, then, that agency personnel were supportive of lethal wildlife population control. Some members of the public may not be as familiar with these common management practices, leading to less public support.

As with controlling wildlife population sizes, hunting or trapping for food was not as popular with the public as were other situations. The public seemed to be more supportive of lethal management to control a perceived wildlife problem than to obtain food. Personnel were more supportive of this situation than were the public. Of the lethal management situations we presented, this one had the largest disparity between public and agency support, highlighting an area of potential conflict. Because hunting and trapping are also considered important tools for wildlife managers, it is especially important to be aware of public attitudes toward this issue.

LWM scale

Of all explanatory variables, gender and attitude toward consumptive recreation were most strongly related to public support of lethal wildlife management overall. Frequency of hunting and fishing participation and experience with wildlife problems were also significant, though only in bivariate analyses. As expected, men were more supportive of lethal wildlife management than women. Other studies have found women more likely than men to oppose lethal wildlife management techniques (Donnelly and Vaske 1995, Teel et al. 2002). Women's opposition to lethal management was most likely related to reportedly high levels of concern about animal cruelty and exploitation (Kellert 1980), and a general aversion to killing or violence (Gray 1993).

Attitude toward consumptive recreation was a stronger predictor of public support for lethal management than any other explanatory variable. Donnelly and Vaske (1995) suggested that specific attitudes related to a management action were better for predicting public reaction than traditional sociodemographic characteristics. In addition, lethal management often involves consumptive recreation as a management tool. It was not surprising that those who supported consumptive use of wildlife also found lethal methods to control wildlife populations acceptable. One lethal management situation discussed in our survey specifically concerned attitudes toward consumptive recreation ("provide opportunities to gather food"). Given this overlap, it was highly likely that a person's attitude toward consumptive recreation would influence attitude toward lethal wildlife management. However, we included attitude toward consumptive recreation in order to explore relationships between other independent variables and support for lethal wildlife management while controlling for the impact of consumptive recreation attitude.

The prediction that members of the public who hunted or fished more frequently and those experiencing problems with wildlife would be more supportive of lethal wildlife management was accurate (though only in bivariate analysis). Hunters and anglers are consumptive users of wildlife resources and are more likely than nonparticipants in consumptive recreation to share a utilitarian disposition toward animals (Kellert 1980). It was therefore not surprising that a positive relationship was found between hunting or fishing frequency and

support for lethal wildlife management. Researchers in Utah found similar results: hunters were more supportive of lethal predator control than were nonhunters (Teel et al. 2002). Donnelly and Vaske (1995) found that hunters in New Hampshire were more supportive of a proposed moose (*Alces alces*) hunt than were nonhunters. We found that hunting and fishing frequency no longer predicted support for lethal management in multivariate analysis, suggesting these relationships may be mediated by attitude toward consumptive recreation.

Other studies have also suggested that experience with wildlife problems increases the likelihood one will support lethal wildlife management. In one case, homeowners and agricultural producers in Virginia who experienced wildlife damage problems were more likely to support dramatic reductions in wildlife population size (West and Parkhurst 2002). A Connecticut community experiencing numerous deer problems voted in favor of an archery hunt to cull the herd (Kilpatrick and Walter 1997). While experience with wildlife problems was not the strongest predictor of attitude toward lethal management, it was an important variable to assess as concerns about human-wildlife conflicts continue to grow. Further, in more specific management situations than explored here, particularly in local areas where management action is being considered to control nuisance wildlife, experience with problems will likely be an even stronger predictor of public support for lethal management.

Age, consumptive recreation attitude, and management position were the strongest predictors of support for lethal wildlife management among wildlife agency personnel. Hunting frequency also was significant in bivariate analysis. Older personnel were more likely to support lethal management than were younger personnel. Kellert (1980) and Kaltenborn et al. (1999) found that older people tend to hold more utilitarian views of animals than do younger people. This could be true for older wildlife personnel as well. Younger people tend to be more humanistic (Kellert 1980) and ecologicistic (Kaltenborn et al. 1999) in orientation toward animals, suggesting they may be more open to a variety of solutions to wildlife overabundance issues. In addition, older personnel are likely to possess a more traditional management perspective than their younger counterparts. Kennedy and Mincolla (1982) suggested that new recruits into natural

resource management have a somewhat idealistic view of the field. With time, some idealism may fade as they gain experience and deal with the realities of natural resource management, such as the need to implement lethal wildlife management. The fact that older personnel were more supportive of lethal wildlife management may therefore reflect not only age but also their experience in wildlife management. Further study is needed to assess impacts of agency personnel age and experience on support for lethal wildlife management.

Positive agency personnel attitudes toward consumptive recreation were related to support for lethal wildlife management. Unlike that of the public, however, agency personnel attitude toward consumptive recreation was not the strongest predictor of support. Management position was the strongest predictor of attitude toward lethal management. Among wildlife personnel, managers were more likely to support lethal management than were nonmanagers. We suggest that managers were more aware of problems with wildlife as well as methods to deal with problems. They were more likely willing to do whatever it takes to manage wildlife problems successfully with a minimum of costs. In a study comparing attitudes toward animals among Bureau of Land Management biologists and the public, Peyton and Langenau (1985) proposed that biologists tended to rely on objective scientific arguments rather than value-laden judgments to assess wildlife management issues. This perspective likely leads to greater support for lethal wildlife management.

It was surprising that no other significant relationships were found between other explanatory variables and support for lethal wildlife management in either sample group. Studies have found that people with lower levels of education (Donnelly and Vaske 1995, Teel et al. 2002) and income (Donnelly and Vaske 1995) were more likely to support lethal management actions. Rural residents have been found more accepting of lethal wildlife management than their urban counterparts (Teel et al. 2002). We found no such relationships. We also found that property owners were not more supportive of lethal management than nonproperty owners. We suggest that landowners in Michigan may be tolerant of some wildlife damage because of perceived benefits of having wildlife on their land or because they are not experiencing wildlife damage severe enough to warrant lethal management of wildlife.

Response bias

Men, hunters, anglers, and those with higher education levels responded to the survey in greater numbers than would be expected based on known populations in Michigan. Response bias among these groups may have resulted in artificially high levels of support for lethal wildlife management. We were able to adjust for gender bias in our sample and respondents through weighting. Space limitations do not allow for complete analysis of all other potential response biases, and it is never possible to fully characterize survey nonrespondents. However, managers may be interested in evaluating differences in support for lethal management among hunters and nonhunters. For the purpose of this discussion, nonhunters are those who indicated that they never hunt in a typical year, and hunters are those who reported hunting frequently, sometimes, or rarely in a typical year. Brief analysis revealed that while hunters were more supportive of lethal management than nonhunters in most situations, there were no differences between groups in support for lethal management to control wildlife diseases or ensure public safety. Hunters and nonhunters alike were more supportive of lethal management to control wildlife diseases than for any other purpose. Further, majorities of both hunters and nonhunters were supportive of lethal management in all situations. Thus while differences existed between groups, the high level of support for lethal wildlife management found among hunters and nonhunters suggests that our results may be fairly accurate in representing the state despite possible response biases.

Management implications

While we found majority public support for all lethal management situations presented, some situations received more public support than others. In particular, the public was overwhelmingly supportive of lethal wildlife management to control wildlife diseases, ensure species survival, and ensure public safety. They were less supportive of lethal management in other situations such as controlling wildlife damage or providing opportunities to gather food. Diefenbach and Palmer (1997) suggested that managers should use marketing techniques to promote wildlife population control and management to the public. By focusing on the issues of greatest concern to the public, managers have the best chance of developing a message that

will increase public support for lethal wildlife management, and thereby decrease disruptive opposition to management policies. Marketing campaigns utilizing a variety of approaches, including print and television media, government brochures, and public meetings, could be helpful in reaching diverse audiences to broaden support for lethal wildlife management policy.

Managers should be aware that despite our findings of general support for lethal wildlife management, others have found that lethal techniques remain controversial, particularly in urban and suburban environments, even after having been implemented for some time (Lauber and Knuth 2000, Lauber et al. 2001). Persisting conflicts over use of lethal management suggest it will be important to continue monitoring public opinion in the future as urban and suburban areas continue to grow and the number of human-wildlife conflicts continues to increase.

Further, because we found that agency personnel were more supportive of each lethal management situation than were the public, managers seeking to implement lethal wildlife management should be cautious. Majority public support for each situation suggests that managers have a good base from which to start, but public support varies greatly depending on the situation. When situations arise in which lethal wildlife management is being considered, managers should attempt to include the public in the decision-making process in order to bolster policy support and reduce potential conflicts (Bjerke et al. 2000). Doing so will also allow managers to gain insight into public perspectives and management preferences for the situation, to educate public participants about the diversity of needs and concerns for public lands, and to develop management plans that satisfy a variety of stakeholder interests (Lauber et al. 2001).

Finally, we assessed attitudes toward lethal management in general. Managers should continue to study public attitudes in specific management situations, as attitudes may vary by species of concern, area of interest, and severity of issue (Riley and Decker 2000). Case-specific studies may be necessary to effectively predict public reaction to lethal management actions in particular situations. Analyses of different sociodemographic and attitudinal explanatory variables also could provide a better picture of public attitudes toward lethal wildlife management overall and for specific lethal management situations. Detailed attitudinal vari-

ables could be especially helpful in gauging public reaction to management actions. Such analyses could allow managers to better predict opposition to planned lethal wildlife management and therefore provide opportunities for building consensus prior to implementation.

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See next page for Appendix.

Appendix. Independent variables measured and used to explain support for lethal wildlife management among members of the public and wildlife agency personnel in Michigan, 1999.

Variable	Question and coding
Gender	Are you male or female? 0 = Female, 1 = Male
Age	In what year were you born? Age = 1999–year born
Education	What is the highest level of formal education that you have completed? Ranged 1–7 (<High School Graduate–Graduate or Professional Degree)
Income	What was your gross household income (before taxes) in 1998? Ranged 1–5 (<\$20,000–\$75,000 or more)
Childhood residence	In what type of area did you spend all or most of your childhood? Ranged 1–5 (Rural, Farm–Metropolitan Area)
Property ownership	Do you own property in Michigan? 0 = Did not own property, 1 = Property owner
Hunting frequency	About how often, in a typical year, do you engage in each of the following natural resource activities? Ranged 1–4 (Never–Frequently)
Fishing frequency	About how often, in a typical year, do you engage in each of the following natural resource activities? Ranged 1–4 (Never–Frequently)
Wildlife problems	Have you or any members of your immediate family had any problems with white-tailed deer/geese/other species of wildlife <i>in the state of Michigan</i> within the last 5 years? 0 = Did not experience problems, 1 = Experienced problems
Consumptive recreation	Scale made up of 7 items measuring support for hunting, fishing and trapping. ^a Ranged 0–35 (Low–High support for consumptive recreation)
Management (agency)	Determined <i>a priori</i> . ^b 0 = Not in a management position, 1 = In a management position

^a (Mertig and Koval 1999, Koval 2002).

^b Management positions = biologists and supervisors; Nonmanagement positions = administrators, secretaries, technicians, and laborers.