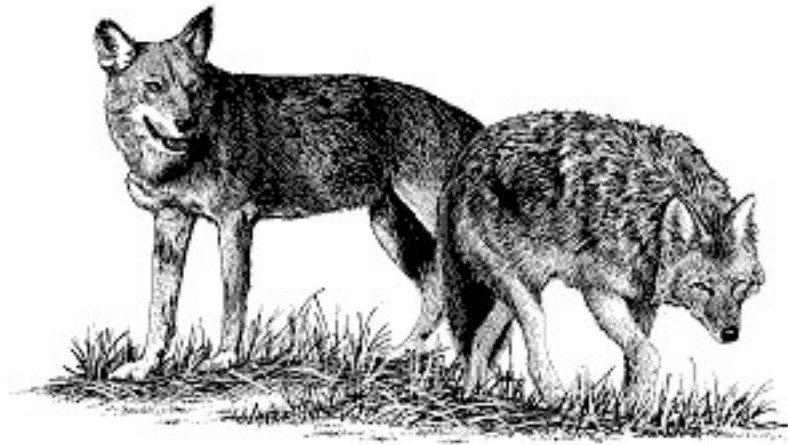


**Toward improving the effectiveness of wolf management approaches in
Michigan: insights from a 2010 statewide survey**



February 2012

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EXECUTIVE SUMMARY

Whereas in the past wolf management in Michigan was restricted to recovery, today, managers must contend with range expansion and post-recovery issues including policy changes (e.g., federal delisting, regulated hunting seasons); public responses to policy change (e.g., lawsuits, public votes, media coverage, poaching); and balancing preferences, tolerance, and behaviors of traditional and non-traditional wildlife stakeholders both within and outside Michigan. Previous studies have characterized management stakes, stakeholders, and associated attitudes and preferences about wolf management in Michigan. Other work in the Midwest has explored the role of hunters as wolf stewards and the relationship between wolf tolerance and compensation. These studies have provided critical point-in-time data about the human dimensions of wolf management, particularly about stakeholders' fear, experience, and knowledge about wolves and wolf management. Additional social science research needs identified by previous work, the 2007 Michigan Wolf Management Roundtable, and the 2008 Michigan Wolf Management Plan as being essential to accompany ecological, social, and regulatory changes include: (1) investigate social factors critical to wolf management, especially hunting (e.g., risk perception, value orientations, media coverage); (2) designing, implementing, and evaluating tools to educate key stakeholders about, reconcile competing stakeholder opinions for, and reduce stakeholder conflict vis à vis wolves and wolf management (e.g., hunting, compensation schemes); and (3) evaluating and improving perceived legitimacy of institutional arrangements for wolf management. Current events in Michigan (e.g., delisting) provide an ideal time to address these gaps in understanding and provide new social science insight for improving the current and future effectiveness of wolf management in Michigan based on the best available and timely scientific information.

Herein, we present findings from a study designed to investigate some social factors relevant to wolf hunting in Michigan. We conducted a statewide public opinion telephone survey in 2010 of Michigan residents. We explored the extent to which residents: (1) value wolves, (2) are interested in hunting wolves, (3) believe a decision to hunt wolves should be made by public vote and (4) are committed to sound science as a necessary component of wolf management decisions about hunting. We used voluntary telephone surveys to contact Michigan residents over the age of 18 derived from random-digit dial samples of landline telephones between May 18 and July 13, 2010 (margin of sampling error $\pm 3.2\%$). The questions were administered as part of the 56th round of the Institute for Public Policy and Social Research's Office for Survey Research at Michigan State University. All data are publically available (www.ippsr.msu.edu) to benefit public education as well as academic and policy research. A total of 973 Michigan residents participated in the telephone survey. A large majority of residents (82%, n=785) agreed that wolves have value. A minority (14%, n=137) agreed they would hunt or trap wolves if such activities were legal. The question of whether or not public vote should decide wolf hunting received a plurality of responses. Finally, most residents (78%, n=754) stated a commitment to sound science as a necessary component of wolf management. We identified patterns of agreement among socio-demographic and stakeholder groups that indicate low levels of conflict. Most residents, including hunters, Northern Lower Peninsula (NLP)

residents and minorities, highly value wolves, are not interested in hunting them and support the role of science in making decisions. Most groups do not strongly favor or oppose public vote use.

Results suggest there is currently agreement among groups throughout Michigan regarding attitudes toward wolf hunting. Low conflict among sociodemographic groups provides an opportunity to consider alternative ways (e.g., exploring attitude change, measuring stewardship) to assess public opinion about wolves and wolf management (e.g., beyond simple quantifying of attitudes, measuring tolerance). Although the NLP may be considered within current wolf range, NLP residents maintain distinct attitudes from other residents in wolf range [i.e., Upper Peninsula (UP)], illustrating that Michigan stakeholders should not be treated homogeneously. High commitment to science in decision-making among almost all groups (with the exception of racial minorities) suggests that Michigan residents will consider science when supporting or opposing management strategies, which may inform how they vote in a public vote. Scientific commitment coupled with a lack of strong response to public votes (except among UP residents) suggests that if decision-makers engage citizens throughout decision-making processes, public votes may be not be needed. Findings from this project can inform other current MDNR wildlife management priority areas, including human-wildlife conflict, urban deer management, or policy evaluation.

ACKNOWLEDGEMENTS

Pat Lederle was integral to the development of survey questions used in this research as well as constructive reviews. The Department of Fisheries & Wildlife and School of Criminal Justice at Michigan State University provided funding for this work. Shauna Hanisch and anonymous participants of several conferences were very helpful with constructive comments. Finally, we are grateful to the participants of the State of the State survey, for which this work would not otherwise be possible.

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INTRODUCTION

Federal regulations such as the Endangered Species Act (ESA) exist in part to prevent species extinction and foster recovery in the United States. Ideally, these regulations facilitate species recovery to the point where the species no longer requires federal protection and is "delisted." Managing species "post-recovery" requires managers to consider a host of new issues including: (1) policy changes (e.g., compensation schemes, regulated hunting seasons), (2) public responses to policy changes (e.g., lawsuits, public votes, media coverage, poaching), and (3) balancing preferences, tolerance, and behaviors of traditional and non-traditional stakeholders. This is the case with the gray wolf (*Canis lupus*) in Michigan.

Inquiry into the social issues surrounding wolf delisting and subsequent management is still in its infancy, yet such insight is critical for informing policy decisions (Bruskotter, Toman, Enzler, & Schmidt, 2010; Treves, 2008; Vucetich, Nelson & Phillips, 2006). Similar to claims about wolf biology and ecology, claims about social influences on wolf management often underpin and are thought to justify certain policy options. Yet these claims have yet to be thoroughly examined and verified. Knowledge regarding Michiganders' support for various management activities is essential for effectively manage wolves (Bruskotter et al., 2010; Musiani & Paquet, 2004), particularly as wolves are delisted and their management jurisdiction rests with the state. Quantifying social factors influencing public opinion can inform how wildlife managers reconcile differences in stakeholder opinions in the face of scientific uncertainty, political debate, and extensive media coverage. Deeper understanding about public attitudes toward wolves in a post-recovery climate and factors influencing such attitudes can also contribute to more resilient decision-making regarding wolves as well as other species with the potential to be delisted in the future (Bruskotter et al., 2010).

A brief history of gray wolf management in Michigan

Once present in all 83 Michigan counties, wolves were eliminated from the Lower Peninsula (LP) by 1910 [Michigan Department of Natural Resources (MSNR), 2011]. During this time, active predator control and persecution helped to drive wolves toward elimination (MDNR, 2011). Wolves received full legal protection in Michigan in 1965 and were federally listed under the Endangered Species Act in 1974. By the early 1990s, wolves naturally recolonized the Upper Peninsula (UP) from Canada, Wisconsin and Minnesota and may have expanded into the Northern Lower Peninsula (NLP) in recent years (Figure 1). Today, an estimated 600 wolves exist in the state (MDNR, 2011). The first statewide wolf recovery plan was signed by the Director of the Michigan Department of Natural Resources (MDNR) in 1997. Since that time a number of wolf recovery activities have occurred, including the 2005 Wolf Roundtable, which was convened to replace the existing wolf management plan. In 2008, the Michigan Wolf Management Plan was approved and focused on management that fostered coexistence of humans with a viable and recovered wolf population (MDNR, 2011).

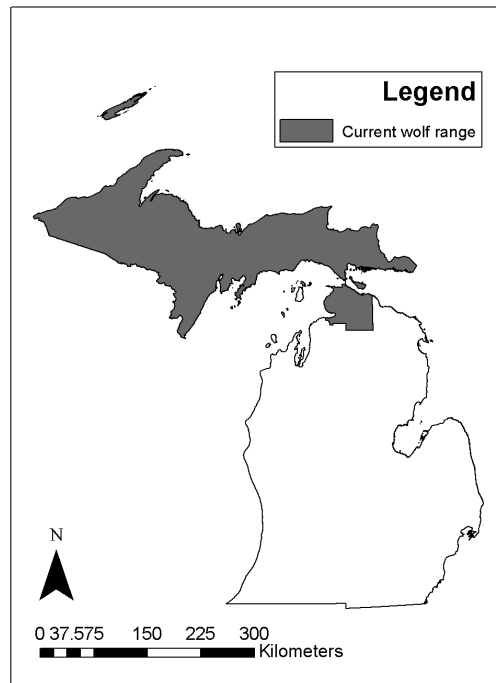


Figure 1. Map of Michigan and counties that as of January 2012 may have wolf populations.

Several human dimensions studies have explored public perceptions of wolves in Michigan over the past three decades when wolves were federally managed and Michigan was crafting a statewide management plan. Hook and Robertson (1982) assessed anti-predator attitudes in the state. They reported that fear of wolves, negativistic (i.e., skeptical or derisive) attitudes toward animals in general, region of residence and anti-DNR sentiment predicted anti-wolf attitudes. Respondents that were older, had less education, smaller income or a rural childhood also held anti-predator attitudes. Hook and Robinson also found that most residents favored wolf reintroduction in the state.

Kellert (1990) conducted a statewide study of public attitudes, knowledge, and behaviors related to wolves in Michigan. He found strong support for wolf restoration among different groups (e.g., LP residents, deer hunters, trappers), with the exception of farmers. Farmers also reported the most antagonism and hostility toward wolves. Deer hunters demonstrated the most interest, affection and concern for wolves. Trappers were also highly appreciative of the wolf and were the most knowledgeable of all groups. LP residents, in comparison to UP residents, expressed greater affection for the wolf but also more fear and less awareness and outdoor recreational interest in wolves.

Mertig (2004) surveyed public attitudes regarding support for wolf recovery efforts when wolves had already become established in the UP and managers were

considering reclassifying wolves from endangered to threatened.¹ This study found overall high support for wolf recovery efforts, which increased farther from established wolf range. Mertig reported less fear and similarly low knowledge of wolves among many Michigan residents compared to Kellert's (1990) study. The majority of residents supported a "hands-off" approach as long as wolves did not injure people; residents also supported killing or relocating problem wolves. Support for killing wolves to reduce population size was not strong. Similar to Kellert's (1990) findings, most Michigan residents did not support consumptive uses of wolves (i.e., hunting or trapping wolves).

Peyton et al. (2007) measured tolerance (i.e., a measure of people's capacity to accept living near a species) for wolves in the UP. They found levels of tolerance toward wolves in the UP were strongly related to beliefs about the benefits of wolves and moderately related to concerns about negative impacts of wolves, suggesting that addressing the benefits and costs of wolves is important in residents' decision-making about wolf management. Region of residence and hunting participation also predicted tolerance. Although considerable support for the presence of UP wolves existed, analysis revealed that when residents were grouped by their tolerance of wolves there was no overlap in desired population sizes. Essentially, disagreement between tolerance groups over how many wolves should be allowed to exist suggested that any population goal would be considered too many wolves for some residents and too few for others.

These aforementioned studies have provided managers with important knowledge about and factors influencing public opinion. In total, these studies reveal Michigan residents have:

- A relatively high value for wolves;
- Decreasing fear of wolves overall (e.g., fear that wolves are dangerous to people, beliefs that observing or hearing a wolf would be frightening);
- Decreasing support for active wolf recovery in the UP;
- Increasing awareness of and indirect experience with wolves (e.g., watching television programs or reading about wolves) but not increasing knowledge; and
- Weak support for preventive depredation measures, such as the use of guard dogs or fladry.

We also know from these studies that important influences on attitudes include media exposure, personal proximity, experience with killing wolves and other animals (Mertig, 2004)(Table 1). Even with this knowledge, wolf management could benefit from additional social science insight, specifically about social factors influencing changes in wolf management policy that may accompany delisting from the ESA such as hunting (Lederle pers. comm., 2010). Decision-making has been delayed (via court battles and drawn out public involvement processes) and enforcement compromised (via poaching) by differences in stakeholder opinions regarding how to manage wolves in western states. Therefore, effective management will also require understanding how to consider all stakes and bridge gaps between opposing opinions to avoid the conflict that has contributed to stalled progress in the past.

¹ Endangered and threatened classifications are legal terms with detailed definitions under the ESA and significant differences at the federal level.

Wolf Management Status	Key Concepts Explored	Key Findings	Reference
Endangered	Attitudes toward predators	High support for wolf reintroduction; fear, negativistic attitudes, age, education, income, region, type of community an anti-DNR sentiment predicted anti-wolf attitudes	Hook & Robinson 1982
Endangered; recovering in UP	Attitudes, knowledge and behaviors toward wolves	High support for wolf reintroduction but relatively low knowledge; significant differences among farmers, hunters and regions	Kellert 1990
Delisting considered; well-established in UP	Attitudes and knowledge toward wolves	High support for wolf reintroduction but relatively low knowledge remained; decreasing fear; low support for hunting wolves; Not In My Backyard (NIMBY)	Mertig 2004
Managers still considering delisting; unconfirmed sightings in NLP	Social carrying capacity (SCC) for wolves	Tolerant and intolerant groups' SCC do not overlap, suggesting potential conflict over wolf management; possible increasing support for hunting wolves	Beyer et al. 2006; Peyton 2007

Table 1. Summary of key findings from human dimensions of wolf and wolf management studies in Michigan (1982-2011).

Relevance of human dimensions to post-recovery wolf management in Michigan

Human dimensions practitioners and wildlife managers have identified a number of factors important to consider for wolf management in a post-recovery regulatory environment in general. Understanding these factors may be important to help predict public responses to policy changes and balance preferences, tolerances and behaviors of traditional and non-traditional stakeholders. The nature of human-wolf interactions is expected to evolve in several ways (Wydeven, Treves, Brost, & Wiedenhoef, 2004; Naughton-Treves, Grossberg, & Treves, 2003) and will have critical implications for tolerance levels. Thus, and first, as wolf populations increase and human and wolves increasingly overlap, humans may have more direct experiences with wolves (e.g., close encounters in residential and ranching areas, during recreational activities). Direct experience (which can be positive or negative) may lead to stronger attitudes that will influence decision-making (Heberlein & Ericsson, 2005). In other words, there is reason to believe these experiences will influence values that will in turn inform attitudes about management alternatives. For example, the UP resident who enjoys listening to nearby wolves howling could be influenced by this positive experience and judge favorably management alternatives that maintain wolf populations in her region. Conversely, the livestock owner who experiences a depredation event may relate that negative experience to wolf management and oppose management alternatives that maintain wolf populations in her region. Knowing what experiences will increase with a growing Michigan wolf population (e.g., growing in number and in geographic region) and if certain experiences predict certain attitudes toward management strategies, such as lethal control, can contribute to more effective wolf management and decision-making.

Second, human-wolf conflict (HWC) may increase as wolf and human populations grow and overlap. HWC can be defined as conflict between humans and wolves (e.g., livestock depredation) and conflict among people over wolf management. Managing HWCs may necessitate targeted management alternatives (e.g., compensation schemes, regulated hunting seasons), to which the public will respond (via public comment, media coverage, public votes,² lawsuits or poaching) based on diverse preferences. Identifying patterns of agreement or disagreement within and between socio-demographic and stakeholder groups can help reveal and predict sources of potential conflict among people over wolves and wolf management.³ Traditional demographic variables considered in human dimensions inquiry include political ideology, party affiliation, community type, education level, sex, age, and hunter status. Considering the less common but equally important variables such as race and ethnicity can aid in accurately quantifying public opinion at a statewide level (Manfredo & Zinn, 1996; Vaske, Donnelly, Williams & Jonker, 2001) especially as certain minority groups such as Hispanics grow in Michigan (U.S. Census Bureau, 2010). Quantifying public opinion is paramount for effective management, which ideally considers anyone with a stake in the issue (Prugh et al., 2000).

Third, wildlife management and decision-making processes have and continue to evolve (Bruskotter et al., 2010) to be more inclusive of traditional (e.g., hunters) and nontraditional stakeholders (e.g., wildlife watchers), transparent and adaptable. The decision-making process—particularly how fair and just the process appears to stakeholders—will influence public responses to those management changes. Purposefully engaging stakeholders introduces challenges and opportunities for wildlife managers in addition to those related to HWC mitigation (e.g., more perspectives to consider but also more knowledge about local conditions); yet stakeholder involvement can increase support for management and the need for tolerance and knowledge about how to live with wildlife as well as decrease conflict between stakeholder groups, including managers and general public (Lafon 2004). By garnering stakeholder knowledge about wildlife, management policies can be more accurately informed about local conditions and ultimately be more socially acceptable because stakeholders are involved in the process from the start (Decker & Chase 1997).

² Public vote initiatives are policies drafted by a group of residents that get placed on general election ballots when sufficient petition signatures are garnered (Williamson, 1998). Often public votes may facilitate a democratic, inclusive process (Cronin, 1989); they may also lead to dichotomous policy-making (i.e., either/or policy options that do not fully represent available and perhaps politically preferred management alternatives)(Whittaker & Torres, 1998), override science's role in decision-making (Minnis, 1998), allow special interests to exert strong influence, and disproportionately rest upon the quality and stability of public opinion (Williamson, 1998).

³ While the debate over wolves, as well as other environmental issues, is often framed in dichotomous terms (e.g., hunters versus animal welfarists, urban versus rural residents), these dichotomies do little to represent reality or advance decision-making. Rather, it should be recognized that an individual could play many roles and hold opinions with important nuances. For instance, one can both identify as a hunter *and* an environmentalist with values and attitudes that reflect these multiple dimensions.

Evidence that participatory process can benefit (e.g., by respecting and considering their opinions) all stakeholders involved is prolific; simply being involved in the management process can increase awareness among various publics that managers care about their opinions (Stout et al. 1996).

Lastly, politics can be just as influential on management outcomes as is biological and social science (Nie, 2002). In some instances, science is positioned against politics. For example, the most recent federal wolf delisting occurred via congressional rider in a budget bill (rather than being an agency decision based on science), setting a precedent for endangered species management. Robbins (2001) noted this congressional action illustrates how politics can trump science in wildlife management decisions and endangered species conservation. Ultimately, to position science against politics is a false dichotomy (Farrell, 2011). Many stakeholders believe science is uncontested, completely objective, and clearly informs policy decisions. In reality, these dominant, traditional and technical approaches can fail to adequately frame problems or separate scientific facts from normative (i.e., value-laden) judgments (Farrell, 2011; Funtowicz & Ravetz, 1993; Nie, 2003). By failing to recognize the social, ethical, political, and economic dimensions, traditional, technical-based science is thus limited in its ability to wholly address wolf management (Moore & Nelson, 2010; Nie, 2003). HWC is fundamentally a value-based conflict over more than just how many wolves should live in a particular region. Wolf management may act as a surrogate for issues pertaining to land use, wilderness, biodiversity, endangered species, government, science, rural-urban discrepancies and tribal rights (Wilson, 1997).

Statement of Need

Given the potential for these aforementioned factors to influence the human dimensions of wolf management in a post-recovery climate, it is reasonable to explore how, if at all, they manifest in Michigan. Exploring these concepts in Michigan can provide managers with insight about how Michigan residents may react to policy changes regarding wolves and wolf management.

To this end, we assessed whether residents: (1) value wolves, (2) are interested in hunting wolves, (3) believe a decision to hunt wolves should be made by public vote and (4) are committed to sound science as a necessary component of wolf management decisions about hunting. We focused on hunting and trapping of wolves because it is a potential policy change that has been identified in previous human dimensions work as being relevant to some stakeholder groups in Michigan (Michigan Wolf Management Roundtable, 2006) and has generated debate elsewhere in the United States. We also explored comprehensive demographic effects on public attitudes to better understand social factors critical to wolf management (Figure 2).

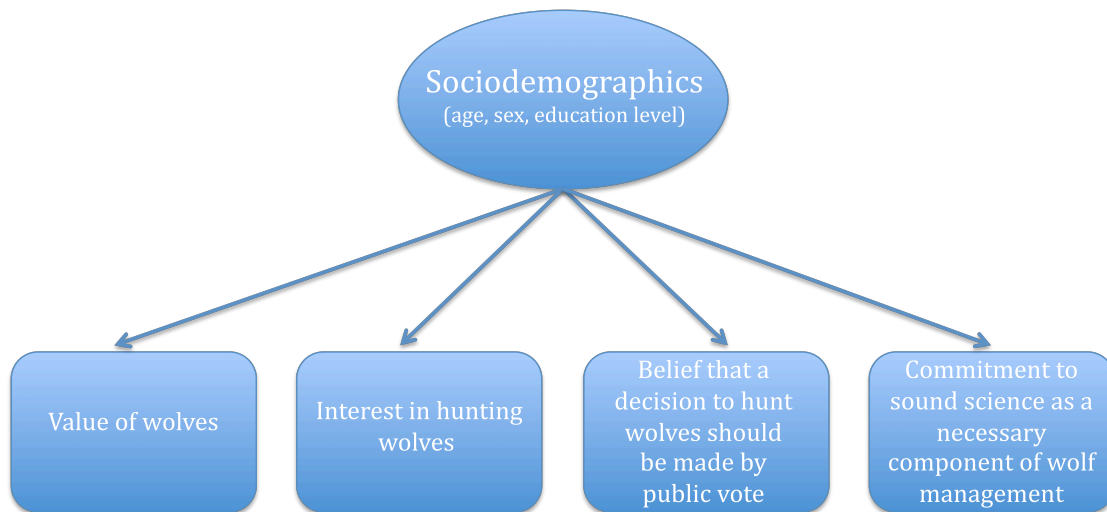


Figure 2. Conceptual diagram of concepts explored in this study. Four wolf-related attitudes and the predictability of sociodemographic variables on each attitude were assessed.

METHODS

Data collection

We used voluntary telephone surveys to contact Michigan residents over the age of 18 derived from random-digit dial samples of landline telephones between May 18 and July 13, 2010 (margin of sampling error $\pm 3.2\%$). Questions were administered as part of the 56th round of the Institute for Public Policy and Social Research’s Office for Survey Research at Michigan State University. This quarterly statewide State of the State (SOSS) survey polls Michigan residents on a number of contemporary and state-specific issues. (www.ippsr.msu.edu/soss/) Four questions were queried using 7-point Likert-type scales (strongly agree to strongly disagree) (Table 2). Independent variables consisted of sociodemographics variables including: political ideology (i.e., liberal versus conservative), party affiliation (i.e., Democrat versus Republican), community type, race, ethnicity, education level, sex, age, religion, hunter status, and region of residence.

Concept regarding residents:	Question
Value of wolves	“I enjoy knowing wolves exist in Michigan.”
Interest in hunting wolves	“I would be likely to purchase a license to hunt or trap wolves.”
Belief that a decision to hunt wolves should be made by public vote	“The decision to hunt wolves should be made by public vote.”
Commitment to sound science as a necessary component of wolf management	“Wolves should only be hunted if biologists believe the wolf population can sustain a hunt.”

Table 2. Concepts explored and questions asked in telephone survey of Michigan residents (n=973) between May 18 and July 13, 2010.

Data analysis

We used regression to analyze continuous variables (i.e., age, education, political ideology, party affiliation). We used ANOVAs for categorical variables (i.e., region, community type). Finally, we used t-tests for dichotomous variables (i.e., religion, race, ethnicity, sex and hunters). We weighted all data using SOSS post-stratification weight to ensure representative statewide analysis because disproportionate sampling occurred across regions; some areas were more sampled than others (Vaske, 2008). We used PASWStatistics 18 software (SPSS Inc., 2010) for statistical analysis and ANOVAs, t-tests and regressions for identifying significant differences among groups depending on the level of measurement for that variable. The University Committee on Research Involving Human Subjects at Michigan State University (IR# 95-499) reviewed and approved methods used in this research.

RESULTS

Descriptive Statistics

A total of 973 Michigan residents participated in the telephone survey. A large majority of residents (82%, n=785) agreed that wolves have value (Figure 3).

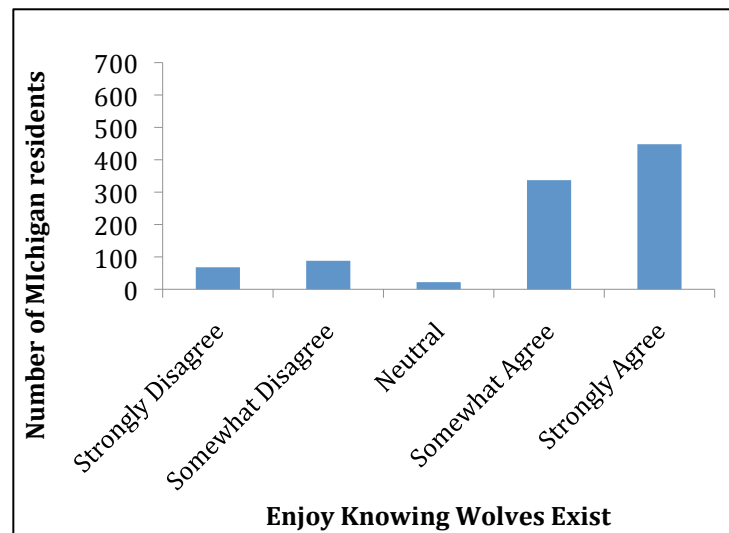


Figure 3. Residents' value of wolves. Eighty-two percent (n=785) of the sample agreed and 16% (n=156) disagreed with the statement "I enjoy knowing wolves exist in Michigan."

In contrast, a minority (14%, n=137) agreed they would purchase a license to hunt or trap wolves if such activities were legal (Figure 4).



Figure 4. Residents expressing interest in purchasing a license to hunt wolves. Fourteen percent (n=137) agreed with the second statement “I would be likely to purchase a license to hunt or trap wolves”; 85% (n=817) disagreed.

The question of whether or not public vote should decide wolf hunting received a plurality of responses (Figure 5).

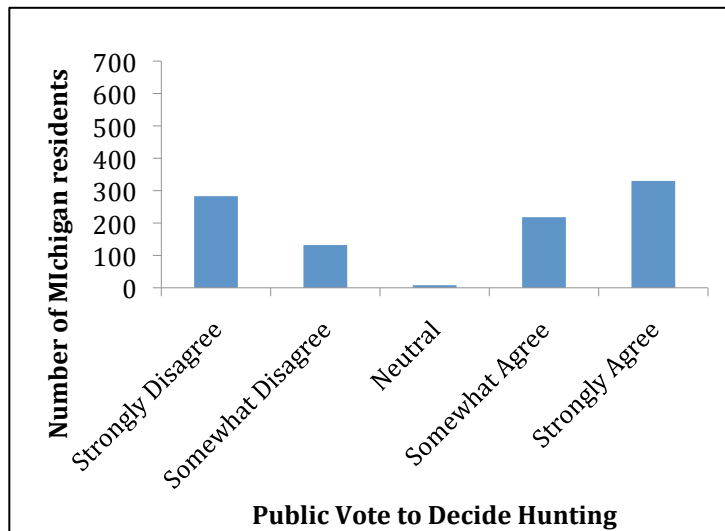


Figure 5. Belief that a decision to hunt wolves should be made by public vote. For the statement “The decision to hunt wolves should be made by public vote”, 56% (n=548) of the sample agreed and 43% (n=415) disagreed.

Finally, most residents (78%, n=754) believed scientific justification is required to hunt wolves (Figure 6).

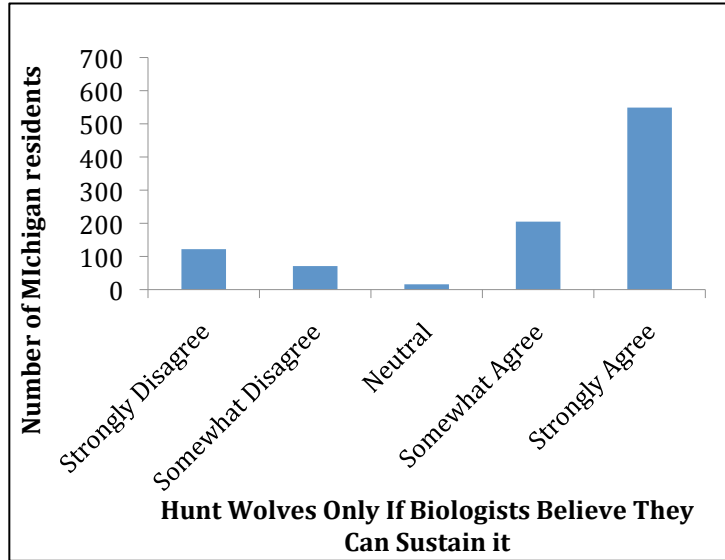


Figure 6. Commitment to sound science. Seventy-eight percent (n=754) agreed and 20% disagreed (n=194) with the statement “Wolves should only be hunted if biologists believe the wolf population can sustain a hunt.”

Sources of agreement among Michigan residents

We analyzed socio-demographics and stakeholder groups for patterns in responses to identify social factors critical to wolf management, especially hunting.

Wolf value. Wolf value ($\geq 73\%$) was high among most groups (Table 3). Liberals ($r=0.125$, $p<0.00$), rural residents ($F=3.33$, $p<0.05$), whites ($t=4.01$, $p<0.00$), and Hispanics ($t=6.08$, $p<0.00$) most strongly agreed that wolves have value.

	% Agree	% Disagree	N	Test statistic	P-value
Liberal	87	13	342	r=0.125	0.000
Moderate	73	27	75		
Conservative	79	17	495		
Urban	81	18	553	F= 3.33	0.036
Suburban	73	21	276		
Rural	86	14	137		
White	83	15	766	t=4.01	0.000
Non-White	73	23	150		
Hispanic	95	5	39	t=6.08	0.000
Non-Hispanic	81	17	908		
UP	61	39	33	F=6.50	0.002
NLP	82	16	56		
Rest of MI	82	15	874		

Table 3. Proportion of residents that agreed or disagreed that wolves in Michigan have value.

Interest in hunting. Groups showed consistently little interest in hunting or trapping wolves ($\geq 73\%$ disagreement; Table 4). Democrats, Independents ($r = -0.108$, $p < 0.00$), and minorities (i.e., both non-whites $t = 5.42$, $p < 0.00$ and Hispanics $t = 3.13$, $p < 0.00$) showed the least hunting interest. Interest in hunting decreased from rural to urban residents ($F = 11.76$, $p < 0.00$).

	% Agree	% Disagree	N	Test statistic	P-value
Democrat	11	89	489	$r = -0.108$	0.001
Independent	11	87	127		
Republican	21	78	306		
Urban	4	94	553	$F = 11.76$	0.000
Suburban	11	86	276		
Rural	18	82	137		
UP	55	45	31	$F = 26.68$	0.000
NLP	27	73	56		
Rest of MI	12	87	881		
White	16	83	773	$t = 5.42$	0.000
Non-White	5	92	151		
Hispanic	8	92	39	$t = 3.13$	0.003
Non-Hispanic	14	84	908		

Table 4. Proportion of residents that agreed or disagreed they would purchase a license to hunt or trap wolves.

Public vote. Independents, Republicans, liberals, non-Hispanics, and residents outside the UP were split on the public vote issue (Table 5). Democrats ($r = -0.149$, $p < 0.00$) and conservatives ($r = -0.153$, $p < 0.00$) showed greater public vote support. While the majority of moderates (67%, $n = 50$) did not support a public vote to decide hunting, conservatives showed the opposite trend. Hispanics showed the lowest support for use of a public vote (23%, $n = 9$; $t = -5.09$, $p < 0.00$).

	% Agree	% Disagree	N	Test statistic	P-value
Democrat	67	32	489	$r = -0.149$	0.000
Independent	56	43	127		
Republican	49	50	306		
Liberal	47	53	342	$r = -0.153$	0.000
Moderate	32	67	75		
Conservative	66	33	495		
Hispanic	23	77	39	$t = -5.09$	0.000
Non-Hispanic	58	42	908		
UP	81	19	32	$F = 4.02$	0.018
NLP	53	42	55		
Rest of MI	56	44	882		

Table 5. Proportion of residents that agreed or disagreed a decision about hunting wolves in Michigan should be made by public vote.

Certainty in science. Most groups agreed that biological science should inform decisions about wolf hunting ($\geq 73\%$), with non-white residents as the exception at 51%

(n=75; t=7.3, p<0.00) (Table 6; Figure 7). Independents, Republicans (r= -0.085, p<0.01), suburbanites (F=6.14, p<0.00), and Hispanics (t=2.27, p<0.05) all showed the greatest commitment to science for their respective groups.

	% Agree	% Disagree	N	Test statistic	P-value
Democrat	75	22	489	r= -0.085	0.009
Independent	84	16	127		
Republican	82	18	306		
Urban	73	26	553	F= 6.14	0.002
Suburban	81	15	276		
Rural	78	22	137		
White	83	15	770	t= 7.3	0.000
Non-White	51	47	147		
Hispanic	87	13	39	t= 2.27	0.023
Non-Hispanic	78	23	908		

Table 6. Proportion of residents that agreed or disagreed wolves should only be hunted if biologists believe the population can sustain it.

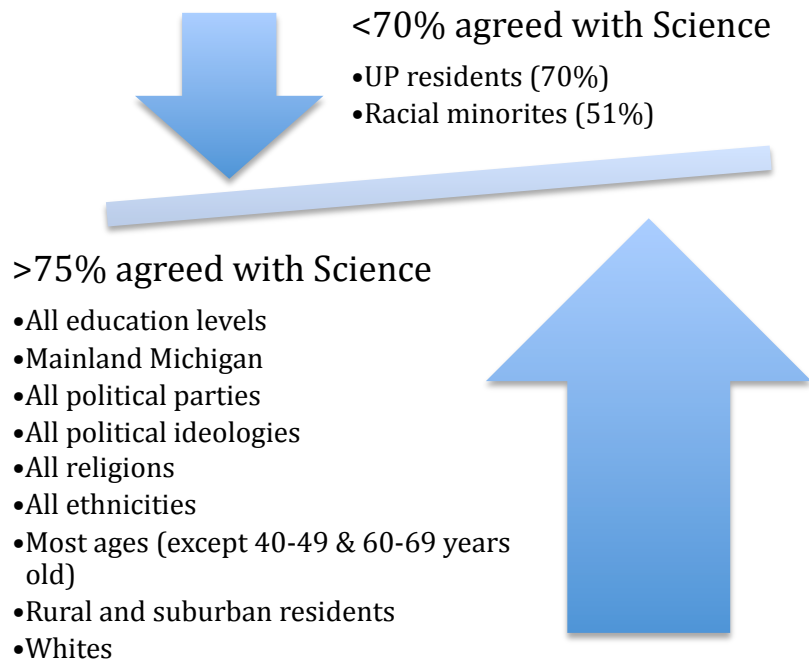


Figure 7. Commitment to science in decision-making. With very few exceptions, most residents agreed science should support the sustainability of a possible hunt.

Comparisons between the Upper and Lower Peninsula Residents

UP residents were consistently different from the rest of the state, displaying the greatest support for a public vote to decide hunting (81%, n=26; F=4.02, p<0.02) and lowest wolf value (61%, n=20; F=6.50, p=0.002). They also showed the greatest interest in hunting or trapping wolves (55% agreement, n=17; F=26.68, p<0.00). NLP residents,

on the other hand, were often similar to their southern counterparts in terms of support for a public vote and science, as well as valuing wolves (all $p > 0.5$). Finally, we observed decreasing interest to hunt from UP to southern Michigan.

CONCLUSION

Regulatory changes for wolf management in Michigan may parallel changes in public opinion about policy changes and balancing preferences of traditional and nontraditional wildlife stakeholders. Understanding the social factors critical to wolf management, especially hunting, can help managers more effectively design, implement, and evaluate wolf management activities. Below, we discuss the most noteworthy findings and management implications from this study and identify questions for future management and research.

First, our results contribute insight into stakeholder tolerance for wolves and their management. Previous human dimensions inquiry (in Michigan and elsewhere in the Midwest) has focused on measuring tolerance for wolves during times of high conflict between stakeholder groups and between humans and wolves (Treves et al., 2009; Naughton-Treves et al., 2003; Carpenter et al., 2000). These studies tell us that tolerance for wolves is the minimal requirement for wolf populations to persist near human populations and cautions us that conflict between stakeholders is likely to arise when "passive tolerance" shifts to "active intolerance" (Bruskotter & Fulton, 2012). The potential lack of conflict among our study residents suggests an opportunity to start thinking beyond a simple tolerance-intolerance continuum and consider wolf stewardship more directly. Bruskotter & Fulton (2012:3) defined active wolf stewardship as "direct actions (i.e., behaviors) undertaken to positively impact a wildlife population, species, or the habitat on which they depend" and proposed measuring the concept in ways that permit analysis across the spectrum of public attitudes and behaviors that affect wolf recovery and future challenges to wildlife management more generally. Specifically, they propose measuring the ethics of decision processes, residents' opinions (especially of those most at risk and living near wolves) and politics (Carpenter, Decker & Lipscomb, 2000). In an example of measuring the ethical dimensions of wolf management, Gore et al. (2011) analyzed online comments about genetically rescuing of inbred wolves on Isle Royale for various ethical justifications. In considering ethical dimensions and stewardship of wolf management, managers may better understand--and thus predict-- stakeholders' roots motivations for supporting or opposing various management strategies. This knowledge can then be considered during decision-making processes, used to anticipate public reactions to those decisions, inform education campaigns and increase compliance.

Another way to move beyond a tolerance-intolerance scale is to consider the social identity of different wolf stakeholders. Social identity refers to a concept that measures how an individual feels and values membership in a particular group, such as animal welfarist or hunter. Social identity can have a significant influence on attitudes and behaviors and thus may help explain and understand stewardship and other wildlife-related behaviors (Enck & Brown, 2002; Manfredi, 2008). Exploring a wider breadth of diverse stakeholders, grouped by social identity, may reveal and help predict both individual and group patterns related to wildlife values, attitudes and behaviors.

Such information can be utilized during stakeholder involvement (e.g., which groups work best together based on similar values and attitudes) to help reach compromise, increase compliance and avoid conflict.

Second, our analysis revealed little potential conflict among stakeholders regarding survey questions; we found little disagreement between Michigan residents, who by and large agreed that wolves have value, are not likely to purchase a hunting license if wolf hunting were legalized, and agree that science should inform decisions to hunt wolves. These attitudes were also held by minorities such as Hispanics, non-Caucasians and urban residents, groups that typically comprise non-traditional stakeholder groups in Michigan and who have not generally been well-represented in wildlife management (Manfredo, 2008). Importantly, these groups comprise a significant proportion of Michigan's population. For example, Hispanic populations have grown by 35% in Michigan (while total Michigan population has decreased by 0.6%) over the past decade (U.S. Census Bureau, 2010). Historically, traditional wildlife stakeholders such as white, male hunters have dominated stakeholder input into wildlife management decisions, in part because they are the primary financial supporters of management (Rutberg, 2001). Managers have identified a need to account for preferences of traditional and nontraditional stakeholders' opinions in post-recovery wolf management (Bruskotter et al., 2011). Results herein detail nontraditional stakeholder attitudes, which, for our questions, revealed similar attitudes as traditional stakeholders. Our results affirm Kellert's (1990) findings that residents who live within wolf range are in agreement with those who do not with regard to their attitudes about wolves and wolf management.

Political ideology and party affiliation, as well as minority status and region of residence, were the only variables to show clear majority support (Figure 8) or opposition to a public vote (Figure 9). Several stakeholder groups (e.g., individuals with less than high school diploma and 60+ years old, UP residents, conservatives) also showed some level of support for a wolf hunt decision being made by public vote. Among residents who agreed a public vote should be used to decide a wolf hunt, a majority disagreed that they would purchase a hunting license.⁴ These groups may exert influence on public opinion about using public votes to decide wolf hunts in Michigan because they may be the ones to introduce and strongly influence public vote processes (e.g., gathering support and petitions within their ranks, influencing the wording of ballot questions). When managers know who is already engaged, they may be able to deploy diverse stakeholder engagement strategies to mitigate or reduce conflict. Information regarding which groups support public votes can be used to determine who should be targeted by educational interventions or decision-making processes. In these instances, managers are already aware of diverse methods to engage public participation (e.g., resident task forces). Kellon and Arvai (2010) suggested structured decision-making, adaptive management (both active and passive types), and analytic-deliberative frameworks to improve stakeholder involvement in environmental decisions. Fischhoff (2005) advocated stated choice methods that can be

⁴ This result may not be surprising given that prior public votes on wolf hunting have often been to restrict or ban hunting practices; this pattern is most likely due to the fact that non-hunters increasingly outnumber hunters (Manfredo, 2008).

used during workshops to help stakeholders explore trade-offs between various management strategies to determine the most supported alternative. Nelson and Vucetich (2009) use argument analysis (i.e., logical reasoning using known factual premises to guide conclusions) to incorporate conservation ethics into the decision-making process. Gore et al. (2009) proposed wildlife-related risk communication campaigns that disseminate balanced information to reduce wildlife-related risk perceptions may be useful to reduce stakeholder conflicts about wildlife.

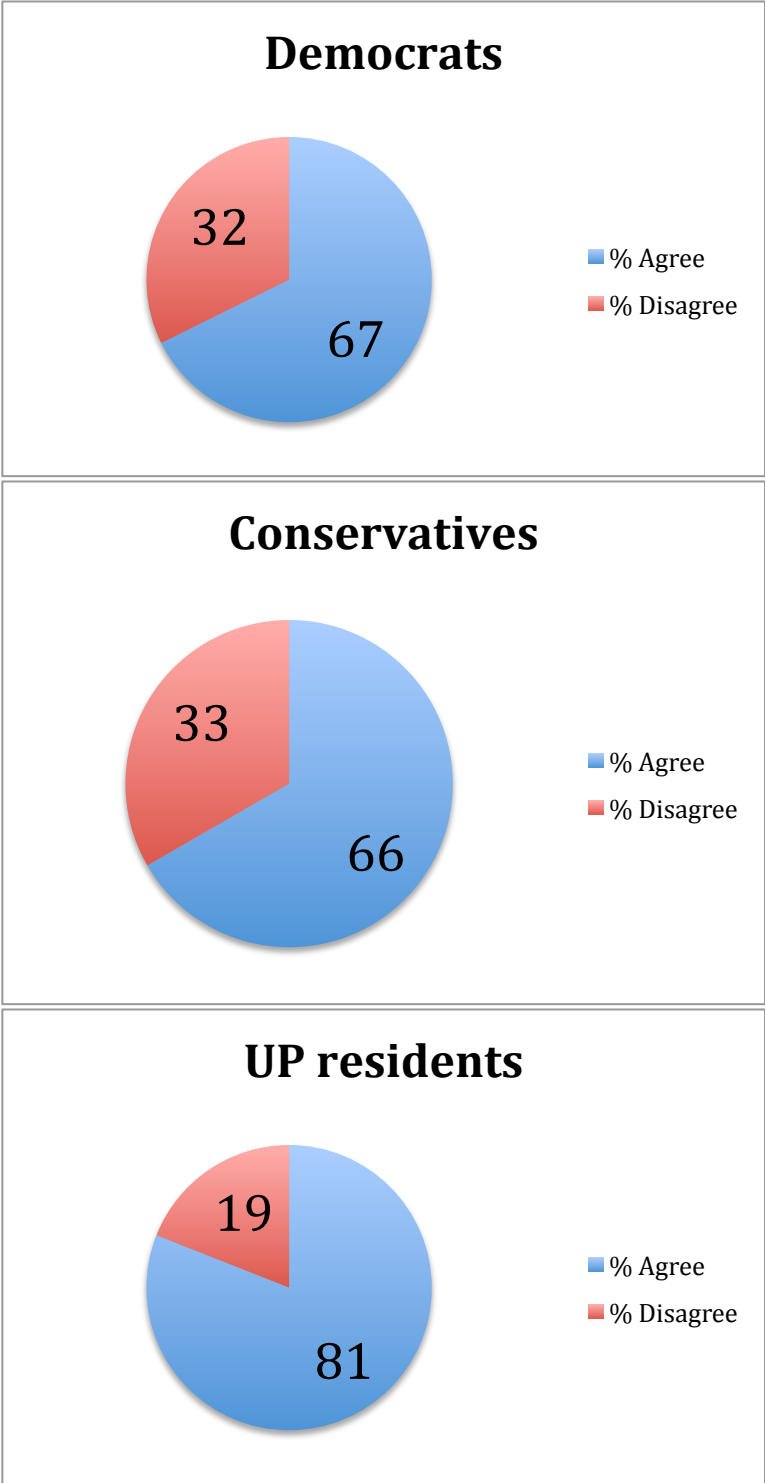


Figure 8. Support for a public vote. Sixty-seven percent of Democrats, 66% of conservatives and 81% of UP residents showed clear support for a public vote.

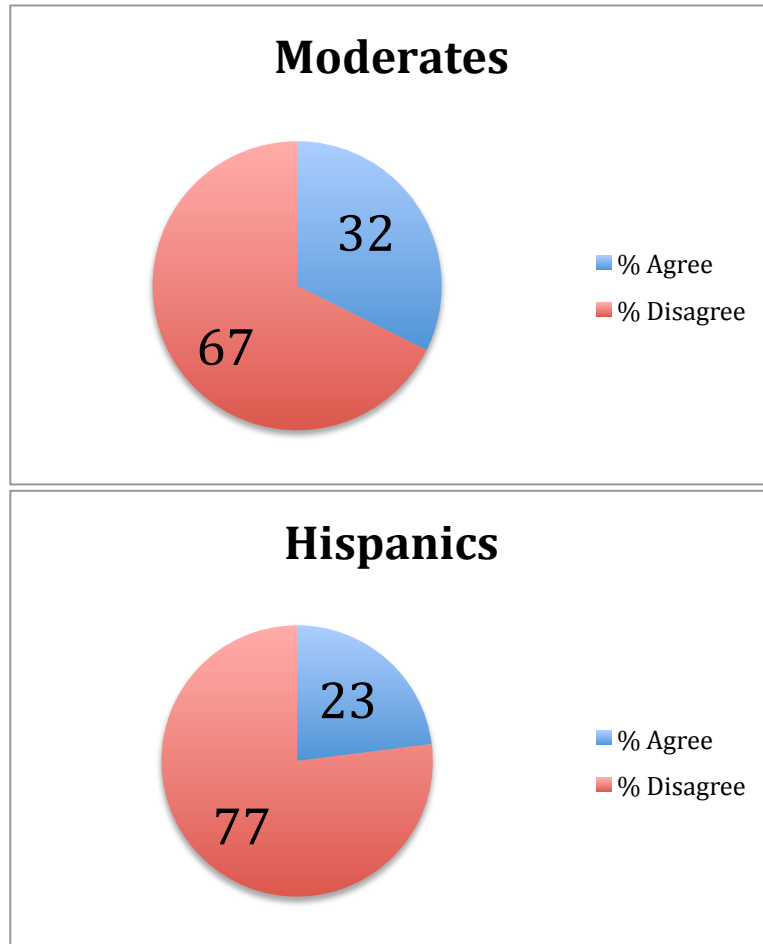


Figure 9. Opposition to a public vote. Sixty-seven percent of Moderates and 77% of Hispanics clearly opposed a public vote.

Third, it is important to consider regional difference among Michigan residents (e.g., LP versus UP). Our results illustrate that for our survey questions, the NLP (i.e., the most recent possible range expansion for wolves in Michigan) might not be "lumped" with the UP just because both regions are within wolf range. Political affiliation and community type (and concomitant racial, ethnic, and religious groups) are perhaps stronger predictors of how wolves will be received in the NLP than the UP. Because the NLP is less or differently rural, politically liberal and relatively homogenous in wolf-related attitudes, is it possible that human-wolf or human-human conflict over wolves may manifest in a different way than it has in the UP (where wolves have been established for a longer period of time) (Enck & Decker, 1997). The idea of experience influencing wildlife-related attitudes may be important to consider in distinguishing between the NLP and UP when it comes to changes in wolf management policies (Gore & Knuth, 2009). Specifically, the influence of media on public perceptions of wildlife can be highest in instances where experience is low (e.g., in the NLP, where wolves have only possibly expanded) (Gore & Knuth, 2009).

Finally, results from this work address public opinion on the roles of science and politics in wolf hunting decisions. Many groups (i.e., Independents, Republicans,

liberals, non-Hispanics, residents outside the UP) were split on whether or not a public vote should be used to decide a wolf hunt, but overall, a slight majority agreed it should be used. Yet a strong majority of all groups (e.g., Independents, Republicans, suburbanites, Hispanics) agreed science should be used to decide a wolf hunt. This speaks to critical concerns regarding science, namely that public support of science is decreasing (as evidenced by current debates over, for example climate change science and teaching evolution in K-12 schools), which may lead to public votes that decrease science's role by allowing the public to make decisions regarding technical management issues that require sophisticated scientific knowledge (Minnis, 1998). Scientific commitment coupled with a lack of strong response to public votes (except among UP residents) may suggest that, if decision-makers can involve the public appropriately when deciding wolf hunting, public votes may not be endorsed by stakeholders in disagreement with management policy. Managers can be aware that not only will high quality and reliable data be needed to inform decisions, but that such data should be well communicated with decision-makers, the public and the media. Fortunately, the literature is full of best practices for effectively communicating science to decision makers, the public, and the media (e.g., Sater & Shull, 2000; Hayes & Grossman, 2006).

Management Implications

In sum, our investigation into sociodemographic factors critical for wolf management post-recovery yields the following insights and implications:

- ✓ According to our measures, there is currently little disagreement among groups throughout Michigan regarding attitudes toward wolf hunting.
- ✓ Low conflict among sociodemographic groups provides an opportunity to consider alternative ways of assessing public opinion about wolves and wolf management. Beyond notions of building, maintaining or increasing "tolerance," we may consider building, maintaining or increasing "stewardship."
- ✓ High commitment to science among almost all groups suggests that Michigan residents will consider science when forming opinions about management strategies, which may inform how they vote in a public vote. Racial minorities showed low commitment to science; while we do not currently know the cause of these attitudes, it may be related to unfavorable perceptions of scientific authority associated with unjust power regimes. Carefully thought out and targeted education and involvement campaigns may be able to address this issue once we have a better understanding of the causal relationship between race and commitment to wildlife science.
- ✓ UP residents were most likely to agree that a public vote should be used to decide a wolf hunt and Hispanics were least likely to agree.
- ✓ Although the NLP may be considered within current wolf range, NLP residents maintain distinct attitudes from other residents in wolf range (i.e., UP). Residents with low personal experience with wildlife may be more susceptible to media and less susceptible to education campaigns. The design, implementation, and evaluation of tools to educate residents about, reconcile competing stakeholder opinions for and reduce stakeholder conflict vis-à-vis

wolves and wolf management (e.g., hunting, compensation schemes) should not be homogenized across the state and stakeholders.

These insights serve to stimulate thinking about additional areas for further inquiry:

- If lack of stakeholder conflict is evidence of effective wolf management, what mechanisms are available to managers to preserve existing low levels of conflict?
- Are UP residents, the group most supportive of a public vote to decide wolf hunting and subject to risks posed by wolves, more distrustful of wildlife science in general? Why, and if so, are there stakeholder involvement strategies or science communication strategies that may be adapted so as to attend to this group's attitudes in a proactive way?
- What is the effect of wolves' regulatory status on public opinion about wolves? Replicating our study after wolves are delisted from the federal ESA could help managers improve the efficacy of wolf management by quantifying and explaining how social forces affected public opinion about wolves.
- For many stakeholder groups, biological science is important for inform decisions to hunt wolves. How do we know when we have enough scientific information to make a decision? How do we know when the issue is not a lack of scientific information but something else entirely (i.e., a non-science issue)?

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APPENDIX
Conference presentation

Michigan citizen's attitudes toward wolves & wolf management: insights from a statewide survey

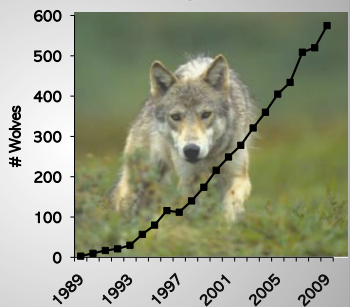
Michelle Lute¹,
Meredith Gore¹, Michael Nelson¹, John Vucetich² & Pat Lederle³

¹Michigan State University
²Michigan Technical University
³Michigan Department of Natural Resources



Wolves in Michigan


- ◆ Not in my backyard
- ◆ Low tolerance among some groups



Kellert 1990, Mertig 2002, Peyton et al. 2007

Known


- ◆ Low tolerance → conflict



Treves et al. 2009, Treves and Martin 2010, Nie 2003

Unknown

- ◆ Are attitudes changing?
- ◆ If so, how?



Treves et al. 2009, Treves and Martin 2010, Nie 2003

Objectives

- ◆ Diagnose sources of stakeholder disagreement
- ◆ Explore attitudes and behavioral intention
 - ◆ Existence value
 - ◆ Wolf hunting and trapping
 - ◆ Ballot initiative
 - ◆ Belief in science



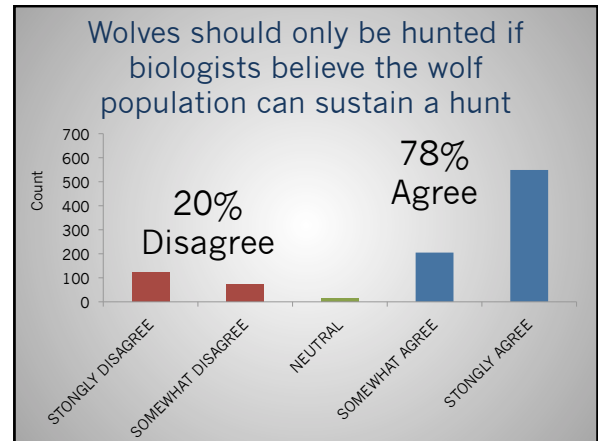
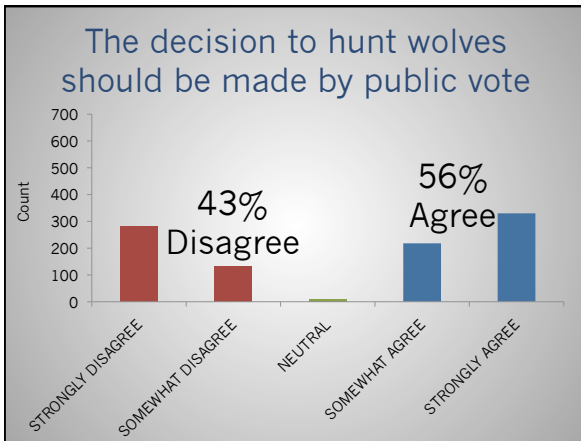
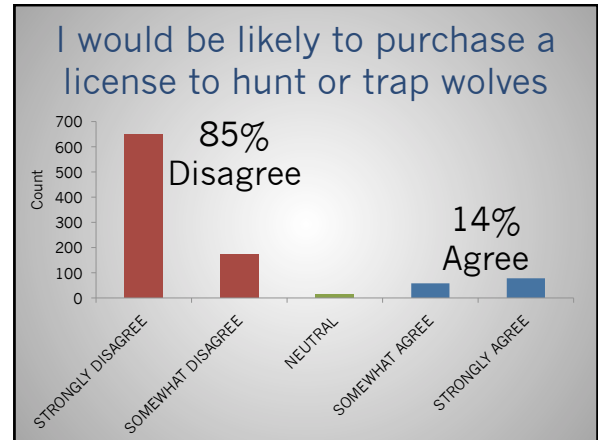
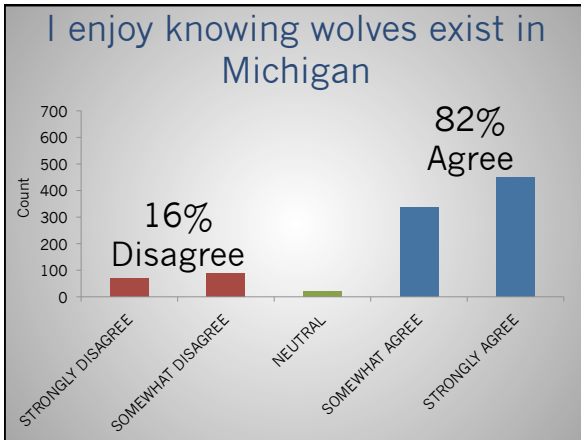
Photo credit: S. Sisti

Methods

- ◆ State of the State Survey
- ◆ Institute for Public Policy and Social Research, MSU
- ◆ State-wide, stratified random, N=973
- ◆ Telephone interview
- ◆ May 18, 2010 to July 13, 2010



Photo credit: J. Sartone, NatGeo



Independent Variables

- ◆ Political ideology, party affiliation
- ◆ Urban vs rural
- ◆ Race/ ethnicity
- ◆ UP vs NLP
- ◆ Education
- ◆ Sex
- ◆ Age
- ◆ Hunters
- ◆ (Farmers)

Photo credit: J. Crivello, NatGeo

I enjoy knowing wolves exist in Michigan

	% Agree	% Disagree	Test statistic	P-value	N
Liberal	87	13	r= 0.13	0.000	342
Moderate	73	27			75
Conservative	79	17	F= 3.33	0.036	495
Urban	81	18			553
Suburban	73	21			276
Rural	86	14			137

I enjoy knowing wolves exist in Michigan

	% Agree	% Disagree	Test statistic	P-value	N
White	83	15	t= 4.01	0.000	766
Non-White	73	23			
Hispanic	95	5	t= 6.08	0.000	39
Non-Hispanic	81	17			
UP	61	39	F= 6.50	0.002	33
NLP	82	16			
Rest of MI	82	15			874

I would be likely to purchase a license to hunt or trap wolves

	% Agree	% Disagree	Test statistic	P-value	N
Democrat	11	89	r= -0.108	0.001	489
Independent	11	87			
Republican	21	78			306
Urban	4	94	F= 11.76	0.000	553
Suburban	11	86			
Rural	18	82			137
UP	55	45	F= 26.68	0.000	31
NLP	27	73			
Rest of MI	12	87			881

I would be likely to purchase a license to hunt or trap wolves

	% Agree	% Disagree	Test statistic	P-value	N
White	16	83	t= 5.42	0.000	773
Non-White	5	92			
Hispanic	8	92	t= 3.13	0.003	39
Non-Hispanic	14	84			

The decision to hunt wolves should be made by public vote

	% Agree	% Disagree	Test statistic	P-value	N
Democrat	67	32	r= -0.149	0.000	489
Independent	56	43			
Republican	49	50			306
Liberal	47	53	r= -0.153	0.000	342
Moderate	32	67			
Conservative	66	33			495

The decision to hunt wolves should be made by public vote

	% Agree	% Disagree	Test statistic	P-value	N
Hispanic	23	77	t= -5.09	0.000	39
Non-Hispanic	58	42			
UP	81	19	F= 4.02	0.018	32
NLP	53	42			
Rest of MI	56	44			882

Wolves should only be hunted if biologists believe the wolf population can sustain a hunt

	% Agree	% Disagree	Test statistic	P-value	N
Democrat	75	22	r= -0.085	0.009	489
Independent	84	16			
Republican	82	18			306
Urban	73	26	F= 6.14	0.002	553
Suburban	81	15			
Rural	78	22			137

Wolves should only be hunted if biologists believe the wolf population can sustain a hunt

	% Agree	% Disagree	Test statistic	P-value	N
White	83	15	t= 7.3	0.000	770
Non-White	51	47			147
Hispanic	87	13	t= 2.27	0.023	39
Non-Hispanic	78	23			908

Conclusions

In general,

↑ Wolf value

↓ Hunting

↑ Belief in Science



- ◆ Pattern may be augmented if trends of increasing urbanization and minorities continue

Photo credit: Montana Fish, Wildlife & Parks

Conclusions



- ◆ Political party and ideology important, but influence is unclear



- ◆ Conservatives, Democrats support public vote, minorities don't, others split

Conclusions



- ◆ Hunters don't differ from public



- ◆ UP still the exception
- ◆ NLP similar to the rest of the MI

Implications

Little disagreement among, within stakeholder groups = think beyond tolerance

Role of politics in management evolving

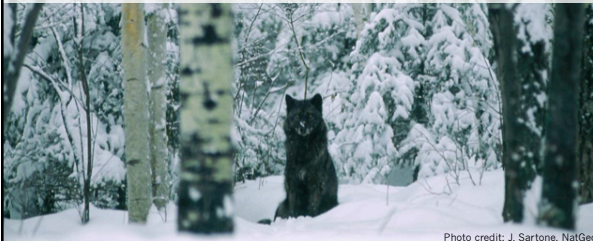


Photo credit: J. Sartone, NatGeo

Future Research

Causal roots of perceptions

Nature of human-wolf interactions

Outreach and communication interventions

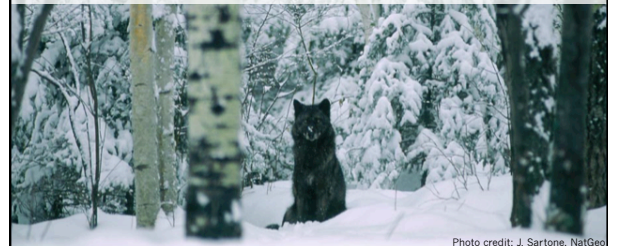


Photo credit: J. Sartone, NatGeo

Acknowledgements

Funding: Department of
Fisheries & Wildlife,
ESPP, MSU

Institute for Public Policy
and Social Research

Riley/Gore Lab: B Muter, J
Kahler, S Hanisch, S Riley

Paul Curran CSTAT

Photos: Isle Royale Wolf-
Moose Study



Questions?

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