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Michigan Wolf Management 2009 Report

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ABSTRACT

On May 4, 2009, the final rule to delist gray wolves (Canis lupus) in the Western Great Lakes distinct population segment was published. However on July 1, 2009, the US Fish and Wildlife Service (USFWS) withdrew the delisting rule because they had failed to provide notice and a comment period in the rule making process. This returned wolves to Federal endangered status and management authority returned to the Federal government. During winter 2008-2009, we estimated a minimum of 577 wolves in the Upper Peninsula (UP), an increase of 11% from the previous year. Evidence of possibly two wolves was documented in the Northern Lower Peninsula (NLP). We maintained a sample of radio-collared wolves by fitting 34 new wolves with collars to support the population survey work, as well as provide information useful for managing wolf livestock and wolf-human conflicts. We monitored 57 different wolves for at least part of the year. Nine of the 57 collared wolves died, including eight from illegal killing. In 2009, wolves were involved in 12 livestock depredation events resulting in the loss of 14 animals on eight farms. The number of depredation events was similar to the previous five years. A total of \$4,696.50 was paid to producers for livestock killed by wolves. There were two verified depredations on domestic pets. We recorded 74 nuisance wolf complaints; 42% of complainants perceived wolves as a threat to personal or family safety. In 2008, the State Legislature passed two laws that allow citizens to kill wolves in the act of attacking their livestock or dogs. These laws were in effect during the two months of state management authority in 2009; citizens did not kill any wolves under these authorities.



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INTRODUCTION

Wolves occupied all of Michigan at the time of European settlement. The United States Congress passed a wolf bounty in 1817 in the Northwest Territories, which included the area that would become Michigan. A wolf bounty was the ninth law passed by the first Michigan Legislature in 1838. Wolves were probably extirpated from the Lower Peninsula (LP) by 1910. The bounty on wolves continued until the period between 1922 and 1935, when a State trapper system was in effect. The state reinstated the bounty in 1935, but repealed it 1960 after wolves were nearly eliminated. The State granted full protection to wolves in 1965. By 1973, the wolf population was estimated at six animals in the UP (Hendrickson et al. 1975). Between 1954 and 1988 there was no evidence of reproducing wolves; however, in 1989 biologists documented the birth of pups from a pair of wolves in Dickinson County. Since that time, the population has increased and expanded its range into all the counties of the UP, although wolves only occur occasionally in Keweenaw County. The UP of Michigan is about 42,610 km² (16,500 mi²) and approximately 65% is favorable wolf habitat (Potvin et al. 2005).

The gray wolf was declared an endangered species under the provisions of the Endangered Species Preservation Act in 1967, and with the passage of the Endangered Species Act in 1973, the gray wolf was added to the current Federal list of threatened and endangered species in 1974.

To consider wolves eligible for removal from the Federal list of threatened and endangered species (i.e., delisting), the USFWS recovery plan called for a separate subpopulation of 100 or more wolves in Michigan and Wisconsin combined for five or more years, and a stable population in Minnesota. The Minnesota wolf population is secure; increasing from 1,500 animals in 1989, to about 3,000 animals in 2004. The combined Wisconsin and Michigan population first exceeded 100 animals in 1994 and met the numerical recovery criterion in 1999. Eight years later, in March 2007, the USFWS removed wolves in Michigan from the Federal list of threatened and endangered species. A Federal court overturned this delisting decision in September 2008. The USFWS again removed wolves from the Federal list of Threatened and Endangered species on May 4, 2009. However, two months later (July 1, 2010) the USFWS withdrew the delisting rule because they had failed to provide notice and a comment period on the new rule. Today, the wolf remains classified by the USFWS as an endangered species.

Until recently the State's Wolf Recovery and Management Plan, officially adopted in 1997, guided wolf recovery in Michigan. This plan called for reclassification of wolves from endangered to threatened status after the population in Michigan exceeded 100 animals for five consecutive years. The wolf population met this criterion in 2000 and two years later the State reclassified wolves to threatened status. Removal of wolves from the State list of threatened and endangered species required a population of 200 or more animals for five consecutive years. The State removed wolves from the

Threatened and Endangered species list on April 9, 2009 after meeting this recovery goal in 2004.

Since 1997, the context of wolf management in Michigan has changed considerably. The wolf population size and distribution has expanded, presenting a need to address a different set of biological and social issues. In response to these changes, the Department of Natural Resources (now the Department of Natural Resources and Environment (DNRE)) initiated revision of the 1997 wolf management plan, which included a review of the best available scientific information and substantial involvement of affected stakeholder groups and the public. The Department convened an advisory committee, called the Michigan Wolf Management Roundtable, to develop recommendations to guide management of wolves and wolf-related issues. The Department adopted the revised plan based on these recommendations on July 10, 2008. The revised plan is based on sound science and careful and respectful consideration of the diverse perspectives held by Michigan society.

The purpose of this report is to summarize wolf population monitoring and management activities in Michigan during 2009.

WOLF POPULATION MONITORING, UPPER PENINSULA

A winter wolf survey allows us to monitor the status of wolves in the UP and to determine a minimum estimate of the number of wolves. The survey consists of an intensive and extensive search of roads and trails throughout the UP for wolf tracks, scats, and other sign. The search is systematic and guided by citizen observations of wolves, previous winter survey results, and movement information collected on radio-collared wolves. The survey also incorporates observations of packs with radio-collared wolves made from fixed-wing aircraft. The integrity of the minimum population estimate is maintained by using established procedures designed to avoid double-counting of wolves. A detailed description of survey procedures can be found on the DNRE website:

(http://www.michigan.gov/documents/dnr/Estimating_Wolf_Abundance_in_Michigan_060208_239125_7.pdf).

From 1989 through 2006, the DNR attempted to count wolves throughout the entire UP. However, as the wolf population increased, it became more difficult and time consuming to separate adjacent wolf packs. As a result, we developed a sampling system to reduce the amount of area searched in order to allow more time to count wolves in adjacent territories accurately. The new approach uses a geographically based stratified random sample, produces an unbiased, regional estimate of wolf abundance, and provides the opportunity for discovering areas of growth and decline in wolf abundance in Michigan's UP. The new approach is more efficient, saves time, and reduces associated costs.

We divided the UP into 21 wolf survey units and assigned each unit to one of three strata. Stratum assignments are based on geographical location (east vs. west UP) and wolf density from 2003-2005. In 2008, we pulled the most western survey unit out of the sample because wolf density in this area did not align with the range of densities

assigned to each stratum. We will survey wolves in this unit each year and add the count to the estimate from the stratified random sample. The survey period starts in December and continues through March unless snow conditions deteriorate earlier. We assigned survey units to DNRE staff or United States Department of Agriculture (USDA) Wildlife Services employees who use ground tracking as well as aerial observations of packs with radio-collared wolves to determine the number of animals.

In cooperation with USDA-Wildlife Services, DNRE staff spent an estimated 1,254 hours conducting the wolf survey, which yielded a minimum winter wolf population estimate of 577 wolves in the UP in the winter of 2008-09 (Fig. 1).

We estimated the 2009 minimum population to contain 108 packs, 20 pairs, and four loners, with the highest density of wolf packs continuing to be in the western UP. The mean pack size over the previous five years was 4.6; however, during last year's survey the average pack increased to 5.3 (Table 1).

The 2009 population estimate was an increase of 11% over the winter 2007-08 minimum population estimate of 520 (Fig. 2).

WOLF POPULATION MONITORING, NORTHERN LOWER PENINSULA

In October 2004, a coyote trapper mistakenly captured and killed a wolf in Presque Isle County. This was the first verification of a wolf in the Lower Peninsula in at least 65 years. We found tracks of two additional wolves in the same vicinity a few weeks later. Since these events, we have surveyed the NLP to determine whether wolves had successfully colonized the area. For three years (2005-2007), we surveyed portions of the NLP for wolf sign in late February and early March. This survey had two components: a prioritized area search and a targeted search based on citizen reports of wolves or wolf sign. USDA-Wildlife Services, Little Traverse Bay Band of Odawa Indians, and Central Michigan University worked cooperatively with us on the surveys. We searched nine survey units ranging in size from 200-400 mi², however, no wolf sign was found. We also checked tracks and wolf sightings reported by the public but found no wolves. Starting in 2008, we only used the targeted search approach because of the lack of evidence of wolf presence in the NLP the previous three years. We sent out a press release asking the public to report any wolves or wolf sign they encounter from mid February through early March. We found no wolves or wolf sign in the NLP during the 2008 or 2009 winter survey period. However, video images of single wolves were recorded in Emmet (May 19, 2009) and Presque Isle (July 27, 2009) counties.

RADIO COLLARING AND TELEMETRY

Monitoring radio-collared wolves provides valuable information used to help estimate population abundance, wolf survival rates, and causes of mortality. Knowledge of wolf territories and movements obtained through telemetry also provides useful information to aid in the management of wolf-human conflicts (e.g., livestock depredations and nuisance wolves). A total of 34 wolves were captured in 2009; 25 new wolves were

collared with VHF radio-collars, one was fitted with a new collar that was originally captured in Wisconsin, two were captured twice, and two new wolves were fitted with GPS collars for the predator/prey research project in Menominee County. Twenty-eight wolves were captured during the trapping period which occurs from late spring (when overnight temperatures no longer fall below 0°C (32°F) to around the first week in July (when dog training season begins). Coyote trappers incidentally captured an additional six wolves which were collared and released.

We based telemetry and territory calculations on a bio-year (a one-year period from April 15 through April 14 of the following year). Although data collection has concluded, the analysis for the 2009 bio-year is not complete, yet the analysis will be based on 1,484 telemetry locations from 55 individual wolves (Fig. 3).

Territory sizes for bio-year 2008, (April 15, 2007– April 14 2008), were calculated from 30 wolves which had 30 or more telemetry locations (Fuller 1989) using the minimum convex polygon method (Mohr 1947). We excluded locations isolated more than 5 km from other points from the territory calculation as these locations are extra-territorial moves (Fuller 1989). We considered clusters of telemetry locations more than 5 km apart with regular movements between the clusters as part of the territory. The mean territory size for all 30 wolves during the 2008 bio-year was 173.2 km² (66.9 mi²).

There has been a general decline in the mean pack territory size since 2000 in the Western UP (Fig. 4). We assigned wolves to the Western UP using the regional landscape ecosystems of Michigan (Albert 1995). With mean pack size remaining relatively stable and most (perhaps all) suitable habitat already occupied, it appears territory size has declined to accommodate the growing population. Minnesota reported similar declines in mean territory size, from 166 km² in 1988 to 102 km² in 2004 as their population increased (Erb and Benson 2004). The smaller territory sizes documented in Minnesota suggests territory sizes in the UP may continue to decline as long as prey density is adequate. The small sample size of wolf territories in the Eastern UP prevented a similar analysis. Wolf territories in the Eastern UP are larger (\bar{x} = 226.4 km² in 2008) because wolf densities are lower and some of the packs follow migrating deer.

WOLF MORTALITY

Like other species of wildlife, wolves die from a variety of natural and human-related causes. Identifying the causes of mortality helps managers understand the factors that influence the population and helps focus management if we desire to change the growth rate (positive or negative change) of the population.

During bio-year 2009, we recovered 25 uncollared wolves. The top three causes of mortality for uncollared wolves were vehicle strikes ($n=13$), followed by illegal killing ($n=7$), and depredation control actions ($n=2$). We must be cautious when interpreting the importance of different mortality factors, because we are more likely to discover deaths of uncollared wolves caused by humans (e.g., vehicle strikes). Nine radio-

collared wolves died in bioyear 2009. Eight collared wolves were illegally killed and one nuisance wolf was killed (50 CFR 17.21; a demonstrable but nonimmediate threat to human safety).

In Michigan, illegal killing of wolves accounted for 40% of radio-collared wolf mortality during bio-years (April 15 to April 14 the following year) 1999–2009 (Table 2). Sixty-six percent ($n=78$) of the mortalities for radio-collared wolves are human related. These estimates of mortality may underestimate the amount of natural mortality because we vaccinated captured wolves for a variety of diseases and treated for mange prior to 2004. These handling protocols may have reduced the amount of natural mortality observed in the Michigan sample.

While humans cause the majority of wolf mortality, the rate of mortality has been low enough that the population has continued to grow. From 1999 to 2005, the annual mortality of wolves ranged from 15 to 46% depending on the method of analysis (Huntzinger et al. 2005). Although mortality rates varied annually and confidence limits were large, the rates did not show an increasing or decreasing trend during the study period.

DEPREDATION OF DOMESTIC ANIMALS

Wolves normally kill or injure wild prey and competitors, and sometimes attack domestic animals. A depredation event occurs when a predator kills or injures one or more domestic animals at a given time. Although the frequency of wolf depredation is lower in Michigan than in Minnesota or Wisconsin, depredation is an important management issue.

During 2009, 14 verified depredation events occurred; 12 involved livestock and two involved domestic dogs (Table 3). The 14 verified depredation events resulted in the loss of 16 animals (Table 4) which is less than 2008 when wolves killed a relatively large number of small animals.

With the exception of depredation events involving small animals, the vast majority of events in the UP have involved the loss of a single animal. In 2009, 8 packs (7%) attacked domestic animals (Fig. 5).

The UP has approximately 900 livestock farms located in clusters because of soil and climatic conditions. Beef cattle and calf operations are the most common type of farms in the region. In 2009, eight farms experienced wolf depredation. From 1998-2009, 54 (approximately 6%) UP farms experienced a verified wolf depredation (Fig. 6). Thirteen (24%) of these 54 farms have experienced more than 1 wolf depredation event.

Wolves are not the cause of all livestock depredations. In 2009, coyotes were responsible for 12 additional depredations.

Michigan law defines captive cervids (e.g., deer and elk raised in enclosures) as livestock. Captive cervid operations range in size from less than one acre to more than 5,000 acres. Currently, the UP has 33 captive cervid facilities. The first two cases of verified wolf depredation on captive cervids (in this case, white-tailed deer) occurred in 2004, but none has occurred since.

Wolf depredation events have been sporadic and annual fluctuations occur. While the number of livestock depredations has increased as the wolf population has grown, the relationship between wolf abundance and livestock depredation indicates it takes a large increase in the wolf population to increase the rate of livestock depredation. The relationship between the number of wolves and the number of depredation events suggests that for every 100 additional wolves in the population there will be about three additional livestock depredation events per year (Fig. 7).

In 2009, we verified two wolf depredations on dogs; one on a dog in the act of hunting and the other was near a residence. However, another possible wolf depredation of three beagles was reported. Unfortunately, the owner did not make a report until days after the event and we could not verify this event. Between 1996 and 2008, 36 wolf attacks on domestic dogs were verified in Michigan; 33 dogs were killed and nine were injured as a result of those attacks. Yearly losses vary and actions of a single pack of wolves can be an important influence. Of the 33 wolf-related dog deaths verified since 1996, 52% involved hounds used to hunt bear. Dogs used for hunting bear released at bear bait sites may have an increased risk of attack because wolves sometimes visit these bait sites. Most of the other dog attacks occurred in close proximity to their owners residences.

The distribution of dog depredation is wider than livestock depredation; however, the actions of a few packs, as well as a few individual bear hunters, resulted in several clusters of attacks (Fig. 8). We did not find a strong relationship between wolf depredation on dogs and wolf abundance (Fig. 9).

INDEMNIFICATION

In Michigan, two funding sources are used to compensate livestock producers for losses attributable to wolves. The Michigan Department of Agriculture (MDA) administers the State fund that first became available in 1998. MDA's annual budget appropriation identifies the funding for this program. Thus, funding and the rules regarding these payments have varied depending on the year. The MDA currently pays 100% of the value of the animal (up to \$4000) at the time of loss. MDA is responsible for determining the value of each animal lost. The DNRE, or designated agents (i.e., USDA-Wildlife Services) are responsible for verifying the cause of livestock depredations. The law requires MDA to compensate livestock owners for livestock killed by wolves, regardless of the efforts owners did or did not make to reduce depredation risks. The legislation allows MDA to seek reimbursement from the DNRE for costs of compensation; DNRE has reimbursed MDA for the last five years.

Defenders of Wildlife (\$5,000) and one citizen (\$100) established the second source of money for compensation in 2000. This private fund received a second donation from Defenders of Wildlife (\$5,000) in 2006. The International Wolf Center in Minnesota administers this fund and we use this funding source to pay the difference between the value of young-of-the-year livestock killed by wolves between January 1 and September 1 and their fall market value. Because of conditions placed on the donated funds, supplemental payments are not available for captive cervids.

In 2009, a total of \$4,686.50 in compensation was paid to farmers for livestock depredation caused by wolves from the two fund sources (Table 5). In-line with the frequency of depredation events, indemnification has varied through time, the highest payments were made in 2008 (\$8,964.90).

RESOLVING WOLF-LIVESTOCK CONFLICTS

Many techniques can effectively prevent or deter wolf-livestock conflicts. However, the effectiveness of some techniques may be temporary, and some techniques may fail to work altogether in certain situations. Where conflicts occur despite reasonable efforts to prevent them, the DNRE or USDA-Wildlife Services takes appropriate steps to eliminate or minimize ongoing problems. As directed in the newly revised management plan, we guide our responses by the severity and frequency of depredation.

Non-lethal methods used to resolve wolf-livestock conflicts include improving animal husbandry practices by using best management practices (BMPs), exclusion, frightening devices and harassment (e.g., fladry, flashing lights, strobe light/siren devices, shell crackers, rubber ammunition), and protection of livestock (e.g., livestock guarding animals). We offer non-lethal methods to livestock producers when we find that wolves are harassing, injuring, or killing livestock.

Non-lethal techniques were used at six of the eight farms that experienced wolf depredation in 2009. In addition, non-lethal control measures were applied at seven farms where wolves were thought to be harassing livestock.

Wolves were managed under Federal authority during most of 2009. The use of lethal control following established DNRE guidelines was only available for two months (May 4 through July 1). During the two months in 2009 when lethal control was available, one wolf was killed in response to livestock depredation (Fig. 10.). The USFWS withdrew the delisting rule in July and returned wolves to endangered species status, eliminating our option of lethal control to address wolf depredation issues.

At various times, the USFWS has allowed the use of lethal control under a permit or a special rule. When these permits or special rules were in effect, or while wolves were not on the Federal list of threatened and endangered species, DNRE and USDA Wildlife Services killed 41 wolves in response to depredation events (Fig. 10).

The 2008 wolf management plan called for the development of a permitting process to allow livestock producers to control wolves on their property, as necessary, following a verified wolf depredation event. We have drafted operating guidelines for the permit process. However, the USFWS must remove wolves from the Federal list of threatened and endangered species before we can implement the permit process. The management plan also identified the need to develop a system to allow livestock owners to kill wolves in the act of livestock depredation. The Michigan Legislature passed a law that allows the owner of livestock or their designated agent to remove, capture, or, if deemed necessary, use lethal means to destroy a gray wolf that is in the act of preying upon the owner's livestock. The Legislature also passed a similar law that allows dog owners or their designated agents to remove, capture, or, if deemed necessary, use lethal means to destroy a gray wolf that is in the act of preying upon the owner's dog. Both laws became effective for the two months when wolves are federally delisted, however citizens did not kill any wolves under these authorities.

RESOLVING WOLF-HUMAN CONFLICTS

Most wildlife has the potential to be dangerous to humans in certain situations. Segments of the public can overestimate or underestimate the actual human safety risks posed by wolves. Some people may feel the mere presence of a wolf population poses a serious safety threat, whereas others may not recognize that wolves could be dangerous to people in certain situations. Accurate perceptions of the human-safety risks posed by wildlife can facilitate appropriate levels of concern and responses to particular situations.

Most Michigan residents place a high priority on wolf management actions that address public concerns for human safety (Beyer et al. 2006). In most cases, people can take simple, sensible measures to avoid those situations and protect themselves against harm. Other cases may warrant higher levels of concern and professional assistance. We solved most wolf-human conflicts using nonlethal methods. However, in a few incidents lethal control was warranted and carried out under Federal regulations (50 CFR 17.21, which allows the take of an endangered species when there is a "demonstrable but nonimmediate threat" to protect human safety, or to euthanize a sick or injured wolf), or while wolves were not Federally-protected. In 2009, we did not euthanize any wolves to protect human safety. The DNRE and USDA-Wildlife Services have killed ten animals (nine involving human safety and one sick wolf) under the authority of this regulation since 2004 (Fig. 11).

In 2004, we created a wolf activity form to track negative wolf/human interactions and our responses. Prior to 2004, we only recorded depredation complaints. In 2009, 74 complaints were recorded and since 2004 we documented 410 (Fig. 12). On-site visits by the DNRE or USDA Wildlife Services were made on 264 (64%) of the 410 reports.

In 2009, 42% ($n=31$) of the complainants reported a “perceived threat to personal or family safety” as their main cause for concern. This perceived threat to human safety was also the most frequent complaint for all 410 records (34%, $n=140$) (Fig. 13.).

While use of the wolf activity form does an adequate job of tracking negative interactions, wolf–human interactions can be positive. The wolf activity form does not track positive interactions, such as opportunities for studying, viewing, or listening to wolves because positive interactions with wolves elicit few reports.

INFORMATION AND EDUCATION

The need for education is widely recognized and the wolf management plan includes discussion of the need for a wolf information and education program to respond to the many needs of Michigan citizens. Each year, the DNRE initiates or is involved with a variety of educational efforts.

In 2009, the Michigan Wolf Coordinator responded to many requests for data or information from private citizens, tribal interests, USFWS, United States Forest Service, and universities. The Coordinator presented 22 formal wolf presentations to a diverse group of audiences throughout the State and responded to 39 wolf related media requests. In 2009, Michigan also hosted the Midwest Wolf Stewards Conference; an annual meeting designed to bring together state, federal, tribal and international wildlife managers, researchers, and representatives from private organizations working on wolves in the Great Lakes region.

To help minimize conflicts between wolves and hunting dogs, we placed information on the location of recent and past wolf-dog conflicts in the Michigan Bear Hunting Guide and the Hunting and Trapping Guide for 2009.

The Michigan Wolf Management Plan calls for the establishment of regular communication among agencies, stakeholder groups, and the public. This communication will allow interested parties to monitor progress made toward implementation of the Plan and provide opportunities for the DNRE to receive input on specific management issues. To facilitate these benefits, the DNRE is creating a statewide team with representatives from a cross section of organizations and agencies interested in wolf management. We sent letters requesting participation in a Wolf Citizens Advisory team to 24 stakeholder groups in late 2009.

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Table 1. Minimum winter wolf population survey results in the UP of Michigan.

Parameters	2000	2001	2002	2003	2004	2005	2006	2007 ^a	2008 ^a	2009 ^a
Population										
Estimate	216	249	278	321	360	405	434	509	520	577
No. Packs	63	70	63	68	77	87	91	94	115	108
No. Pairs	27	33	17	18	24	24	22	21	27	20
No. Loners	14	5	8	11	6	6	11	5	11	4
\bar{x} Pack Size	3.2	3.5	4.3	4.6	4.6	4.6	4.6	4.9	4.4	5.3
Miles										
Surveyed	6,314	6,205	7,326	8,092	8,298	8,458	8,622	6,562	5,956	5,687
Hours	2,550	2,120	2,447	2,385	2,005	2,609	2,122	1,801	1,400	1,254 ^b

^a A stratified random survey was used to estimate the minimum winter wolf population estimate.

^b A portion of the hours were estimated using 2008 reported hours.

Table 2. Causes of mortality for radio-collared wolves in the UP of Michigan for bioyears (April 15 through April 14) 1999-2009.

Mortality Factors	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009 ^d	Total	Percent
Vehicle	2	1	0	2	3	0	3	2	5	3	0	21	18%
Illegal Take ^a	1	1	3	5	3	7	4	6	4	5	8	46	40%
Trauma-human	0	0	0	0	2	0	0	0	0	0	0	2	2%
Euthanized ^b	0	0	0	0	1	0	2	2	2	0	1	8	7%
Mange	1	1	3	1	1	2	4	4	1	0	0	18	15%
Wolf Kill	0	0	0	1	0	1	0	3	0	0	0	5	4%
Other ^c	0	0	0	0	1	2	0	1	1	0	0	5	4%
Unknown													
Trauma	0	0	1	1	1	0	0	0	0	1	0	4	3%
Unknown	1	0	1	1	0	1	1	2	0	1	0	7	7%
Total	5	3	8	11	12	13	14	20	13	10	9	117	

^aIllegal kill includes presumed mortality based on the radio-collar having been cut off.

^bEuthanized includes animals killed for depredation control and human safety issues.

^cOther includes mortality from additional natural causes such as stress, pulmonary congestion, and renal failure.

^dBio-year 2009 will not be complete until 4/14/10.

Table 3. Number of verified wolf depredation events by animal type and year in the Upper Peninsula of Michigan. A depredation event consists of one or more animals being killed or injured at a given time.

Year	Cattle	Sheep	*Small Animals	Cervids	Dogs	Total
1996	0	0	0	0	1	1
1997	0	0	0	0	0	0
1998	3	0	0	0	0	3
1999	1	0	0	0	3	4
2000	2	1	2	0	0	5
2001	3	0	0	0	3	6
2002	4	0	1	0	5	10
2003	11	1	1	0	9	22
2004	7	2	0	2	4	15
2005	2	2	1	0	3	8
2006	8	1	1	0	3	13
2007	12	2	0	0	3	17
2008	10	0	4	0	0	14
2009	9	3	0	0	2	14
Total	72	12	10	2	36	132

*Small animals include chickens, turkeys, ducks, geese, game birds, and domestic rabbits.

Table 4. Number of domestic animals killed or injured by wolves, by animal type and year, in the Upper Peninsula of Michigan.

Year	Dogs	Cattle	Sheep	Chickens	Ducks	Geese	Turkeys	Game Birds	Rabbits	Cervids	Totals
1996	1	0	0	0	0	0	0	0	0	0	1
1997	0	0	0	0	0	0	0	0	0	0	0
1998	0	3	0	0	0	0	0	0	0	0	3
1999	3	1	0	0	0	0	0	0	0	0	4
2000	0	2	1	7	1	0	0	0	0	0	11
2001	3	3	0	0	0	0	0	0	0	0	6
2002	6	4	0	14	0	0	7	0	0	0	31
2003	11	11	2	13	0	0	0	0	0	0	37
2004	4	7	3	0	0	0	0	0	0	2	16
2005	3	2	7	1	0	0	0	0	0	0	13
2006	4	9	4	35	0	0	0	0	0	0	52
2007	5	17	7	0	0	0	0	0	0	0	29
2008	0	13	0	0	12	38	0	40	12	0	115
2009	2	11	3	0	0	0	0	0	0	0	16
Totals	42	83	27	70	13	38	7	40	12	2	334

Table 5. Payments for wolf depredation of livestock by year and fund in the UP of Michigan.

Year	MDA ^a (\$)	IWC ^b (\$)	Total (\$)
1998	612.50		612.50
1999	400.00		400.00
2000	850.00		850.00
2001	1,450.00	750.00	2,200.00
2002	3,081.00	567.50	3,648.50
2003	4,370.00	350.00	4,720.00
2004	4,575.00	860.00	5,435.00
2005	1,510.00	380.00	1,890.00
2006	1,765.00	825.00	2,590.00
2007	5,564.75	1,095.00	6,659.75
2008	7,264.90	1,700.00	8,964.90
2009	3,556.50	1,170.00	4,696.50
Total	34,969.655	7,697.50	42,667.15

^aMDA- Michigan Department of Agriculture; administers the State indemnification fund.

^bIWC- International Wolf Center; administers a private indemnification fund provided by Defenders of Wildlife and one citizen.

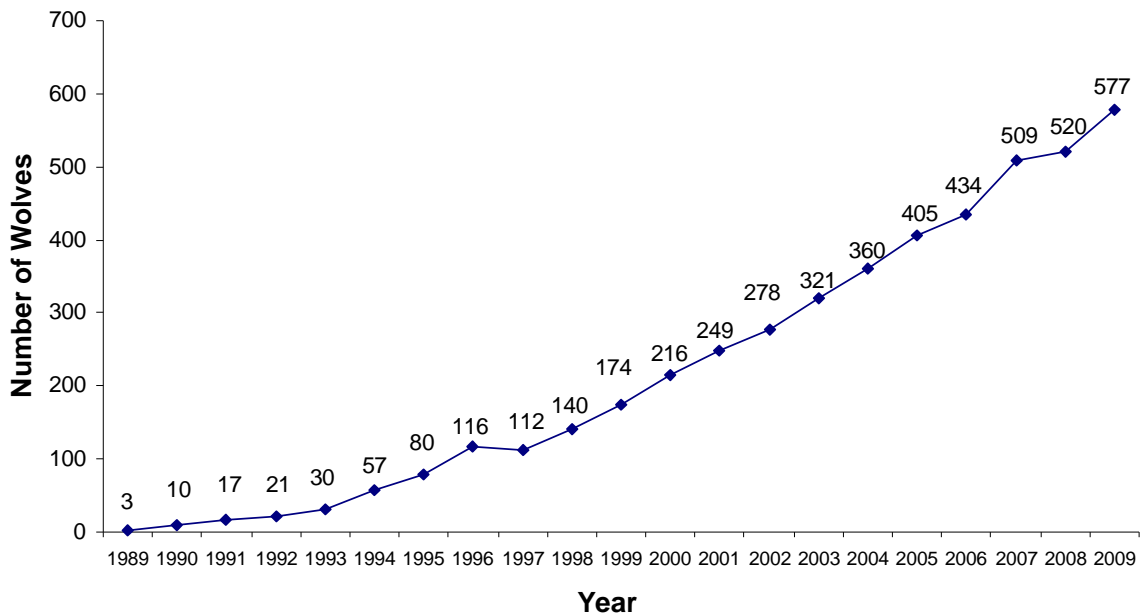


Figure 1. Minimum estimates of the number of wolves in the UP of Michigan (excluding Isle Royale), 1989-2009.

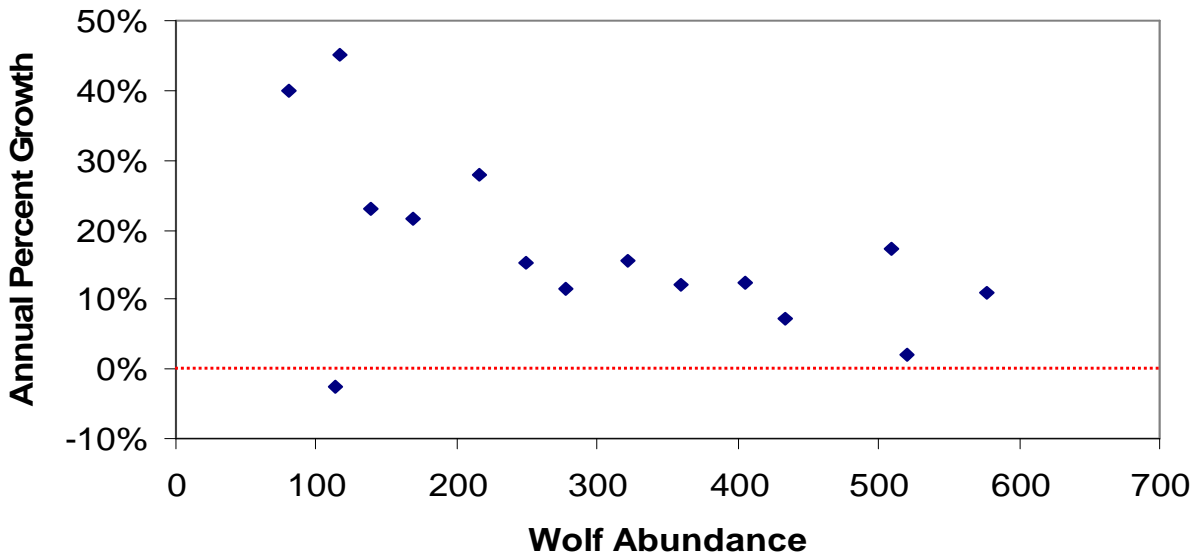


Figure 2. Abundance and annual percent growth of wolves in the UP of Michigan, 1999-2009. The dashed line represents zero growth.

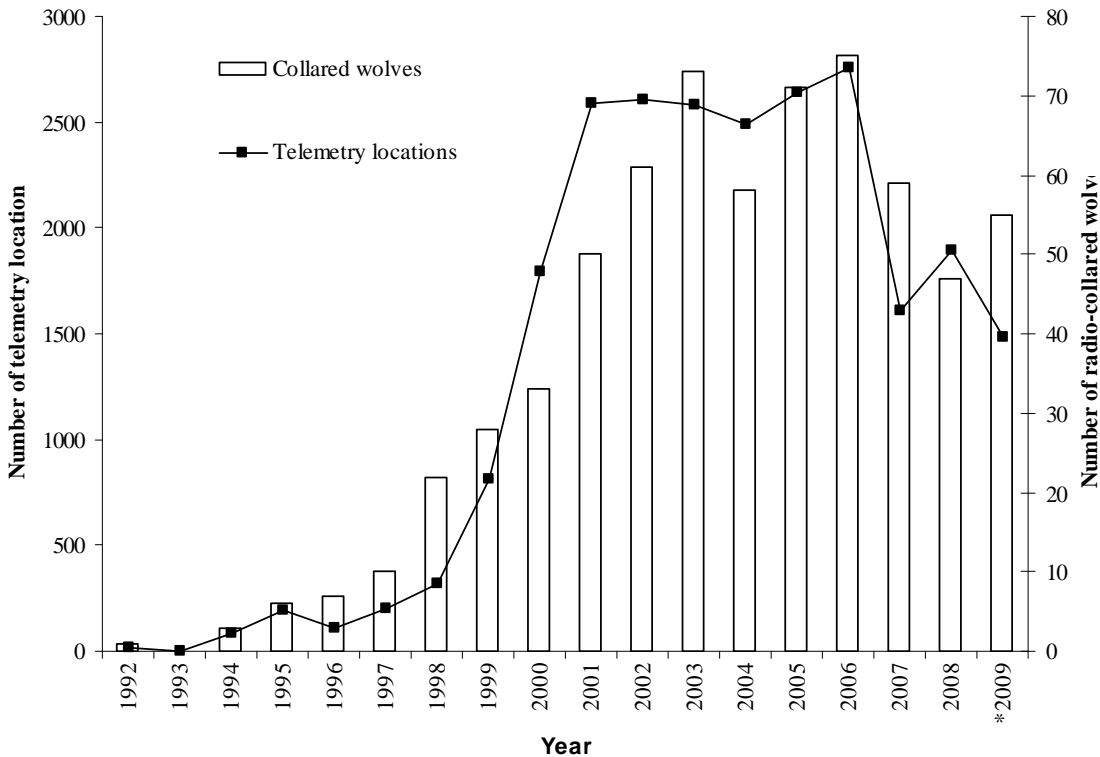


Figure 3. Number of VHF radio-collared wolves monitored and telemetry locations collected by bio-year (April 15 thru April 14) in the UP of Michigan, 1992-2009. *Bio-year 2009 is not complete.

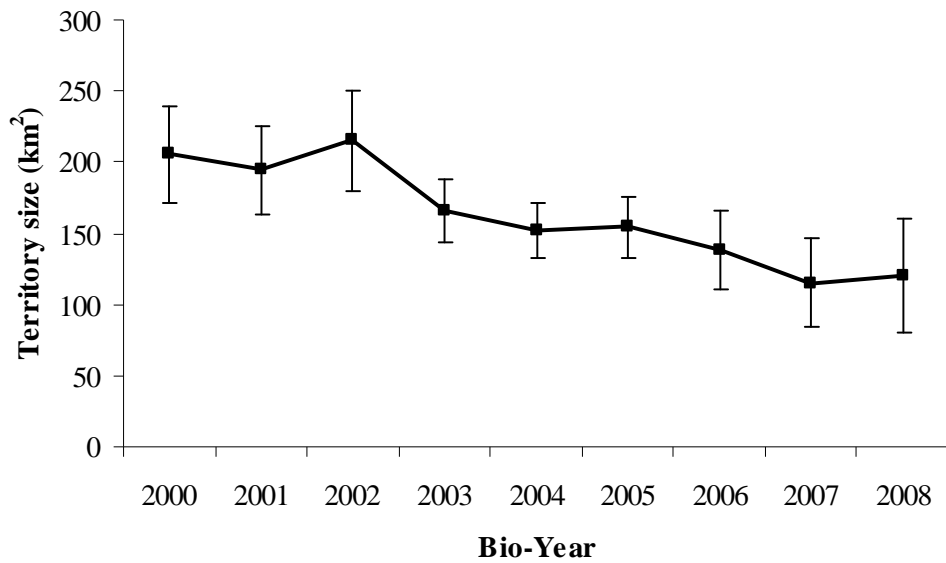


Figure 4. The average territory size (km²) and 95% confidence limits for radio-collared wolves in the Western UP of Michigan during bioyears (April 15 through April 14) 2000-2008.

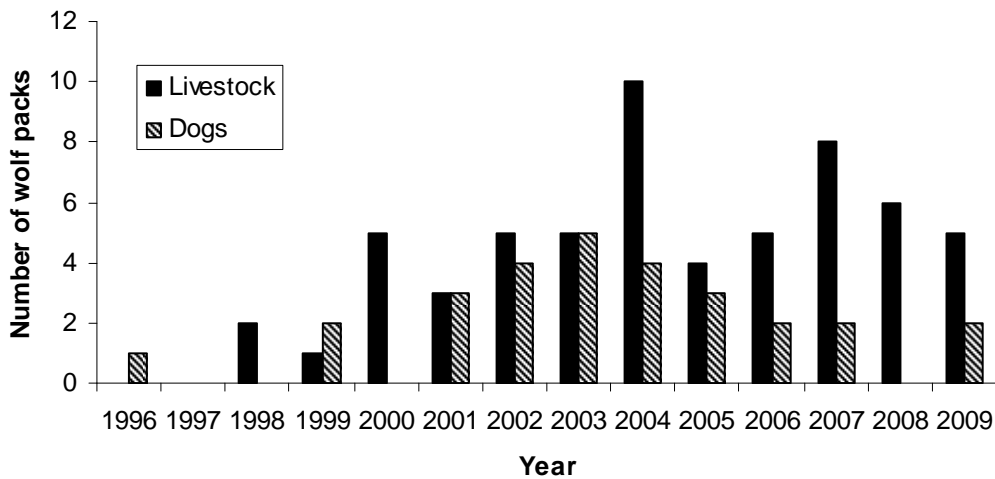


Figure 5. Number of wolf packs involved with depredation of livestock and dogs in the UP of Michigan, 1996-2009.

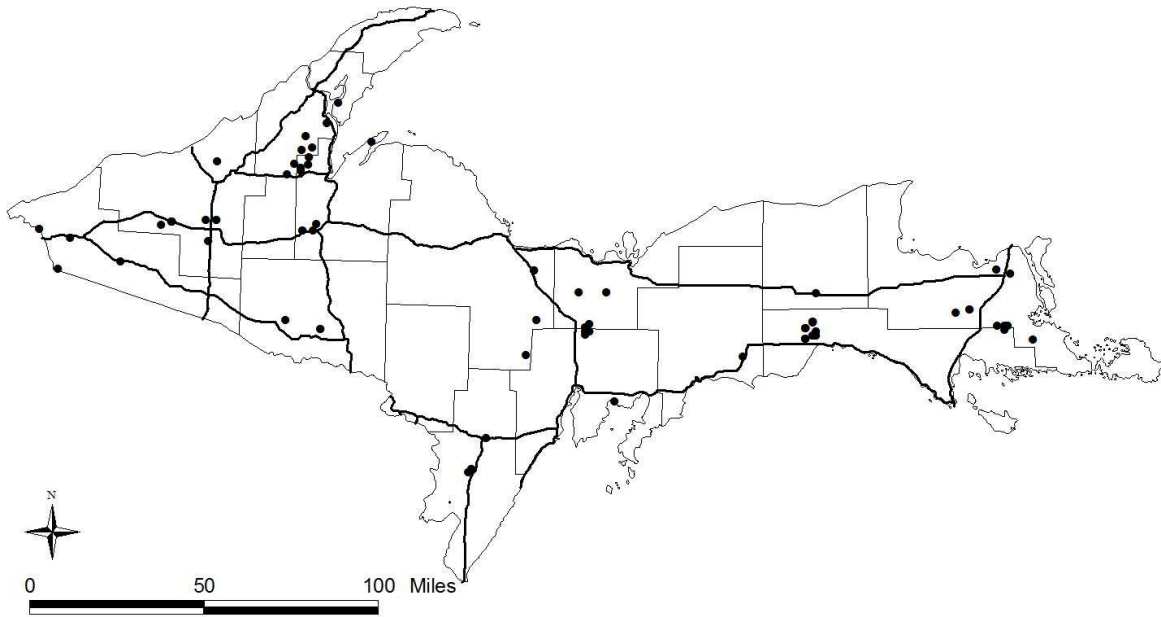


Figure 6. Distribution of verified wolf depredation of livestock events in the UP of Michigan, 1998-2009. A depredation event consists of 1 or more animals being killed or injured at a given time.

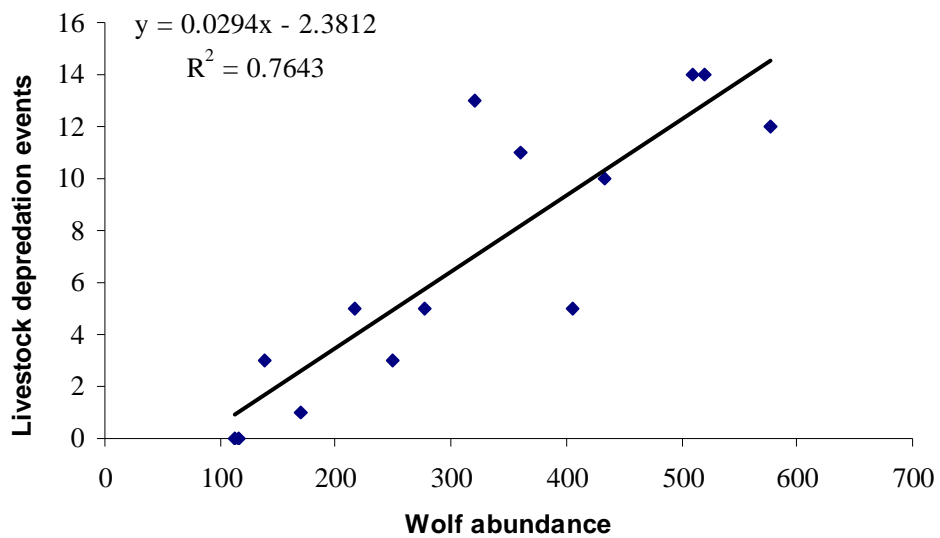


Figure 7. The relationship between wolf abundance and the number of livestock depredation events in the UP of Michigan, 1996-2009.

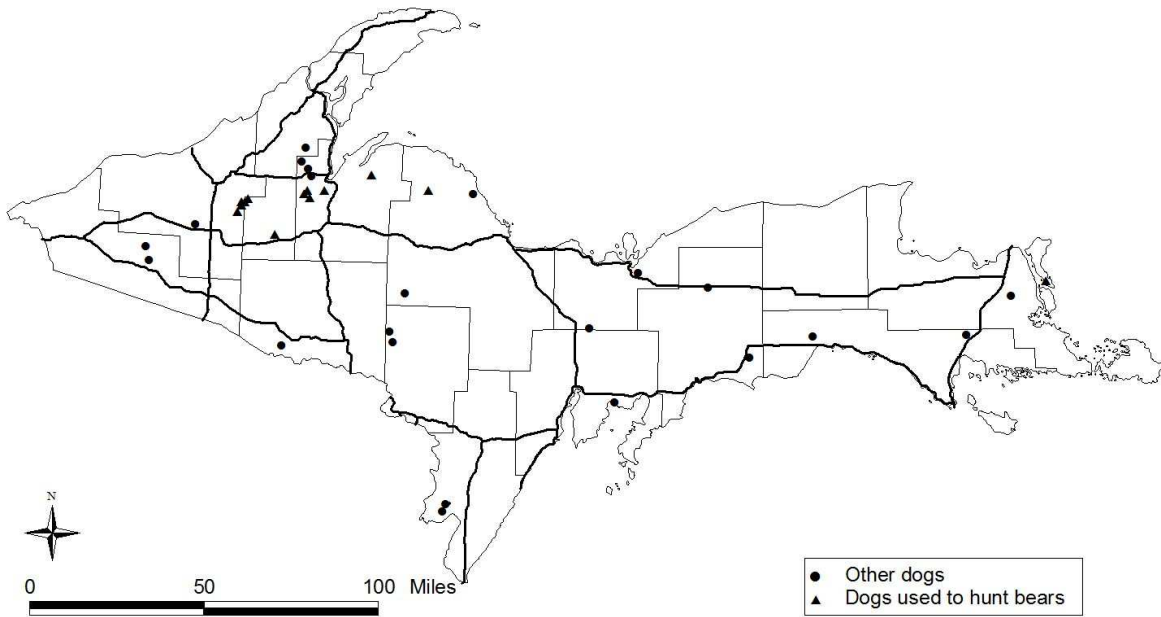


Figure 8. Distribution of verified wolf depredation of dog events in the UP of Michigan, 1996-2009. Dogs killed or injured while hunting bears are identified.

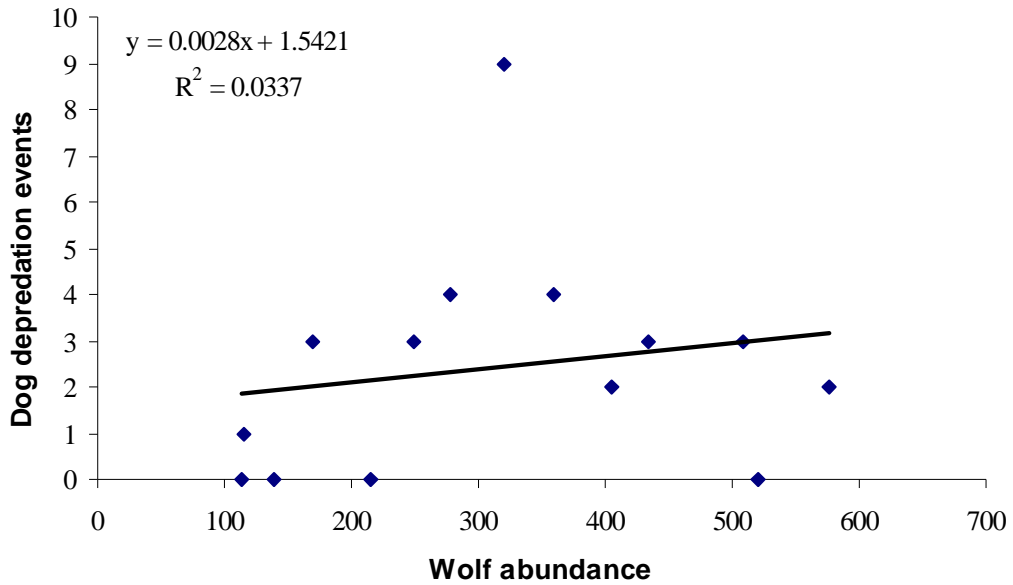


Figure 9. Relationship between wolf abundance and the number of dog depredation events in the UP of Michigan, 1996-2009.

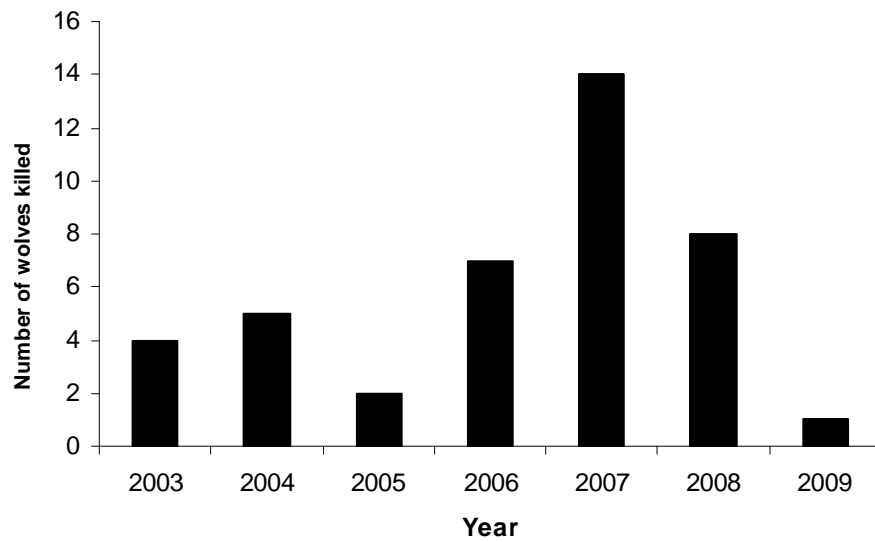


Figure 10. Number of wolves killed in response to verified livestock depredation in the UP of Michigan, 2003-2009.

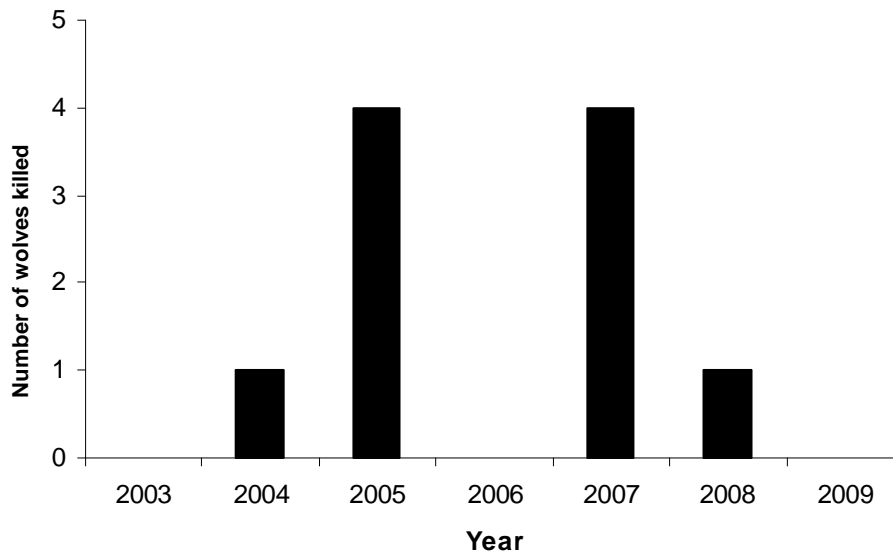


Figure 11. Number of wolves killed in response to wolf-human conflicts in the UP of Michigan, 2003-2009.

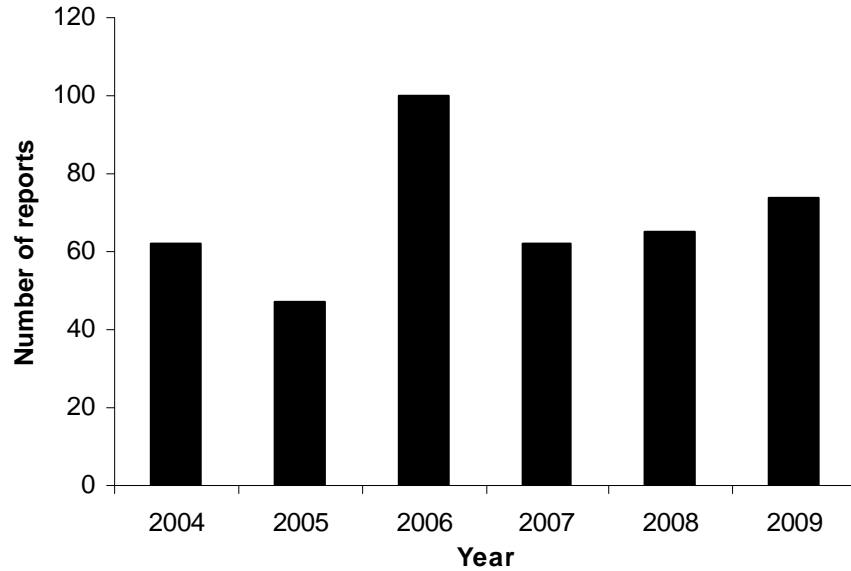


Figure 12. Number of wolf activity reports submitted by Michigan residents and visitors, 2004-2009.

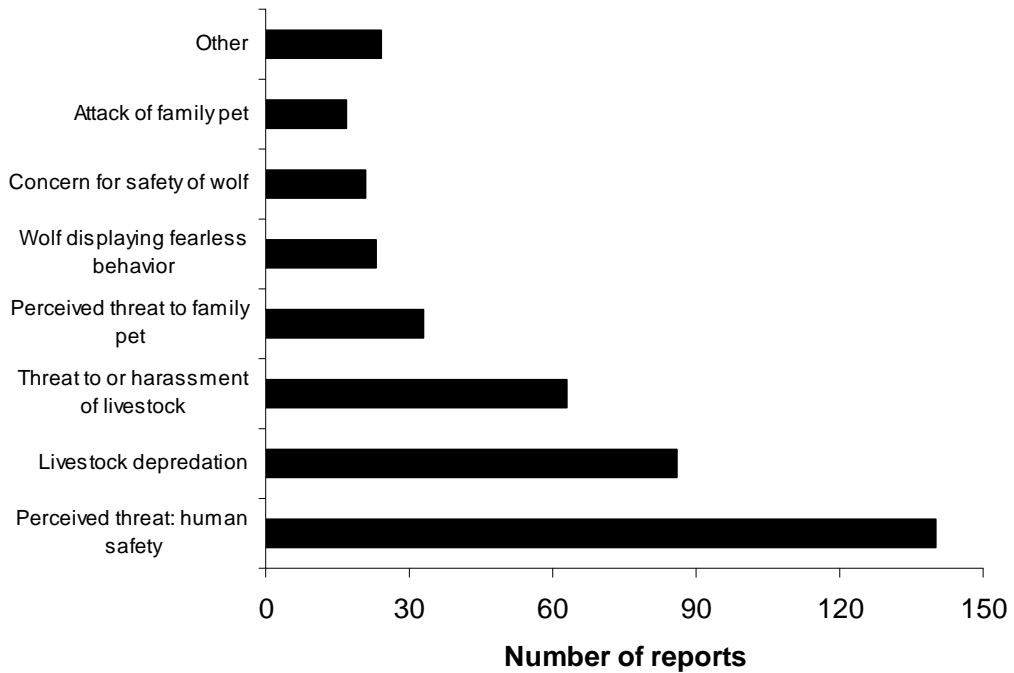


Figure 13. Comparison of the reasons why Michigan citizens contacted the Michigan Department of Natural Resources and Environment regarding wolves. Bars represent the number of reports by reason from 2004- 2009.