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THE PERCEPTIONS OF MICHIGAN HUNTERS REGARDING WOLVES (*CANIS LUPUS*)
AND THE IDEA OF A WOLF-HUNT AS A MANAGEMENT OPTION

by

Zachary A. Merrill

A Thesis Submitted to the Graduate College
in partial fulfillment of the requirements
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THE PERCEPTIONS OF MICHIGAN HUNTERS REGARDING WOLVES (*CANIS LUPUS*)
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Zachary A. Merrill, M.A.

Western Michigan University, 2016

Gray wolves (*Canis lupus*) are an important keystone species in mixed forest ecosystems throughout the Great Lakes region. Due to wolves being placed on the Endangered Species List in 1974, the wolf population of Michigan has increased from near extinction in 1974 to greater than 650 in 2013. The return of wolves to northern Michigan ecosystems has re-ignited complex debates regarding how humans and wolves should best coexist. Wildlife professionals have become increasingly aware of the importance of human response for sound wildlife management decisions. The most effective management plans require cooperation from all parties, including farmers, citizens, tourists, wildlife managers, and hunters. This research, based on an online survey of more than 1200 hunters completed between February and July of 2015, assesses perceptions related to gray wolf management policies among hunters in eight regions of Michigan. The questionnaire also collected information on knowledge of the species with regards to their ecological importance. Inferential and spatial statistics were used to determine variations in opinions and knowledge about wolves by respondent's age and other demographic categories as well as how this knowledge varies by state region. Information obtained may be used to help educate wildlife managers on what hunters actually know about wolves and how Michigan hunters perceive both wolves and the potential efficacy of wolf management options across the state.

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	ii
LIST OF TABLES.....	v
LIST OF FIGURES.....	vi
CHAPTER I.....	1
INTRODUCTION.....	1
<i>Organization of Thesis</i>	3
CHAPTER II.....	5
WOLF HISTORY IN MICHIGAN.....	5
CHAPTER III.....	9
LITERATURE REVIEW.....	9
<i>Balancing Wildlife Management with Human Considerations</i>	9
<i>Livestock Depredation</i>	10
<i>Perceptions of Wolves</i>	13
<i>Perceptions of Wolf Reintroduction</i>	16
<i>Perceptions of Wolves in the Great Lakes Region</i>	18
CHAPTER IV.....	22
METHODOLOGY.....	22
<i>Data Collection</i>	22
<i>Questionnaire</i>	23
<i>Data Analysis</i>	25
CHAPTER V.....	27
RESULTS.....	27
<i>Respondents Characteristics</i>	27
<i>Overall Perception Differences</i>	28
<i>Variations in Perceptions Across Demographic Groups</i>	30
<i>Regional Variations in the Perceptions Related to the Importance of Wolves</i>	32
<i>Regional Variation in Management Strategies</i>	34
<i>Qualitative Analysis</i>	36
CHAPTER VI.....	38
DISCUSSION OF RESULTS.....	38
<i>Perceptions by Age</i>	38

Table of Contents - continued

<i>Perceptions by Educational Attainment</i>	39
<i>Perceptions by Income Level</i>	40
<i>Perceptions by Gender</i>	40
<i>A Summary of Demographic Factors Predicting Perceptions of Wolves</i>	41
<i>Discussion of Regional Variations in Perceptions of Wolf Importance and Related Management Strategies</i>	42
<i>Discussion of Overall Wolf Importance and Implications for Different Management Strategies</i>	44
<i>Qualitative Analyses</i>	45
<i>Potential Management Implications</i>	48
CHAPTER VII.....	50
CONCLUSION.....	50
<i>Overall Conclusion</i>	51
APPENDICES	53
Appendix A.....	54
QUESTIONNAIRE	55
Appendix B.....	60
HSIRB APPROVAL.....	61
Appendix C.....	62
PRESS RELEASES	63
REFERENCES	64

LIST OF TABLES

2.1 Wolf History in Michigan	8
5.1 Respondent Demographics	28
5.2 ANOVA Demographic Results of Overall Wolf Importance	30
5.3 Students <i>t</i> -test Results Overall Wolf Importance by Gender	31
5.4 ANOVA Regional Variation in Overall Perception of Wolves	32
5.5 Means of Differing Overall Perceptions by Region	33
5.6 Regional Variation in Management Strategy	34
5.7 Regional Variation in Wolf Importance	35
5.8 Qualitative Analysis Themes	37

LIST OF FIGURES

4.1 Study Regions	24
5.1 Percentage of Total Respondents by Region	29
5.2 Means of Likert-type Score of Differing Overall Perceptions of Wolves Importance to the Environment by Respondents Region of Primary Residence	33

CHAPTER I

INTRODUCTION

The growing population of gray wolves (*Canis lupus*) in Michigan has become a controversial topic among a number of interest groups including hunters, farmers, and wildlife enthusiasts. Diverse types of people may have drastically varied perceptions of wolves and propose differing strategies to manage the rebounding wolf population. Emotions can run high among those personally involved with wolves. Some residents in Michigan feel that their own interests, including security of livestock, accessibility to game, and other recreational activities are threatened by the growing wolf population (Hook and Robinson 1982). Other residents fear that the return of a top predator to a dominantly human environment will cause an increase in human-wolf conflicts in the region (Kellert 1985).

Native Americans consider the wolf sacred as their brother; crediting wolves for teaching them how to forage and hunt (The American Indian Heritage Foundation 2013). European settlers had a much different attitude towards coexistence with wolves. Their goal was eradication with the popular perception that “the only good wolf is a dead wolf.” Perceptions and attitudes toward wolves may be placed in two broad categories “It is either a love’em or hate’em relationship with little middle ground between the two groups” (Taylor 1983, 7). The controversy is strong among farmers, hunters, and outdoor enthusiasts. In many cases, disputes are based on individuals’ threat perception to self, their interests, and attitudes towards the animal. Differing perceptions have been related

to a person's knowledge and experience with the gray wolf (Williams et al. 2002). In Michigan, the increasing wolf population has led to a debate over what types of management practices will be employed, if any, to keep the growing wolf population controlled.

Adding to the controversy is a series of changes in official rulings regarding wolf management. In 2012, the state of Michigan delisted wolves from the Endangered Species List which led to a wolf-hunt being authorized by Michigan's Natural Resource Commission in 2013. As wolves were now listed as a game species, a debate ensued over how wolves should be managed in the state. Citizens and wildlife interest groups collected enough signatures to create a wolf-hunt ballot initiative. In November 2014 this ballot initiative was voted on by residents of Michigan, resulting in the wolf-hunt being discontinued as a management practice. A federal appeals judge has recently (2015) decided to relist gray wolves as an endangered species in Michigan (Oosting 2015) because researchers have determined wolves have not recolonized enough of their native habitat and remain in need of continued federal protection. The back and forth movement between delisting, relisting, and hunting has certainly contributed to the feeling of uncertainty among stakeholders and ordinary citizens regarding what is recommended or 'right'. Many say there are enough wolves to call for delisting.

The controversy surrounding wolves in Michigan led to this study to better understand Michigan residents' perceptions of wolves, more specifically hunters' perceptions of wolves, and to help identify possible management strategies that might be applied within the state. The perceptions of Michigan hunters are important to consider for the development of successful management strategies.

Michigan hunter's perceptions of wolves' overall importance to the environment and a proposed wolf-hunt will be the focus of this thesis. The purpose of this research is three-fold: 1) to assess the perceptions of hunters on the growing wolf population in Michigan; 2) to understand hunters' perceptions of wolves' ecological importance to the environment; and 3) to assess management ideas among hunters. What are the perceptions of hunters towards wolves? How do the perceptions among hunters in Michigan differ based on standard socio-demographics? How do hunters' perceptions and knowledge of wolves vary spatially across the state? Do management ideas differ among hunters living in different geographical regions across the state?

Hypotheses guiding this research include:

Ho1: There is no difference in hunters' perceptions of the overall importance of wolves in the environment based on respondents age, education, and gender.

Ho2: There is no differences in hunter's perceptions of the overall importance of wolves associated with respondents' region of primary residence.

Ho3: There is no difference in how participants responded to a variety of management options in association with region of primary residence.

Ho4: There is no difference in hunter's perception of the overall importance of wolves to the environment and the variety of management options examined.

Organization of Thesis

This thesis is organized as follows. Chapter II discusses the significant history of wolves in Michigan and some of the major events related to their population change and

management in the state. Chapter III discusses the historical management practices implemented regarding wolves. It also highlights previous research on human perception of carnivores, including wolves globally, nationally, and regionally. There is also a discussion about the ecological importance of wolves within Michigan in this chapter. Chapter IV discusses how data were collected, the development of the questionnaire, and statistical tests employed in this study. Chapter V presents the results. Chapter VI discusses the findings and some possible reasons for differing perceptions among hunters in Michigan and how the results compare with previous literature. Chapter VII, the conclusion provides recommendations for future research on the perceptions of wolves in Michigan and possible management strategies. This chapter also reviews what actions should be taken to better educate and inform residents on the growing wolf population in Michigan.

CHAPTER II

WOLF HISTORY IN MICHIGAN

Wolves have occupied the Great Lakes region including Michigan since the retreat of the last glacial period about 10,000 years ago. Historically, in the pre-European settlement era, wolves were found in all 83 present-day counties of Michigan (Beyer Jr. et al. 2009). Government bounties and state trapper systems began in 1817 and were the preferred management technique by European settlers moving into the region. Wolf bounties continued until 1960 to some degree (Beyer, Jr. et al. 2009). Wolves were completely eradicated from the Lower Peninsula (L.P.) by 1935. Wolves gained legal protection in 1965 from the state, and, in 1974, were federally recognized as an endangered species as part of the Endangered Species Act of 1973 (Roell 2011).

Approximately six wolves remained in the Upper Peninsula in 1974 when researchers from the U.S. Fish and Wildlife Service (USFWS), Northern Michigan University (NMU) and Michigan Technological University (MTU) attempted to translocate four wolves from the Superior National Forest of north-central Minnesota into the Huron Mountain region of Marquette County, Michigan. Human response to the translocation of these wolves led to two wolves being shot on sight, one trapped and shot, and one was struck by a vehicle and killed. This translocation effort failed, illustrating the possibility that lethal human response to wolf recovery would limit success of the species restoration in the Upper Peninsula (Weise et al. 1975). By 1976, other wolves that naturally migrated into the Upper Peninsula (U.P.) of Michigan were found killed by humans despite federal and state protection (Hook and Robinson 1982).

The Endangered Species Act of 1973 theoretically protected the remaining six wolves in the U.P. and the small breeding population of wolves in the Superior National Forest of north-central Minnesota under federal protection. Over time, federal protection began to surpass lethal human response and the Upper Great Lakes wolf population began to expand home ranges into Wisconsin (1975) and Michigan (1989) (Hammill 2007; Beyer Jr. et al. 2009; Roell 2011). The regional wolf population began to successfully reproduce, recover, recolonize, and increase over the next 40 years. From 1977 to 2005, Michigan and Wisconsin experienced a 15 percent annual growth rate expanding wolf populations to 405 and 435, respectively. Minnesota's wolf population recorded a 4 percent growth rate and the population increased to over 3000 individuals (Hammill 2007). In 1997, the Michigan Gray Wolf Recovery and Management Plan was established to manage the growing number of wolves in the state (Michigan Department of Natural Resources 1997). According to the most recent survey in 2013, the Michigan wolf population has increased to more than 650 individuals dispersed among more than 100 distinct wolf packs. (MDNR 2013). The current population of gray wolves in Michigan led to its designation as a game species complete with a hunt on the species in 2013 (MDNR 2015). A timeline of the events described above is presented as Table 2.1.

Michigan is currently home to three ungulate prey species (elk, moose, white-tailed deer) for wolves to consume (Beyer Jr. et al. 2009). White-tailed deer (*Odocoileus virginianus*) and elk (*Cervus canadensis*) are still managed as game and hunted, while disjunct moose populations in the U.P. are not hunted as game. Human hunting of ungulates is considered to directly compete with wolves for resources (MDNR 2015). Human predator competition is often cited as one of the biggest concerns for coexistence

with wolves (Kellert 1987; Tucker and Pletscher 1989; Williams et al. 2002). To the contrary some hunters also mention that wolves are beneficial to the game species. Those who believe wolves are beneficial to game species frequently cite wolves' ability to cull sick or injured animals, which can build a strong healthy game population (Kellert 1991).

Table 2.1 Timeline of Wolf History in Michigan. Source: Beyer Jr. et al. 2009

Year	Event
1817	United States Congress establishes a wolf bounty for the Northwest Territories, including Michigan.
1837	Michigan becomes the 26 th state
1838	Ninth law passed by first legislature of Michigan establishes a wolf bounty; titled “An Act for the Destruction of Wolves”
1910	Wolves most likely eradicated from the Lower Peninsula
1922	Wolf bounty repealed because of fraudulent activities
1922	State paid trapper system enacted
1935	State paid trapper system repealed and new wolf bounty established
1954	Last record of wolf reproduction in the Upper Peninsula
1959	Only one wolf bounty confirmed, down from the average of 31 individuals between 1935 and 1956
1960	Bounty repealed
1965	Wolves gained full legal protection from the state of Michigan
1967	Wolves protected on federal lands by the Endangered Species Preservation Act of 1966
1973	Survey reveals approximately six wolves remained in the Upper Peninsula
1974	Wolf listed as an endangered species under the Endangered Species Act of 1973
1974	Four wolves translocated from the Superior National Forest in northern Minnesota to the Huron Mountain region of Marquette County Michigan, all four wolves were killed by human response within 8 months
1978	Federal recovery plan for the eastern timber wolf completed
1989	First evidence of wolves establishing a territory in Michigan since the 1950’s
1990	First documentation of wolf reproduction in Michigan since 1954
1990	Study completed on public attitudes and beliefs about wolf restoration and recovery in Michigan
1992	First wolf captured and radio-collared in Michigan
1994	Coyote hunting banned during firearm deer season in the Upper Peninsula
1997	Michigan Gray Wolf Recovery and Management Plan approved
2002	Michigan reclassifies wolf to state threatened status as population surpasses criteria established in 1999
2003	Federal government reclassifies wolf to threatened status in a region including Michigan allowing lethal action as a form of management to prevent wolf depredation on domestic animals
2005	Federal court returns wolves to endangered status
2008	Michigan wolf management plan revised
2012*	Senate bill no. 1350 classifies wolves as a game species
2013*	Michigan DNR authorized and managed a wolf-hunt, 22 wolves killed
2014*	Ballot proposal 14-1 was rejected by popular vote, not allowing wolves to be designated game species eliminating the wolf-hunt as a management option
2015*	Federal court returns wolves to endangered status

*Michigan Department of Natural Resources

CHAPTER III

LITERATURE REVIEW

This chapter discusses previous research related to human perceptions of wolves. It examines how the perceptions differ globally, nationally, regionally and across different demographics and interest groups. Discussion of different variables that contribute to differing perceptions of wolves and other top predators is also included.

Balancing Wildlife Management with Human Considerations

Aldo Leopold, a very influential American ecologist, forester, and conservationist known most for writing “A Sand County Almanac” (1949) spoke out in the early 1940s about problems associated with game management. He felt that proper wildlife management was not how to manage the deer but how people should be managed to encourage healthy ecological communities (Flader 1974). Decisions in wildlife management cannot be based strictly on biological data but also on the human response to those data and each distinct species (Bath 1991).

Increased human development and dispersion into wildlife habitat threatens animal populations worldwide. Wolves require a large home range. Human barriers to wolves and their home range include the growth of housing developments, roads and trails. These features can inhibit the mobility and distribution of wolves across the landscape (Whittington et al. 2004). The increase in human incursions into pristine wolf habitat while the wolf population is increasing will inevitably result in more wolf-human interactions (Hammill 2007). A quantitative summary of wolf-human interactions by

McNay (2002) examined 80 records of conflict in Alaska and Canada between 1900 and 2000. Thirty-nine cases of wolf aggression by apparent healthy wolves were documented; 29 cases involved fearless or habituated wolves, and 12 cases involved rabid wolves. Two confirmed deaths from wolves were recorded, both involving rabid wolves. There was only one record of an unprovoked wolf attacking and severely biting a human between 1900 and 1969. There were four cases of unprovoked wolves attacking and severely biting a human between 1969 and 2000 (McNay 2002). Contrary to many beliefs there have been no documented cases of a healthy, wild wolf killing a person in North America (Mech 1992).

Livestock Depredation

A survey of American farmers between 1993 and 1994 found that 51 percent managed their farmland for wildlife by leaving a small percentage of unharvested crops in fields, providing a water source or mineral lick, and providing natural cover near fields for wildlife to inhabit. Seventy-seven percent of these farmers also stated that they allowed hunting or participated in hunting on their property to manage wildlife populations in proximity to their fields (Conover 1998).

In western North America, seasonality and reoccurrences of livestock depredation have been studied by Musiani et al. (2005) to help predict times and locations where depredation is more likely to occur. In Alberta, Canada, these researchers learned the most attacks occurred between June and September with more than 100 attacks occurring in each of these months over the duration of the study (April 1982 - April 1996). These researchers speculated that attacks were more frequent in summer months because they

coincided with open grazing seasons for the livestock. Knowing which months wolf depredation on livestock is more likely to occur can help farmers and ranchers predict vulnerability and needs for added security or better husbandry practices to help circumvent depredation (Musiani et al. 2005). Historical records of reoccurring wolf depredation on farms and predictive modeling of habitat selection preferences among wolves has helped to locate areas where depredation is more likely to occur (Musiani et al. 2005). Removing wolves from these areas of high livestock depredation has been shown to create a territorial void which is soon filled by another wolf pack. Relocation is only a temporary solution to depredation in the area (Hammill 2007).

Depredation in Michigan occurs on approximately 6 percent of farms in the U.P. (Beyer Jr. et al. 2006). A depredation event consists of a wolf severely injuring or killing domesticated livestock or pets. In Michigan there have been approximately 181 verified events of wolf depredation between 1996 and 2010. Most depredation events occurred in 2010 with 58 verified wolf attacks on livestock. Within these 58 events, 39 depredations took place on the same farm, leading one to believe that better husbandry could deter some of these attacks (Roell 2011). The actual number of wolf depredations may be higher as some “kills” cannot be verified as wolf kills, and sometimes depredation credited to wolves is actually due to black bear (*Ursus americanus*) and coyote (*Canis latrans*) attacks. In some cases, a complete animal disappears from the farm and there is no way of determining what actually happened (Roell 2011).

Non-lethal management options can be used to control wolf populations. Livestock protection dogs were used centuries ago in central Europe and Asia. Livestock protection dog’s unpredictable behavior disrupts the vulnerability of the herd. Many

predators were removed from these landscapes due to over-exploitation. The removal of these threats through lethal management has led to a reduction in the use of non-lethal management practices such as livestock protection dogs (Gehring 2010). Other non-lethal options include better fencing, the use of predictive modeling for depredation patterns, rubber bullets, and cracker shells (Musiani et al. 2005; Beyer Jr. et al. 2006; Gehring 2010). In Michigan, a wolf deterrence kit is available to residents and farmers through the Michigan Department of Natural Resources. This kit includes a device that fires a loud cracker shell, scaring the wolf. This device has been rated very favorably among those individuals who have used this as a method to negatively condition wolves to humans (Beyer Jr. et al. 2006). These non-lethal options can be further explored in the Great Lakes region to help manage livestock depredation and put distance between wolf habitat and human development.

One of many obstacles for wildlife management is that many people kill wolves when they move into the area. Kellert (1985) surveyed Minnesota residents finding 53 percent of hunters responded that they knew someone that has illegally captured or killed a wolf and 31 percent of the same hunters said that while hunting they might shoot a wolf on sight. Hunters shooting or capturing wolves is seen as an action that can reduce the effective management of the species. State authorized wolf-hunts have occurred in Michigan (2013), Wisconsin (2012-2014), and Idaho (2011-present) (MDNR 2015; Idaho Fish and Game 2015; Wisconsin Department Natural Resources [WDNR] 2015). In 2015, a federal judge overturned the removal of gray wolves from the endangered species list in the Upper Great Lakes region, which eliminated the potential for wolves to be

considered a game species in Wisconsin, Minnesota, and Michigan (MDNR 2015; WDNR 2015).

Understanding the human dimensions of managing wildlife is just the beginning of proper management. Growing populations of both wolves and humans have led to studies questioning the best policy to manage wolf populations. Questions that arise include, how do people truly feel about wolves? What do people know about the species? What actions can realistically be employed?

Perceptions of Wolves

The way different groups of people, such as hunters, farmers, and wildlife managers perceive wildlife plays a direct role on successful management of the species (Weise et al. 1975; Bath and Buchanan 1989). Assessing human dimensions of wildlife management is essential for the development of sound wildlife management policies that can be successfully implemented (Thompson 1992; Manfredi 2004). This can best be explained by considering wildlife management as a means of managing the people to manage the wildlife. Legislation and hunting laws do not apply directly to the game but to the hunters that hunt the game. Human perception to predators has been closely related to the fate of their population. This has been documented by the successful eradication of wolves in the L.P. of Michigan by early European settlers (Treves 2008; Schanning 2009).

Research on human perceptions of large carnivorous mammals varies across the globe, over time, and by different interest groups (Treves 2003; Williams et al. 2002).

Human-carnivore conflict is an enormous concern for conservation biologists worldwide

because humans tend to take action that undermine current management techniques. Most carnivore species require a large home range and a protein-rich diet causing them to be in direct conflict with humans (Treves 2003). Wolf pack midwinter territory is greater than 179 km² with an average wolf pack size of 4.1 wolves per pack (Gehring 2005). The primary diet of wolves in Michigan is comprised of ungulate species (Roell 2011).

Research in Sweden during the 1970s found that the majority of hunters (70%) believed wolves did not have an overall negative impact on game populations, and wanted wolves to be reintroduced into the high alpine areas (Ericsson 2003). On the other hand, research in Norway found that 51 percent of respondents wanted wolves either completely eradicated from the environment (14%) or reduced (37%) (Bjerke et al. 1998). The 51 percent of respondents that wanted the wolves eradicated or reduced was in contrast to previous research in Norway that showed only 25 percent wanted the current wolf population eradicated or reduced. Seventy-five percent of the respondents wanted to maintain the current population or wanted the wolf population to be increased (Dahle 1987). Researchers speculate that the increase in the predator population has led to an enormous increase in livestock depredation in the area causing perceptions to be much less favorable (Bjerke et al. 1998). Williams et al. (2002) found that respondents in the contiguous U.S. reported a higher proportion of positive perceptions as compared to Scandinavian countries between 1972 and 2000 (Williams et al. 2002).

A national study of American attitudes towards wildlife conducted in 1985 (Kellert) revealed that the overall perception of wolves was modest, ranking 18th out of 33 animals in terms of likeability. Respondents perceived the wolf more favorably than

coyotes, crows, and lizards but less favorable to ladybugs, raccoons, and turtles (Kellert 1985).

Within the contiguous U.S., a greater proportion of research on attitudes and perceptions of wolves was positive compared to research globally (Williams et al. 2002). Williams et al. (2002) published a quantitative summary of attitudinal and perceptual studies between 1972 and 2000. Researchers found that rural residents responded with negative perceptions towards wolves in 10 of 12 cases examined. Ranchers were negative towards wolves in 7 of 9 cases examined. Education was associated with positive perceptions of wolves in 18 of 20 cases examined (Williams et al. 2002). It should be noted that in many of these studies, wolf-reintroduction or a particular interest group, was the focal point of the research.

The difference in attitudes towards wildlife by gender was studied by Kellert (1987). The differences between males and females were so strong that Kellert mentioned it as one of the most important socio-demographic influences on attitudes toward animals. Kellert (1987) revealed females had statistically significant higher ratings to more attractive and domesticated species such as household pets, lady bugs, and swans. Males were more likely to provide a higher rating toward invertebrates and game species, suggesting masculinity plays a role in animal preferences. Males showed a higher participation in consumptive use activities such as hunting than females, which was also speculated as an underlying reason for animal preferences (Kellert 1987).

Perceptions of Wolf Reintroduction

Perception research on wolves in the contiguous United States is typically associated with studies on the attitudes and perceptions of people related to the reintroduction of wolves into historically native habitat. Reintroduction of wolves into historically native habitat particularly during the 1980s and 1990s was, and still is, a controversial topic among many involved. In the 1980s and 1990s, wolf populations began to rebound both naturally and of course, through wildlife management restoration efforts. Reintroduction was successful in Yellowstone National Park (YNP) and unsuccessful in the attempted translocation into the Upper Peninsula of Michigan mentioned previously (Weise et al. 1975; Williams et al. 2002). The reintroduction of wolves into YNP and the Rocky Mountain West was of concern to residents and different interest groups such as big game hunters, ranchers, and environmentalists (Kellert 1986; McNaught 1987; Bath 1989; Tucker and Pletscher 1989; Mech 1995; Pate et al. 1996). Big game hunters were most concerned with wolves destroying the populations of game species (Tucker and Pletscher 1989). Environmentalists wanted wolves to be restored in their natural environment to restore order and balance to the ecosystem. Ranchers were concerned for wolf depredation effects on their livestock (Bath 1991). A survey of park visitors at YNP in the summer of 1985 found that 74 percent of respondents believed the presence of wolves in the park would enhance the experience. Eighty-two percent of respondents felt that wolves should have a place in YNP and 91 percent thought wolves would help maintain a balance among wildlife populations. These results indicate these respondents feel that wolves are important to the environment. Among the main reasons visitors did not agree with wolf reintroduction in YNP was fear for the safety of small

children and the possibility of livestock depredation on farms near the park (McNaught 1987).

Colorado residents were surveyed in the summer of 1994 and results indicated that at the time 70 percent would vote in favor of wolf-reintroduction and 63 percent perceived reintroduction as good. East slope residents were slightly more favorable for reintroduction (73%) compared to west slope residents (65%) demonstrating that perceptions can be divided regionally within a state (Pate et al. 1996). These perceptions and attitudes towards the reintroduction of wolves in the western United States are in contrast with studies incorporating respondents in regions where wolves already had established populations (Ericsson 2003). For example, researchers in Sweden found the general public living in areas where wolves were not present had more favorable perceptions towards wolves as compared to people living in regions where wolves were present (Ericsson 2003). This demonstrates an interesting perceptual difference between people living in proximity to wolves and people not living in proximity to wolves that will be explored further.

Wolves have successfully recolonized regions of historic natural habitat without physical human intervention (disregarding the effects of the Endangered Species Act of 1973). Wolves have successfully recolonized Wisconsin, Michigan, and Montana. The natural recovery of wolves within historic natural habitats is an issue of great controversy. Governments and citizens put a lot of effort into eradicating the wolf from these areas. Between 1870 and 1877 government sanctioned hunters killed 55,000 wolves annually, decimating the wolf population of the western states (Zuccotti 1995). As society shifted views, these same agencies have developed conservation efforts to

restore and promote recolonization. Aldo Leopold was once an advocate for predator control. He later shifted positions and became a supporter of predator conservation (Zuccotti 1995). Leopold's change in ideas about predator management has also been experienced by conservation biologists and government agencies as they now focus on the importance of predators in ecological communities.

Perceptions of Wolves in the Great Lakes Region

A study based on a convenience sample of individuals visiting a science exhibit at the Minnesota State Fair in 1972 found that 56 percent of respondents thought wolves should be protected and 90 percent perceived a Minnesota wolf population had intrinsic value (Johnson 1974). An analysis of approximately 1000 public comment letters received by the United States Fish and Wildlife Service regarding the reclassification of wolves from endangered to threatened in Minnesota found differences in opinions based on location of respondents' primary residence. Less than a quarter of rural residents felt wolves should remain classified as endangered while three-fourths of the comments from urban residents thought wolves should remain classified as endangered (Llewellyn 1978). A survey of Minnesota residents in 1985 indicated an overwhelming majority of respondents disagreed with the statement "Minnesota would be a nicer place to live if fewer timber wolves were present" (Kellert 1986). It should be noted that the wolves in Minnesota were an important population for the Great Lakes region during the 1970s and 1980s when the populations in surrounding states was near extinction. The territorial expansion of Minnesota's wolf population was vital for natural recolonization of the

surrounding Upper Great Lakes states of Wisconsin and Michigan (Beyer Jr. et al. 2009; Hammill 2007; Schanning 2009; Treves 2008).

Hook and Robinson (1982) and Kellert (1991) are two of the earliest studies related to perceptions of Michigan residents with respect to wolf restoration and recovery. Perceptions of wildlife shape people's approval of policies and management strategies regarding the species (Schanning 2009). If policies and management strategies directly conflict with the individual's personal beliefs, ignoring these policies and management efforts will undermine and conflict with management efforts (Beyer Jr. et al. 2009; Schanning 2009). Hook and Robinson (1982) found just over half of respondents (54%) indicated wolves should be restored in the U.P. and 45 percent of respondents supported wolf reintroduction efforts. Fifteen percent of respondents were strongly opposed to reintroduction efforts while 15 percent responded they would actively support reintroduction efforts (Hook and Robinson 1982). Williams et al. (2002) found 51 percent of people nationwide had positive perceptions of wolves and 59 percent supported wolf reintroduction, which is consistent with what previous researchers found in Michigan in 1982 and 1990 (Hook and Robinson 1982; Kellert 1991). They also found significant positive relationships towards wolves among hunters in five of nine studies examined between the years 1972 and 2000 (Williams et al. 2002). This study further illustrates early perceptions of hunters' opinions of wolves primarily before wolves rebounded successfully.

More recent research on perceptions of wolves in Michigan illustrates a dramatic shift in opinion from the early favorability when wolf populations were dismal to more circumspect views after wolves rebounded in the state. Significant changes in attitudes

and perceptions in Michigan have not been studied, but more recent research on Michigan hunter perceptions (Mertig 2004; Beyer Jr. et al. 2006) shows a less positive perception of wolves as compared to what Kellert (1991) and Hook and Robinson (1982) found several decades earlier.

In contrast to previous research on the perceptions of wolves in Michigan, the most recent survey of the general public conducted in 2005 identified less positive perceptions of wolves (Beyer Jr. et al. 2006). Hunters, specifically in the U.P., had the least favorable views. Only 41 percent of U.P. residents strongly approved or somewhat approved of having wolves in Michigan (Beyer Jr. et al. 2006). Notably, at the time of this research, the only wolves in Michigan inhabited the U.P. (MDNR 2015). Lower Peninsula residents demonstrated more overall favorability for the importance of wolves to the ecosystem as compared to U.P. residents. Seventy-two percent of northern Lower Peninsula residents and 80 percent of southern Lower Peninsula residents perceived the ecological value of wolves' as a reason to have wolves in Michigan. In regards to wolves' right to exist in Michigan 50 percent of U.P. residents thought that was an important reason for wolves to inhabit the state, but overwhelming support (>70%) for wolves' right to exist came from respondents from the Lower Peninsula where wolves do not inhabit. The majority (51%) of hunters in the U.P. did not think the benefit of wolves to the ecosystem was a logical reason to allow wolves in Michigan (Beyer Jr. et al. 2006). This result contrasts with research by Kellert (1991) which states that most respondents, including hunters, cited wolves' existence and ecological value as one of the most important reasons for wolf restoration. Differences in research design and questions

make direct comparison impossible when observing different results conducted over time from different studies and by different researchers.

According to the most recent survey of Michigan hunters in 2005 (Beyer Jr. et al. 2006) more than 70 percent of hunters statewide strongly support providing a limited number of permits to shoot wolves during a managed hunting season. More than 83 percent of Michigan hunters statewide would agree to a controlled legal hunting season in areas where the wolf populations would not be endangered (Beyer Jr. et al. 2006). More than 25 percent of Minnesota hunters and residents living in regions with wolves indicated they might shoot a wolf while hunting (Kellert 1987). The 15 percent of wolves that are illegally shot or trapped and the 25 percent of residents living within the wolf range of Minnesota that indicated they might shoot a wolf while hunting further illustrates the importance of understanding the overall perceptions of wolves among hunters in Michigan (Kellert 1987; Fuller 1988).

CHAPTER IV

METHODOLOGY

This chapter discusses the methods of data collection adopted for the research, including identifying the organizations that were contacted to help distribute the questionnaire. It also discusses the development of a questionnaire specific to this topic, identifies questions/statements from other surveys and from previous research, and why specific questions and statements were used. A timeframe for data collection, and a discussion of the statistical tests employed in the analysis of survey results is also provided.

Data Collection

Data collection was conducted from February to July of 2015. A specially-designed questionnaire (Appendix A) was created and approved by WMU's Human Subjects Institutional Review Board (HSIRB) (Appendix B). The questionnaire was designed and implemented using Qualtrics® software (Qualtrics 2015). Qualtrics® is an internet based survey-distributing platform, which allows respondents access to the questionnaire from any computer from anywhere on earth.

Several interest groups were contacted to aid in promotion of the survey through websites, links and publications. The interest groups who were contacted and chose to participate included publishers of "The Michigan Farm News", "Michigan Outdoor News", and "Michigan Out of Doors". The link to the questionnaire was provided to all groups willing to participate by promoting the distribution of the questionnaire. Digital

and paper versions of the “Michigan Farm News” included a short article about the research and provided the link to readers who might be interested in participating in the survey (Appendix C). A small article was also written by Bill Parker, the editor of the “Michigan Outdoor News” (Appendix C) encouraging readers to participate in the research. A web address was provided to access the questionnaire. “Michigan Out of Doors” provided a link on their Facebook page for their followers interested in completing the questionnaire.

Questionnaire

The specially-designed questionnaire for this research (Appendix A) was created from a fusion of previous perception studies. Many questions originally came from studies done by Kellert (1985), Bath (1989), and Bright and Manfredi (1996). Some of these questions were modified as to address respondent’s perceptions about the growing wolf population in Michigan and the possibility of a wolf-hunt to manage the species.

The questionnaire ultimately consisted of three sections. The first incorporated a set of 5-point Likert-type scale questions/statements. The second section included open-ended questions inquiring about respondents’ experiences or past histories with wolves, and other similar predators. The third and final section of the questionnaire surveyed basic demographic information about each of the respondents.

Michigan is subdivided into eight distinct regions for data analysis (Figure 4.1), these regions are consistent with MDNR enforcement units with one exception. The regions the MDNR designated as 3 and 5 were merged together to form one region called

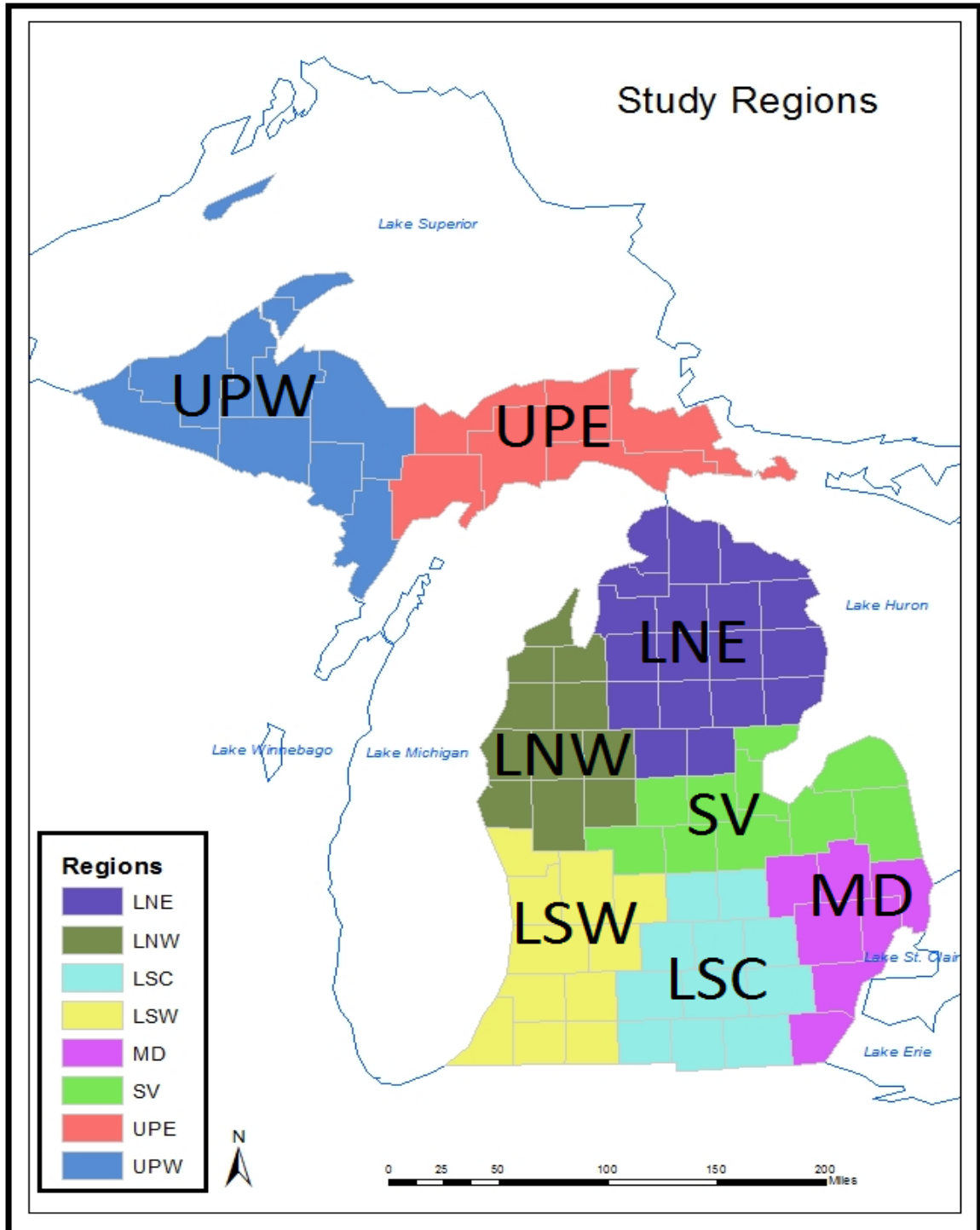


Figure 4.1 MDNR Enforcement Units of Michigan (abridged) used in this study

northeast Lower Peninsula (LNE), these regions appeared much smaller in area and population. Acronyms were created to better represent the regions, eastern Upper Peninsula (UPE), western Upper Peninsula (UPW), northeast Lower Peninsula (LNE), northwest Lower Peninsula (LNW), Lower Peninsula southwest (LSW), southcentral Lower Peninsula (LSC), Saginaw River Valley (SV), metro Detroit area (MD).

Respondents had to qualify to take the questionnaire by responding correctly to questions regarding the inclusionary criteria. At the outset of the online questionnaire, respondents had to agree to consent, confirm they could read and write in English, acknowledge that they were Michigan residents, and be at least 18 years of age. If the respondent did not consent to participate, or could not read and write in English, or were not Michigan residents, or were not at least 18 years of age, an automated message appeared stating they were not eligible to participate in the questionnaire, while thanking them for their time and willingness to participate.

Data Analysis

Questionnaire responses were automatically coded numerically in Qualtrics® (Qualtrics 2015) and placed in a spreadsheet. Data were analyzed using IBM SPSS 23® (IBM SPSS 2015) provided by Western Michigan University's Department of Geography. Respondents were assigned to two groups; hunters and non-hunters, based on their response to question #23, "Do you hunt in Michigan?" and question #15, "What types of activities do you participated in?" Only respondents that indicated that they hunt were used for data analysis because there was an insufficient number of non-hunter respondents to be able to compare the two groups.

Initially, univariate descriptive statistics were used to explore the demographic characteristics of the sample of Michigan hunters. One-way ANOVA was used to compare means of responses across different age, income, and education levels. Groups were composed with respect to how they responded to the following two Likert-type scale statements: “Wolves are important to the environment”, and “Wolves are beneficial to other animals.” Each respondents’ score for these two statements were added together to form an overall wolf importance variable (new range 2-10). In addition, an independent samples *t*-test was used to analyze differences by gender, which is hypothesis one. Hypothesis two was tested using a one-way ANOVA to determine association between how participants responded to the overall wolf importance variable and respondents’ region of primary residence. Hypothesis three was tested using the Chi-square test of independence to determine if differences were present between regions of respondent primary residency and management options. Hypothesis four was tested using Chi-square tests of independence to determine if differences were present between how participants responded to the overall wolf importance variable and how those responses were associated with other statements regarding management options. A qualitative analysis was used to examine the open-ended questions that allowed the respondents to identify positive and negative aspects of wolves.

CHAPTER V

RESULTS

This chapter discusses the results of each hypothesis and the statistical tests employed. The results of the qualitative analysis are also included in this chapter. The decision to accept or not accept the hypotheses identified in chapter 1 is indicated at the end of each subsection.

Respondents Characteristics

Between February and July of 2015, 1176 valid questionnaires were received. Eighty-seven percent of participants were male and 13 percent female (Table 5.1). The distribution of gender is very similar to a recent survey of Michigan hunters of which 80 percent of respondents were male (Beyer Jr. et al. 2006). Sixty-three percent of respondents were between 31 and 60 years of age, 21 percent of respondents were between 18 and 30 years of age, and 16 percent of respondents were over 60 years of age (Table 5.1). Thirty percent of respondents had a high school diploma or less; 35 percent of respondents have a two-year degree, 25 percent of respondents had a four-year degree, and 10 percent of respondents had completed an advanced degree (Table 5.1). Respondents' location of primary residence was distributed across the eight regions being employed for this research (Figure 5.1). Northwest Lower Peninsula (LNW) had the fewest respondents with 5 percent (n=59), and southwest Lower Peninsula (LSW) had the

most respondents with 22 percent (n=255). The remaining regions all had between 10 and 13 percent (n=125-151) of total respondents represented (Figure 5.1).

Table 5.1 Respondent Demographics

Age	%
18-30	21
31-60	63
60+	16
Education	
High school or less	30
Two-year/Associates degree	35
Four-year/Bachelor's degree	25
Advanced degree	10
Income	
\$25,000 or less	13
\$25,001-\$70,000	55
\$70,001 and higher	32
Gender	
Male	87
Female	13

Overall Perception Differences

The overall wolf importance variable had a range of values from two (least positive perception) to ten (most positive perception). A mean was computed for the overall wolf importance variable revealing the perceptions for the entire sample ($\bar{x} = 5.73, sd = 2.48$). Forty-three percent of the sample responded they would shoot a wolf on sight. Sixty-four percent of the sample responded they would apply to hunt wolves if there was a lottery established for this purpose.

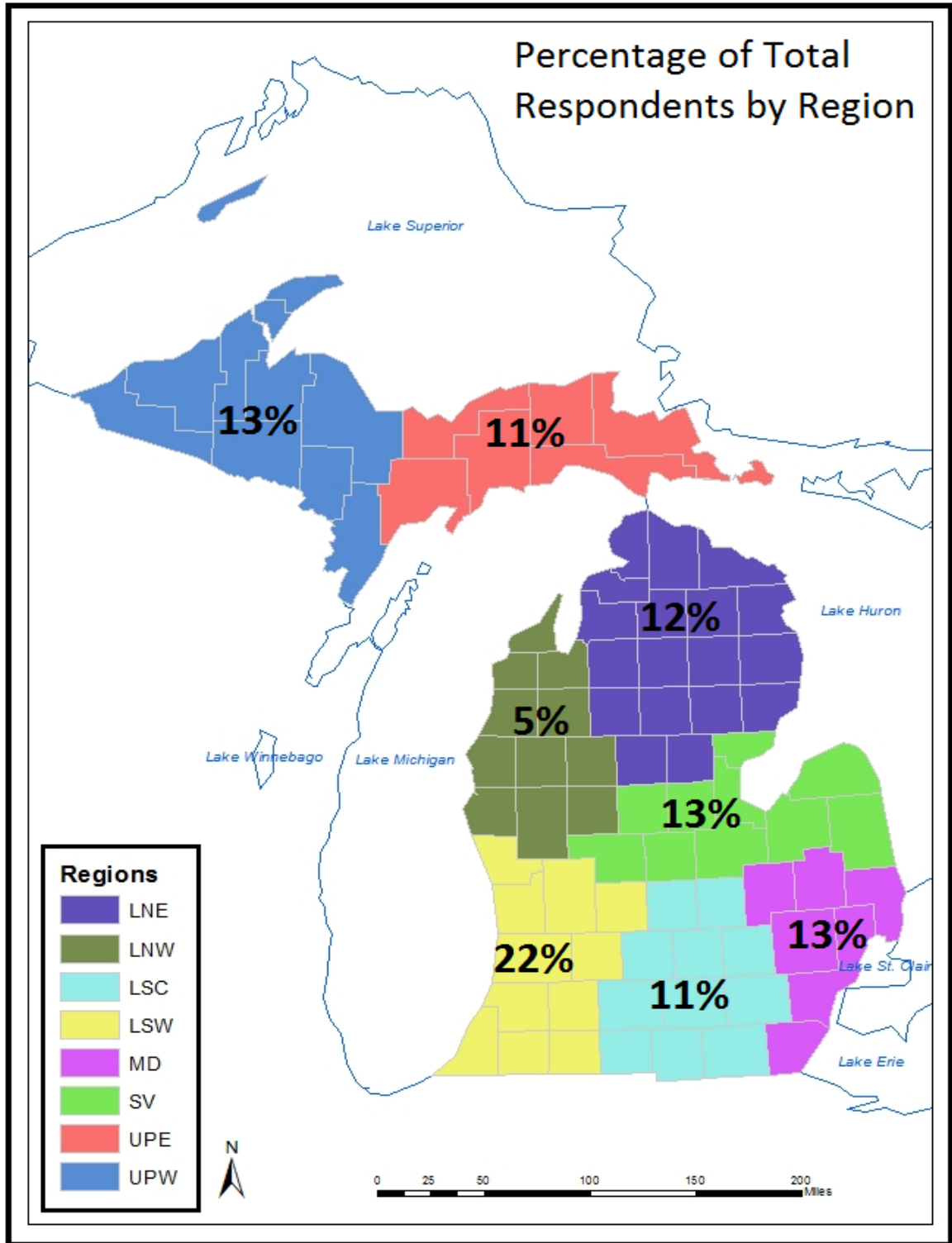


Figure 5.1 Percentage of Total Respondents by Region

Variations in Perceptions Across Demographic Groups

A one-way ANOVA in conjunction with a Fisher's LSD post-hoc test was computed to compare the importance of wolves based on participant's age, education, and income. Significant differences were found among the age groups ($F(2,1169) = 5.38$, $p < 0.005$; Table 5.2). Fisher's LSD was used to determine the nature of the differences between the age groups. This analysis revealed that the youngest respondents (18-30 years of age) had the highest positive perception of overall wolf importance ($\bar{x} = 6.09$, $sd = 2.45$). The oldest age group (60+ years of age) had the least positive perception of overall wolf importance ($\bar{x} = 5.30$, $sd = 2.46$). Every age group was significantly differently ($p < 0.005$) from the others.

Table 5.2 ANOVA Results of Demographic Variables of Overall Wolf Importance

		Sum of squares	df	M square	F	Sig.
Overall perception of wolves associated with age	Between groups	65.757	2	32.878	5.376	0.005
	Within groups	7149.652	1169	6.116		
	Total	7215.4019	1171			
Overall perception of wolves associated with education	Between groups	127.287	3	42.429	7.052	0.0001
	Within groups	6888.861	1145	6.016		
	Total	7016.148	1148			
Overall perception of wolves associated with income	Between groups	44.284	2	22.142	3.654	0.026
	Within groups	6745.264	1113	6.06		
	Total	6789.548	1115			

No significant differences were found between the two highest education categories (four-year degree and advanced degree; Table 5.2) and the two lowest educated categories (high school diploma or less and two-year degree); however, the two highest education categories were significantly different from the two lowest education categories ($F(3,1145) = 7.05$, $p < 0.0001$). The less educated respondents (high school or less, two-year degree) had a less positive perception of overall wolf importance ($\bar{x} = 5.45$,

5.54, $sd = 2.45, 2.44$) than the higher educated respondents (four-year and advanced degree) ($\bar{x} = 6.14, 6.28, sd = 2.38, 2.69$).

Fisher's LSD revealed a significant difference in overall perception of overall wolf importance between the lowest income option on the questionnaire and the highest income option ($F(2,1113) = 3.65 p < 0.026$). Respondents that reported an individual annual income of less than \$25,000 were the most positive about overall wolf importance ($\bar{x} = 6.26, sd = 2.42$). While respondents that indicated an individual annual income of more than \$70,001 were the least positive to overall wolf importance ($\bar{x} = 5.62, sd = 2.5$). There were no other significant differences among income classes.

An independent-samples t-test comparing the mean scores of the overall wolf importance variable between male and female hunters indicated a significant difference between the two groups ($t(1165) = 6.060, p < 0.0001$; Table 5.3). The mean of male respondents was significantly lower ($\bar{x} = 5.57, sd = 2.45$) than the mean of female respondents ($\bar{x} = 6.89, sd = 2.44$). These results indicate that female respondents agreed more strongly than males that wolves were important to the environment and beneficial to other animals. Based on the results, hypothesis one will not be accepted. Significant differences in overall wolf perception were found among age groups, education levels, income categories, and gender.

Table 5.3 Student *t*-test Results for Overall Wolf Importance by Gender

Gender	\bar{x}	sd	t	Significance
Male	5.57	2.45	-6.06	0.0001
Female	6.89	2.44		

(Students t-test result (2-tailed) (Sig. $p < 0.05$)

Regional Variations in the Perceptions Related to the Importance of Wolves

A one-way ANOVA and Fisher’s LSD was also computed to compare Michigan hunters’ perception of overall wolf importance and their region of primary residency. A significant difference was found among the different regions ($F(7,1145) = 5.8, p < 0.0001$; table 5.4). Metro Detroit respondents indicated the most positive perception of overall wolf importance ($\bar{x} = 6.3, sd = 2.32$). Eastern Upper Peninsula (UPE) respondents were the least positive toward overall wolf importance ($\bar{x} = 4.84, sd = 2.45$). These analyses revealed that respondents who indicated western Upper Peninsula (UPW) as location of primary residency possessed a greater positive perception ($\bar{x} = 5.77, sd = 2.55$) to overall wolf importance than respondents indicating UPE as location of primary residency ($\bar{x} = 4.84, sd = 2.45$). UPW did not differ significantly from any other region. Fisher’s LSD indicated respondents residing in UPE were significantly less positive regarding the overall wolf importance as compared to regions UPW ($\bar{x} = 5.77, sd = 2.55$), Saginaw River Valley (SV) ($\bar{x} = 5.6, sd = 2.44$), LSW ($\bar{x} = 6.11, sd = 2.43$), southcentral Lower Peninsula (LSC) ($\bar{x} = 6.05, sd = 2.49$), MD ($\bar{x} = 6.3, sd = 2.32$; Table 5.5; Figure 5.2). Differences in perceptions regarding overall wolf importance were found between regions and therefore Hypothesis two will not be accepted.

Table 5.4 ANOVA Regional Variation in Overall Perception of Wolves

		Sum of Squares	df	M square	F	Sig.
Regional variation in overall wolf perception	Between groups	243.61	7	34.801	5.799	0.0001
	Within Groups	6871.764	1145	6.002		
	Total	7115.374	1152			

Table 5.5 Means of Likert-type Score of Differing Overall Perceptions of Wolves Importance to Environment by Respondents Region of Primary Residence

<i>Region</i>	\bar{x}	<i>sd</i>
UPW	5.768	2.547
UPE	4.836	2.455
LNE	5.219	2.461
LNW	5.475	2.487
SV	5.593	2.444
LSW	6.114	2.435
LSC	6.049	2.486
MD	6.298	2.320

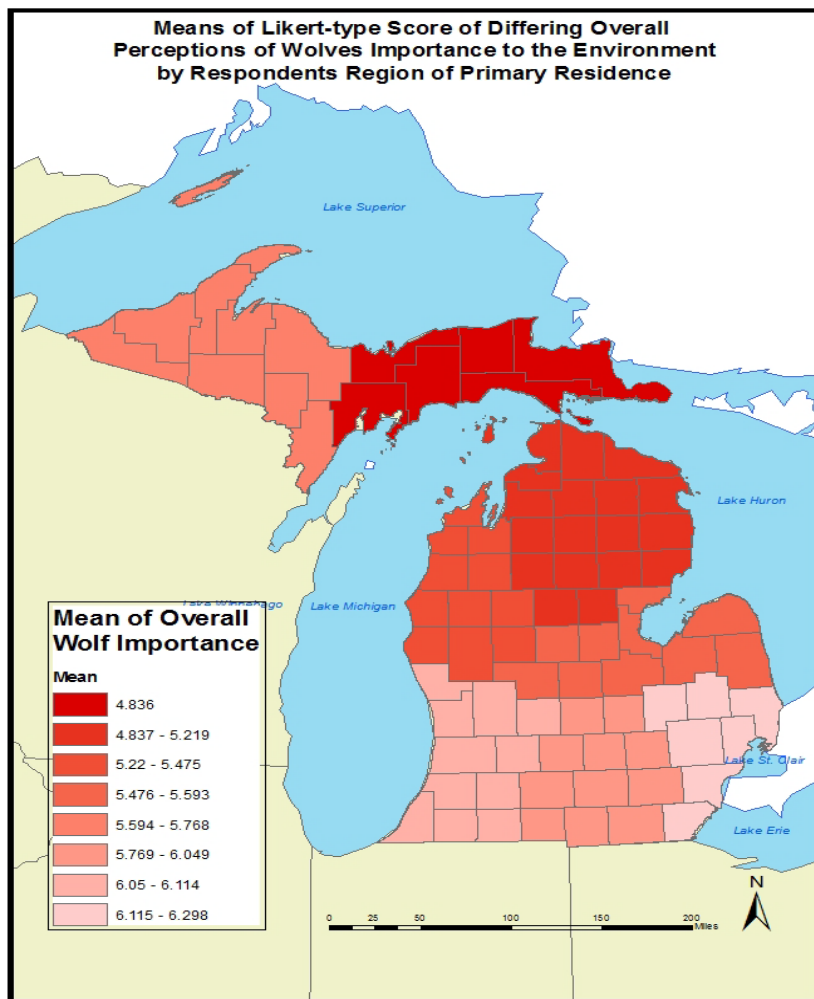


Figure 5.2 Means of Likert-type Score of Differing Overall Perceptions of Wolves Importance to the Environment by Respondents Region of Primary Residence

Regional Variation in Management Strategies

A Chi-square test (χ^2) of independence was used to compare how participants responded to whether they would apply to hunt wolves based on region of primary residency. A significant interaction was found ($\chi^2(7) = 18.497, p < 0.05$; Table 5.6). Respondents residing in UPE were most likely to apply to hunt wolves with 73 percent indicating interest. Respondents in MD had similar interest in applying to hunt wolves with 70 percent indicating interest. Respondents in LSW were the least likely to apply to hunt wolves with only 55 percent indicating interest.

Table 5.6 χ^2 Results of Regional Variations in Management Strategies

Management Options	χ^2 Value (Sig. $p \leq 0.05$)
<i>*Apply to hunt wolves based on region of primary residency</i>	$\chi^2 = 18.497, p < 0.05$
<i>*Shoot a wolf on sight based on region of primary residency</i>	$\chi^2 = 16.796, p < 0.05$

**Indicates Significant Difference*

Another Chi-square test (χ^2) of independence was calculated comparing how participants responded to whether they would shoot a wolf on sight based on region of primary residency. A significant interaction was found ($\chi^2(7) = 16.796, p < .05$; Table 5.6). Respondents residing in UPE were most likely to shoot a wolf on sight with 55 percent, indicating approval for proactive lethal wolf management. Just over half (50.4%) of respondents from northeast Lower Peninsula (LNE) indicated they would shoot a wolf on sight. Sixty-two percent of MD respondents they were not likely to shoot a wolf on sight. MD was the least likely region to shoot a wolf on sight. Differences in degrees of support for different management strategies were found between regions, hypothesis three will not be accepted.

A Chi-square test (χ^2) of independence was again calculated to compare how participants responded to whether or not they would apply to hunt wolves and their perception of overall wolf importance. A significant interaction was found ($\chi^2(8) = 126.296, p < 0.05$; Table 5.7). Respondents specifying a strong positive perception of overall wolf importance were less likely to indicate an intent to apply to hunt wolves. Respondents who indicated a less positive perception of overall wolf importance indicated that they were most likely to apply to hunt wolves. Overall, 64 percent of respondents indicated that they would apply to hunt wolves.

Table 5.7 χ^2 Results of Regional Variation in Wolf Importance

<i>*Apply to hunt wolves and perception of overall wolf importance</i>	$\chi^2 = 126.296, p < 0.05$
<i>*Shoot a wolf on sight and perception of overall wolf importance</i>	$\chi^2 = 168.748, p < 0.05$

**Indicates Significant Difference*

A Chi-square test (χ^2) of independence was calculated to compare how participants responded to whether or not they would shoot a wolf on sight and their perception of overall wolf importance. A significant interaction was again found ($\chi^2(8) = 168.748, p < 0.05$; Table 5.7). Respondents who reported a strong positive perception of overall wolf importance were less likely to indicate intent to shoot a wolf on sight. Respondents who scored low on the overall wolf importance variable indicated that they were most likely to shoot a wolf on sight. Overall, 43 percent of respondents indicated that they would shoot a wolf on sight. Differences in respondents' perceptions of overall wolf importance and the varying degree of support for different management options were found; hypothesis four will not be accepted.

Qualitative Analysis

Composite variables and scales can only go so far in an exploration of such a complex issue. To this end, open-ended questions were also incorporated in this survey. The open ended questions, “What are some positive aspects of wolves?” and, “What are some negative aspects of wolves?” were analyzed by examining and identifying common themes of the positive aspects and negative aspects cited by the respondents. Eight themes were discovered representing positive frequently cited aspects. While six negative themes emerged from the qualitative analysis. The themes and the number of respondents citing each theme are included as Table 5.8. The positive aspect related to wolves most commonly cited by respondents was their role in maintaining ecological balance. The second most frequent response was respondents refused to cite any positive aspects of wolves, negating the question, or inserting a comment indicating that there were no positive aspects of wolves. The negative aspect of wolves cited most frequently by respondents was their role in livestock depredation, followed by wolves overharvesting deer.

Table 5.8 Classification of Emergent Themes of Respondents to Open-Ended Questions Regarding Positive and Negative Aspects of Wolves

Themes	<i>n</i>
Positive Comments	
Ecological Balance	286
NONE	249
Majestic	144
Culling the weak/injured	125
Ungulate balance	102
Right to exist	76
Coyote management	39
Additional game species	27
Negative Comments	<i>n</i>
Livestock depredation	380
Overharvest of deer population	370
Human interests (pets)	255
Human safety	137
Habituation (lack of fear)	83
Overharvest of small game	42

CHAPTER VI

DISCUSSION OF RESULTS

Results of statistical analyses indicated that none of the null hypotheses guiding this research can be accepted. The following is a discussion of these results and what they mean for wildlife management professionals, environmental scientists, and others. Some of the findings correspond directly to what other researchers have found in the US and globally.

Perceptions by Age

Results indicate that younger respondents have more positive perceptions of wolves while the older respondents have the least positive perception of wolves. These results confirm previous research that finds different age groups have different perceptions of wolves (Kellert 1985, 1991; Bjerke et al. 1998). These researchers also found the oldest respondents having the least positive overall perception of wolves and the youngest respondents having the most positive overall perception of wolves. The research by Bjerke et al. (1998) found that respondents less than 55 years of age wanted to maintain or increase wolf populations in Norway while older respondents wanted to reduce or completely eradicate the wolf population. Research by Kellert (1991) indicated the oldest respondents of Michigan residents were the least favorable for wolf restoration, which also corresponds to the results of this analysis. The oldest respondents are more likely to be more connected to agricultural practices, while the younger respondents may

be more influenced by the environmental movement and the dwindling agricultural community in Michigan. Results presented here and the findings of previous research all suggest that as younger respondents begin to hunt more frequently and make up a larger portion of the hunting population more positive perceptions of wolves will follow. A more positive perception of wolves by a younger generation of hunters may lead to less frequent lethal human responses to the wolf population. Approximately 15 percent of the Minnesota wolf population is illegally trapped or shot each year (Fuller 1988). With less negative perceptions of wolves among young hunters it can be expected that fewer wolves will be killed illegally in future years.

Perceptions by Educational Attainment

Results indicate that the least educated respondents had the least positive perceptions of overall wolf importance while the most educated had the most positive perception of overall wolf importance. These results also confirm previous research. Differences in the level of education was found to be a significant factor in previous research by Hook and Robinson (1982), Kellert (1985; 1991), Williams et al. (2002), and Schanning (2009). Williams et al. (2002) found that overall positive perceptions were associated with higher education in 90 percent of the studies he examined. Hook and Robinson (1982) revealed that positive perceptions of predators increased with higher education among Michigan residents. More educated respondents tend to understand the importance of a predator to bring balance to an ecological community. Educating hunters on the importance of wolves can be one of the most proactive ways to aid wildlife management plans for wolves. Less educated hunters can and should be targeted by

wildlife managers with educational programs so they can become more aware of the importance of balance that a top predator can bring to an ecosystem. These results suggest educating hunters on the importance of a top predator to the ecological community is important for successful wildlife management.

Perceptions by Income Level

In this analysis, income and education as independent factors were analyzed separately, and results indicate that higher income respondents had the least positive overall perception of wolves and lower income respondents had the most positive overall perception of wolves. This was in contrast to previous research by Williams et al. (2002) indicating that higher income respondents have a significantly more positive overall perception of wolves in 67 percent of studies examined. Assumptions that higher income has a causal relationship with higher education does not hold true in the current research. Results suggest that education levels and income levels should be analyzed separately in further research. In addition, a two-way ANOVA was computed to test the interaction between income, education, and the composite overall wolf importance variable. No significant interaction was found between the two variable (Income * Education, *d.f.* 6, $F = 0.750$, $p = 0.610$).

Perceptions by Gender

Results from this investigation indicate that female participant's self-reported a significantly more positive overall perception of wolves than male participants. This

mirrors previous research by Kellert (1987) and Williams et al. (2002). In contrast, Bjerke et al. (1998) found a slightly higher percentage of females who wanted the wolf population in Norway to be reduced or eliminated. Kellert (1987) found the differences in perception of the wolf so profound between genders that he cited gender as one of the most important demographic influences towards animals in our society. Kellert's research also revealed that females were more positive towards domestic animals and large "aesthetically attractive" species. Williams et al. (2002) found that males had a significantly positive perception of wolves in only 19 percent of studies examined. Males should be targeted with correct information about wolves. Males may perceive shooting a wolf as a "masculine activity" however, this type of action should be deterred because it is a shameful act of unnecessary violence. It is important to note male respondents drastically outnumbered female respondents, but the percentages of men and women participating in this research are quite similar to the breakdown of hunters in Michigan.

A Summary of Demographic Factors Predicting Perceptions of Wolves

Overall, the least positive perceptions of overall wolf importance were reported by the oldest, least educated males with higher incomes. This confirms much of the previous research on perceptions towards wolves with a couple exceptions, including the interesting fact that higher income respondents were less positive than more educated respondents. Educating the public on the importance of a balanced ecosystem must be a top priority for wildlife managers. Targeting this demographic would be the most efficient way to help guide wolf recovery. Support of local residents living in regions wolves are more common will be important for the success of wildlife management

decisions. Educating people with the most negative overall perception of the species will be important for future successful management practices and the overall recovery of the species. Understanding that older men who hunt can be very set in their ways, targeting young hunters will be more successful.

Discussion of Regional Variations in Perceptions of Wolf Importance and Related Management Strategies

Results from this research indicate there are significant regional differences in positive perception of overall wolf importance. The eastern Upper Peninsula (UPE) respondents indicated the least positive perception of overall wolf importance and metro Detroit (MD) respondents indicated the most positive perception. A significant difference was revealed in the U.P. of Michigan where the only wolf population in the state can be found. Respondents in the western Upper Peninsula (UPW) were significantly more positive towards overall wolf importance as compared to respondents residing in the eastern Upper Peninsula (UPE). Previous analysis that looked at Michigan regionally did not divide the U.P. into two distinct regions as this research did. The difference in these two regions is not surprising based on personal experience living in both regions of the Upper Peninsula. This confirms previous research indicating residents of more rural areas will have the most negative perceptions of predators (Kellert 1991 Bjerke 1998; Williams et al. 2002; Ericsson 2003; Schanning 2009). The UPE was also significantly less positive toward overall wolf importance as compared to four of the six regions encompassing the Lower Peninsula. The only two regions where residents were not significantly more positive than UPE were the northeast Lower Peninsula (LNE) and the northwest Lower Peninsula (LNW) which are immediately south of UPE just

across the Mackinaw Straits. The LNE and LNW have had recently confirmed wolf sightings. Previous research has indicated that hunters in wolf areas were the least positive towards the species (Ericsson 2003). The most recent research on perceptions of wolves in Michigan also indicated less positive perceptions held by residents of the northern Lower Peninsula and Upper Peninsula (Beyer Jr. et al. 2006). Williams et al. (2002) confirms this with a qualitative analysis of previous wolf perceptions. In their research, support for wolf reintroduction was 56 percent among those who did not live near wolves and only 43 percent among people who lived near wolves. Previous research indicated the northern L.P. (LNE, LNW) as a potential habitat for natural wolf recolonization and 78-105 wolves would be feasible (Gehring and Potter 2005). If these findings are true, residents in regions LNE and LNW are aware of the potential natural recolonization of the area from a possible ice bridge connecting the two peninsulas. Residents in these regions may be less positive because of an underlying fear that wolves could likely recolonize their regions. For example, in the winter of 2014, an ice bridge formed connecting Isle Royale National Park to mainland Canada and northern Minnesota allowing for two wolves to migrate to the island and also return to the mainland several hours later (Vucetich 2016). This appears to be the theory of how wolves colonized Isle Royale National Park in the 1940s, where there is a very small disjunct population of wolves today (Vucetich 2016). Recolonization of the L.P. is plausible given the growing U.P. wolf populations and expected territorial expansion.

Results indicate the most likely regions where residents would apply to hunt wolves were the UPE with 73 percent of participants indicating an interest in a wolf-hunt. The next region was MD with 70 percent indicating interest in a wolf-hunt. This was not

expected as previous research stated more urbanized areas have frequently indicated the most positive overall perceptions of wolves and other top predators (Kellert 1991, Pate et al. 1996, Williams et al. 2002; Beyer Jr. et al. 2006; Schanning 2009). This might be explained with the idea of the wolf-hunt appearing glorious or masculine to many respondents considering it as an exotic big-game hunt. Another possibility for this unexpected result is that many people residing in MD own or have access to deer camps in the Upper Peninsula where wolves live. Further research into where participants hunt could help clarify this issue.

Results indicate that the most likely respondents to shoot a wolf on sight reside in UPE and LNE indicating a willingness to kill wolves with 55 percent and 50 percent, respectively. The respondents least likely to shoot a wolf on sight reside in the Saginaw River Valley (SV) (37%) and MD (38%). Results from respondents residing in UPE and LNE were similar in their attitudes toward shooting a wolf on sight, applying to hunt wolves if there was a lottery, and their perception of overall wolf importance. MD respondents, in contrast, would not shoot a wolf on sight but were very likely to apply for a permit to hunt wolves. This result could be related to the lack of desire to poach or illegally kill a wolf. Residents of different regions and different socio-economic groups within the state appear more likely to poach wolves.

Discussion of Overall Wolf Importance and Implications for Different Management Strategies

Almost two-thirds of respondents (64%) indicated that they would apply to hunt wolves if there was a lottery. Fifty-five percent of respondents indicating they would not apply to hunt wolves also indicated a positive perception of the species. These

respondents may already be knowledgeable about how wolves tend to self-regulate populations, or they may perceive hunting as counterproductive to wolves' ecological role. No data have been found on potential population numbers in regards to carrying capacity for the Upper Peninsula wolf population.

Forty-three percent of total respondents indicated that they would shoot a wolf on sight. About 75 percent of respondents whom indicated an overall positive perception of wolves (Score of 7 to 10 for the combined scores of two Likert-type scales regarding overall wolf importance) indicated they would not shoot a wolf on sight. Some confusion regarding what shooting a wolf on sight might actually mean could have occurred with this question. Respondents with an otherwise overall positive perception of wolves might have considered the question to include self-defense. At any rate, the results from this survey are very similar to previous research in Minnesota that revealed more than 15 percent of wolves in Minnesota are illegally shot or trapped each year (Fuller 1988). More than 25 percent of Minnesota hunters indicated that they would shoot a wolf while hunting; 54 percent of these Minnesota hunters indicated that they knew someone that has killed or captured a wolf (Kellert 1986).

Qualitative Analyses

The open ended questions, "What are some positive aspects of wolves?" and, "What are some negative aspects of wolves?" were analyzed and the positive aspects and negative aspects cited by the respondents were categorized into major themes (Table 5.8). The most frequent response to the question, "What are some positive aspects of wolves?" was that wolves restored ecological balance. This may have been influenced from

previous questions on the questionnaire regarding the role of wolves' in maintaining ecological balance. A greater understanding of the need for a top predator in a healthy ecosystem was apparent and unexpected. For the contrary statement, "What are some positive aspects of wolves?" many respondents mentioned that there were no positive aspects of wolves. This was the second most frequent response and appeared to be a way to rebel and sound off on their displeasure with the current controversy regarding management options of wolves. Mention of wolves' majestic beauty occurred often. Respondents often mentioned that wolves were beautiful creatures and people loved to hear them howl. It appeared as if some of these respondents turned to aesthetic qualities when they could not think of other positive qualities of the species. The next two frequent themes that were cited were that wolves keep Michigan's ungulate species in check and wolves cull off weak or injured animals. In some cases, responses were assigned to both themes if a preference could not be established by respondents' word choice or if they mentioned keeping a healthy deer population and culling weak or injured animals separately. These two categories could also be considered sub-arguments in the maintenance of an ecological balance. Alternatively, respondents sometimes appeared to be only concerned with the deer and/or the sick or injured individuals instead of wolves' positive impact on the entire ecological community. Excitement was apparent when respondents cited that wolves could kill coyotes or influence coyote relocation. Some respondents went as far as adding exclamation marks to express their displeasure with the current coyote population and the joy of wolves driving them away. These respondents appeared to understand the overall ecological importance of the wolf to its community citing the ecological balance while keeping deer in check and killing off the

sick and injured the most. It appears that knowledge of wolves' ecological importance is widespread, suggesting that education may not be the answer. Negative perceptions are deep-rooted, weighing more heavily as a factor with respect to their overall perceptions of wolves.

Participants were also asked, "What are some negative aspects of wolves?" The most cited response was concern for livestock depredation. This concern appears to be very high given how few livestock depredation events actually occur in Michigan. Previous questions on the questionnaire regarding perceptions of livestock depredations may also have influenced these responses. Livestock depredation has occurred on approximately 6 percent of farms in the Upper Peninsula from 1996 to 2010 (Roell 2011). The largest number of cases of livestock depredation (58 events) occurred in 2010 with 39 events occurring on a single farm leaving one to suspect better husbandry practices could have deterred some of the events (Roell 2011). Perceptions of livestock depredation and the potential for depredation appear to outweigh the actual occurrences. Livestock depredation is the leading cause for negative perceptions of wolves in Michigan amongst hunters. This suggests educating the respondents on how little depredation actually occurs could help discredit this negative perception. The second most cited negative response was that wolves overharvest and decimate the deer population. This response was expected as the annual deer harvest in the Upper Peninsula has been declining in recent years (MDNR 2015). Experts believe this is related primarily to two of the most severe winters on record in 2013 and 2014 (Erdman 2014). Deer hunters have cited concern for wolf overharvesting in previous research, expressing concern there will be fewer deer left to hunt and that hunters currently fill the

role of the top predator (Beyer Jr. et al. 2006). Perceptions of effects on human interests were frequently cited as a negative aspect. Most of these respondents were concerned for their household pets and hunting dogs. There were 39 verified attacks on dogs in Michigan between 1996 and 2010 (Roell 2011). Wolves see dogs as direct competition because they are from the same family (*Canis*) just as wolves see coyotes as direct competition. Wolves will defend their territory violently from other wolves, coyotes, or dogs (*Canus lupus familiarus*) (International Wolf Center 2016). This concern also seems exaggerated when compared to the number of actual attacks on pets. Surprisingly, fear for human safety was cited less frequently than these other themes. This contradicts previous research on threat perception and overall negative perceptions of wolves (Mech 1995; Williams et al. 2002; Treves 2003). It should be noted that there have been no documented cases of a healthy, wild wolf killing a person in North America (Mech 1992). There have been two documented cases of a rabid wolf killing a person in North America (McNay 2002). Some respondents feel that wolves are losing their fear of humans and becoming increasingly habituated to people and their homes. This perception increased concerns that habitat overlap would lead to more human-wolf conflicts.

Potential Management Implications

A large percentage of hunters indicated that they would shoot a wolf on sight regardless of legality. Wolves self-regulate their populations and defend territory violently. Considering these two realities, further management involving a wolf-hunt should not be required at this time. There are also non-lethal management options for

farmers involving very loud cracker shell-like explosives, which deter wolves from returning to an area or farm. These devices are free to farmers and are provided by the MDNR. Knowledge of the availability of these cracker shell devices may be limited. The MDNR might consider proactively distributing these devices to farmers and residents in areas where wolf-human interaction is most likely to occur.

Residents as well as hunters often perceive the MDNR negatively. Building better relationships and demonstrating empathy for residents negatively impacted by wolves, and building the knowledge base among the people most directly affected by the growing wolf population could improve the response to state wildlife management efforts. Interpretive educational programs at state parks and other venues in the regions where the least positive perceptions occur is also recommended. Sending out informational brochures to residents in these wolf inhabited regions with facts about wolf depredation events, brochures and websites will answer to frequently asked questions, and information regarding how to co-exist with wolves could be very beneficial. This information would help correct common misperceptions of European folklore, movies, and dramatic stories.

CHAPTER VII

CONCLUSION

The wolf population in Michigan is rebounding and this is an ideal opportunity for the MDNR to be proactive in understanding and changing common misperceptions among residents. None of the hypotheses guiding this research were accepted. This examination of hunters' perceptions in Michigan is not without flaws. Many aspects could have been changed or employed differently to better assess the perceptions of Michigan residents.

The original purpose of this research, at the proposal stage, was to look at the perceptions of several interest groups including hunters, farmers, and outdoor enthusiasts. However, hunters unexpectedly dominated the sample. The questionnaire could have been designed more specifically for the Michigan hunting community but this research provides a good first step for further analysis. A better understanding of how to define and target different interest groups would be necessary to make comparisons among them. If the survey had been developed with the idea of only targeting hunters, several questions would have been changed. For example, questions about respondents' farming practices and outdoor activities would have been omitted. After data analyses several misunderstandings resulting from the wording of questions and statements were discovered. More work with focus groups before the public launch of the survey could have reduced these problems. Some questions such as, "Wolves primary feed is livestock" and "Wolves primary feed is deer" would be omitted from further research

based on incorrect word choice or the fact that these questions did not produce useful information.

The limited number of questions regarding wolves' overall importance and participant knowledge of wolves limited the appropriateness options for data analysis. A question specifically asking where hunters hunt would have been ideal to better understand the spatial dynamic further than just where respondents live. Many hunters in Michigan own, rent, or lease hunting property distant from the location of their primary residence.

Continuation of this research to better understand the underlying perceptions is suggested. Expanding this research to include comparisons across different interest groups would be beneficial as hunters are not the only group effected or concerned about the growing wolf population. A longitudinal study to compare change in perception over time is also recommended. A repeat study of this type would help assist in better understanding how perceptions change as the wolf population grows and more human-wolf interactions develop.

Overall Conclusion

Many things may have been done differently to better understand the perceptions of Michigan hunters, and further research is suggested to better understand the underlying reasons for less favorable perceptions among hunters. Older, less educated, males from the UPE region and the LNE region are least understanding of overall wolf importance, more likely to shoot a wolf on sight, and more likely to apply to hunt wolves if there was a lottery. This is not surprising. The MDNR should take proactive steps in order to

promote a more positive perception of wolves among these residents. They could also include younger respondents in interpretive programs and location-based educational activities to promote a better understanding of the importance of wolves to Michigan ecosystems.

APPENDICES

Appendix A
Questionnaire

QUESTIONNAIRE

CONSENT FORM

You are invited to participate in a Western Michigan University research project entitled “Understanding the Controversy Surrounding the Wolf-Hunt by Michigan Residents”. The study is designed to analyze how residents of Michigan perceive wolves, what they know about wolves and where these aspects change throughout the state. Information may help government and private agencies understand what residents know about wolves and the possibility of a wolf-hunt, which could lead to improved educational programs. The study is being conducted by Dr. Lisa M. DeChano-Cook and Mr. Zachary A. Merrill from the Department of Geography of Western Michigan University. The research is being carried out for part of the thesis requirements for Mr. Zachary A. Merrill.

Your responses will be completely anonymous, please do not put your name or address anywhere on this form. You may choose not to answer any question by leaving the question blank. If you do not want to participate in the survey, please tell the researcher and return the survey. Returning the completed survey indicates your consent for the use of the answers you supply. If you have any questions, you may contact Dr. Lisa M. DeChano-Cook at (269-387-3536 or lisa.dechano@wmich.edu), Mr. Zachary A. Merrill at (269-924-5681 or zachary.a.merrill@wmich.edu), the Human Subjects Institutional Review Board (269-387-8293) or the vice president for research (269-387-8298).

This consent document has been approved for use for one year by the Human Subjects Institutional Review Board (HSIRB) as indicated by the stamped date and signature of the board chair in the upper right corner. Subjects should not participate in this project if the stamped date is more than one year old.

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Survey Code _____

Wolves and Wolf Hunting in Michigan

This survey has been created to gain a better understanding of how farmers, outdoor enthusiasts, and wildlife managers perceive wolves and the wolf-hunt among residents of Michigan. Your time to complete this survey is appreciated, thank you very much.

1. What types of activities do you participate in? (**Check all** that apply)

Hunting Fishing Hiking Farming Education Research
 Camping Bird Watching
 Trapping Snowmobiling Other Winter Sports

2. How much do you **agree or disagree** with the following statements. (**Please circle** your answer choice)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Wolves are important to the environment.	1	2	3	4	5
Wolves are beneficial to other animals.	1	2	3	4	5
I like wolves.	1	2	3	4	5
Wolves have always lived in the Great Lakes Region including Michigan	1	2	3	4	5
Wolves attack humans.	1	2	3	4	5
Wolves attack household pets.	1	2	3	4	5
Wolves' primary feed is livestock.	1	2	3	4	5
Wolves' primary feed is deer.	1	2	3	4	5
Wolves' average weight is greater than 140 pounds.	1	2	3	4	5

3. **In your opinion**, a state authorized wolf-hunt in Michigan would... (**Please circle** your answer choice)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Result in large numbers of wolves being killed.	1	2	3	4	5
Result in the wolf population being wiped out.	1	2	3	4	5
Better manage deer populations.	1	2	3	4	5
Better manage wolf populations.	1	2	3	4	5

4. **Approximately** how many wolves inhabit the state of Michigan?

_____ 200-300 _____ 301-400 _____ 401-500 _____ 501-600 _____ 601-700 _____ 701-800 _____ 801-900 _____ 901-1000

5. Where do you get your information about wolves in Michigan? (**Check all** that apply)

_____ Newspaper _____ DNR Brochures _____ Internet _____ Education _____ Science _____ Family/Friend _____ Personal Experience
 _____ Agriculture Brochures _____ Hunting Magazines _____ Other (specify) _____

6. Do you have a farm? _____ Yes _____ No

If yes, is your gross net earning greater than \$10,000? _____ Yes _____ No

If yes, what farming practices do you participate in? (**Select all** that apply)

___ Cattle (Beef) ___ Cattle (Dairy) _____ Agriculture (Please specify)
 _____ Other Livestock (Please Specify)

7. Do you hunt in Michigan? Yes No
If yes, which species do you hunt? (Check all that apply)
 Deer Elk Bear Coyotes Birds Waterfowl
 Other (specify) _____
8. Would you apply to hunt wolves if there was a lottery? Yes No
9. Would you shoot a wolf on sight? Yes No
10. What are some positive aspects of wolves?
11. What are some negative aspects of wolves?
12. What kind of personal experiences do you have with wolves?
13. What kind of personal experiences do you have with coyotes?
14. **On the map of Michigan** on the next page, please **clearly** indicate which Michigan counties contain wolves.
15. Age: 18-30 31-60 over 60
16. Gender: Male Female
17. City/Town of Primary Residence: _____
18. Zip code: _____
19. Political Affiliation: Democrat Republican Independent Green Environmental
 Other (specify) _____
20. Ethnicity: Caucasian African-American Other (specify) _____
21. Your Individual Annual Income: \$25,000 or less \$25,001-\$ 70,000 \$70,001 and higher
22. Highest level of education completed: High school or less Two-year/Associates degree Four-year/Bachelor's degree Advanced Degree



Thank you for taking time to complete this questionnaire! Your answers are appreciated and will be used to better understand the controversy surrounding wolves and the wolf-hunt in Michigan.

Appendix B
HSIRB Approval

HSIRB APPROVAL

Date: February 18, 2015

To: Lisa DeChano-Cook, Principal Investigator
Zachary Merrill, Student Investigator for thesis

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number 15-01-26

This letter will serve as confirmation that the changes to your research project titled “Understanding the Controversy Surrounding the Wolf-Hunt by Michigan Residents” requested in your memo received February 17, 2015 (to use Qualtrics as survey platform; add publisher press release as recruitment strategy; add email recruitment script; modify survey) have been approved by the Human Subjects Institutional Review Board.

The conditions and the duration of this approval are specified in the Policies of Western Michigan University.

Please note that you may **only** conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: January 28, 2016

Appendix C
Press Releases

PRESS RELEASES

March 15, 2015 | MICHIGAN FARM NEWS 3

Farmers asked about wolf opinions

Farmers are being invited to participate in a study aimed at getting to the root causes of Michigan's wolf controversy.

Zachary Merrill, a graduate student at Western Michigan University (WMU), is beginning a study **to target the interest groups that are most directly involved with the controversy surrounding wolves and the wolf hunt in Michigan.** That includes farmers, outdoor enthusiasts and wildlife managers. The survey will seek to "better understand the opinions and knowledge of these groups and what they know about wolves and the wolf hunt in Michigan."

To meet that goal, Merrill invites Michigan farmers - and especially farmers from the Upper Peninsula - to participate in a specially designed questionnaire.

Funded by the WMU Department of Geography, the questionnaire is fairly short, and includes multiple choice, yes-or-no and short answer questions. Completion of the questionnaire should take no longer than 10 minutes.

"Your responses will be valued and used to better understand how to approach the situation and what action should be taken to address the controversy," Merrill said.

A follow-up article will be written upon completion of the study to inform participants of the findings.

"This is a great opportunity to voice your opinion and to be heard on a very controversial topic of interest at this time," Merrill said.

Find the survey at <http://bit.ly/wolvesofmichigan> or contact Mer-

rill by phone (269) 924-5681 or email (zachary.a.merrill@wmich.edu) to inquire about participating in the questionnaire over the phone or by email or mail.

MARCH 13, 2015

OUTDOOR OBSERVATIONS

WHY ARE WOLVES SO CONTROVERSIAL? Seems like everyone in the state has an opinion on wolves and wolf hunting, and those opinions vary greatly. Ask a dozen people about their thoughts on wolves and you're likely to get a dozen different answers ranging from, "They are majestic apex predators that we need to have on the landscape for a balanced ecosystem," to, "They are useless vermin and should be wiped off the face of the earth."



Bill Parker
Editor

Graduate student Zachary Merrill, of Western Michigan University, is researching the topic and wants to hear all of our opinions. The purpose of his study is to target the interest groups that are most directly involved with the controversy surrounding wolves and the wolf hunt in Michigan "to better understand the differences in perceptions and knowledge throughout the great state of Michigan."

Zach is in the process of surveying farmers, outdoor enthusiasts, and wildlife managers to better understand the opinions of these groups and what they know about wolves and the wolf hunt in Michigan.

This is your opportunity to express your views on wolves and wolf hunting to someone who genuinely cares about what you have to say.

I took the survey online and it took about 5 minutes to complete. You can take it online or via mail or even over the phone. Find the survey online at <http://bit.ly/wolvesofmichigan>, contact Zach by phone at (269) 924-5681, or email at zachary.a.merrill@wmich.edu.

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