NORTH DAKOTA GAME AND FISH DEPARTMENT

Wildlife Division
Project W-67-R-63
Phase E, Furbearer Investigations

Study No. E-XI: MOUNTAIN LION POPULATION DATA (SURVEY)

Job No. E-XI-1: Annual Harvest of Mountain Lions in North Dakota

Job No. E-XI-2: Population Demographics of Mountain Lions in North Dakota

Job No. E-XI-3: Mountain Lion Distribution in North Dakota

Job No. E-XI-4: Technical Assistance to Other Agencies and Public Regarding Mountain Lions

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Study No. E-XI: MOUNTAIN LION POPULATION DATA (SURVEY)

By

Stephanie Tucker

A B S T R A C T

Job No. E-XI-1: Annual Harvest of Mountain Lions in North Dakota

We determined the annual harvest of mountain lions in North Dakota via mandatory reporting by hunters. Hunters are required to report their harvest within 12 hours and get a pelt tag from Department personnel to be in legal possession of a mountain lion. In addition, we collected information and/or carcasses of mountain lions shot for protection of property (e.g., livestock) or self, illegally taken, incidentally killed in snares, or those killed by collisions with automobiles (a.k.a., road kills). In 2022-2023, 12 mountain lions (3 F, 10 M) were legally harvested by hunters and 1 female was taken illegally.

Job No. E-XI-2: Population Demographics of Mountain lions in North Dakota

We required hunters to turn in the entire carcasses of all harvested mountain lions after they removed the pelts. We also collected carcasses from mountain lions found opportunistically (e.g., road kills) and those harvested on the Ft. Berthold Indian Reservation, when feasible. From mountain lion carcasses, we collected information on sex, age, and reproductive status of females. We used this information to monitor demographic and trends in abundance. The sex ratio of mountain lion examined from 1 July 2022-30 June 2023 was 0.4 females per male and age was 2.3 ± 1.4 ($\bar{x}$ ± SD) years. Mountain lion abundance trended upward slightly from the previous year, but confidence intervals remained wide due to our low sample sizes.

Job No. E-XI-3: Mountain Lion Distribution in North Dakota

We used a combination of reports of occurrence and hunter questionnaires to determine the distribution of mountain lions in North Dakota. From 1 July 2022-30 June 2023, we recorded 43 reports of mountain lions; of those, 16 reports (37%) were classified as Verified. This was 20% lower than the number of reports of mountain lions compared to the previous year. Similar to past years, the distribution of Verified mountain lion reports occurred primarily in western North Dakota, particularly the northern Badlands region.

Job No. E-XI-4: Technical Assistance to Other Agencies and Public Regarding Mountain Lions

We educated North Dakota residents about mountain lions (i.e., natural history and ecology, physical description of the animal and its tracks, how to live and recreate where large predators reside, what to do if you see a mountain lion, etc.) via public presentations, radio and television interviews, educational brochures, and other agency and non-governmental organization meetings. We communicated with and attended information exchange meetings both locally and regionally. Additionally, we cooperated with USDA-Wildlife Services personnel in North Dakota to investigate reports of livestock depredation by mountain lions.

State of:	North Dakota	
Project No.:	W-67-R-63	Wildlife Surveys and Investigations
Phase:	E	Furbearer Investigations
Study No.:	E-XI	MOUNTAIN LION POPULATION DATA
Job No.:	E-XI-1	Annual Harvest of Mountain Lions in North Dakota
Period Covered:	July 1, 2022 - June 30, 2023	
Personnel:	Stephanie Tucker, Cami Wight, Megan Seidl	
Submitted by:	Stephanie Tucker	

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OBJECTIVES

To determine the annual harvest of mountain lions (*Puma concolor*) in North Dakota.

INTRODUCTION

The first regulated hunting season for mountain lions in North Dakota occurred in 2005-2006 with a harvest limit of 5 and an individual bag limit of 1. We considered this first hunting season experimental with the goal being to acquire biological and distributional information on the population of mountain lions occurring in the state (NDGF 2006). We only allowed North Dakota residents who possessed either a Furbearer or Combination license to hunt mountain lions.

Since that time, we have made several noteworthy changes to the mountain lion hunting season structure. We modified the second regulated hunting season (2006-2007) to prohibit the harvest of kittens (i.e. mountain lions with visible spots) or females accompanied by kittens. Additionally, hunters were not allowed to use dogs to pursue mountain lions until later in the season. In 2007-2008, we divided the state into 2 management zones (Figure 1; Zone 1 had a harvest limit of 5, Zone 2 had no harvest limit) and no longer counted incidental or depredation removals towards the harvest limit. Additionally in 2007-2008, Fort Berthold Reservation (hereafter, Reservation) began a separate mountain lion hunting season within their boundaries. During the 2008-2009 hunting season, we increased the harvest limit for mountain lions in Zone 1 to 8. We again increased he harvest limit in Zone 1 to 10 in 2010-2011, 14 in 2011-2012, and 21 in 2012-2013 harvest seasons. In 2016-2017, we lowered the harvest limit in Zone 1 to 15 and we added a conditional season to Zone 1. The conditional season in Zone 1 allowed for additional hunting opportunity (without the aid of dogs) after the late-season

closed, only if early-season harvest limit had not already been reached and the late-season closed before March 25.

Since 2007-2008, mountain lion hunting within the Reservation has been allowed for tribal members, non-member residents, and non-member non-residents who possess either a Furbearer or Small Game/Furbearer Combo license. Mountain lion hunting regulations within the Reservation have also changed slightly over time. For the 2008-2009 season, the Reservation harvest limit was set at 5. In 2015-2016, the Reservation harvest limit was increased to 10.

We opened the 2022-2023 hunting season for mountain lions on 2 September 2022. We continued to make the season available only for North Dakota residents who possessed either a Furbearer or Combination license. We had a harvest limit in Zone 1, whereas Zone 2 continued to have no harvest limit and remained open until 31 March 2023 (Figure 1). In Zone 1, we split the harvest limit between consecutive early- (2 September 2022-20 November 2022) and late-seasons (21 November 2022-31 March 2023). Zone 1 early-season harvest limit was 8 and the late-season harvest limit was 7 total or 3 females, whichever came first, for a combined harvest limit of 15 in Zone 1. Hunters could use dogs to pursue mountain lions only in the late-season. Additionally, we offered a conditional season after the late-season, which allowed for additional take if 8 mountain lions were not taken during early-season and the late-season closed before March 25.

METHODS

We determined the annual harvest of mountain lions via mandatory harvest reporting. Successful hunters were required to report their harvest within 12 hours either electronically through their online account or by calling or visiting a district office or local game warden. Department personnel then issued a pelt tag for all legally taken mountain lions. At the time of tagging, we collected information about the date, harvest location, and method of take.

Additionally, we collected information and/or carcasses of mountain lions shot for protection of property (e.g., livestock) or self, illegally taken, incidentally killed in snares, or those killed by collisions with automobiles (a.k.a., road kills).

RESULTS

The early-season in Zone 1 closed on the last day of the season with 1 female and 3 male mountain lions being harvested (Table 1). The late-season in Zone 1 closed on 28 March 2023 after the harvest limit was met (1 F, 6 M). Because the late-season closed after 25 March, a conditional season was not held in Zone 1. Additionally, 1 female mountain lion was legally harvested in Zone 2 and 1 male was harvested within the Reservation (Table 1). Therefore, the total legal harvest consisted of 3 females and 10 males (Table 1; Figure 2).

In addition to those mountain lions legally harvested, we documented a mortality of 1 female mountain lion that was illegally shot by an individual after it was incidentally trapped (Table 1-2; Figure 3). The individual did not know that the mountain lion was being restrained by a foothold trap when they initially shot it, but realized it after the fact and self-reported the violation.

DISCUSSION

The number of mountain lions taken legally by hunters increased last season, primarily due to an increased number taken during the early-season in Zone 1 (Table 2; Figure 2). Early-season harvest of mountain lions was the result of hunters being afield for other reasons (deer or elk hunting) and happening upon a mountain lion, not due to specific pursuit of mountain lions. Late-season harvest of mountain lions continued to be done predominately with the aid of dogs. The 1 mountain lion taken in Zone 2 was successfully harvested by snow tracking the animal.

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Table 1. Mountain lion mortalities in North Dakota, 1 July 2022 through 30 June 2023.

ID	Cause of death	Date	Sex	Estimated age class (yr)[a]	County
M354	Legal harvest	9/3/2022	M	4	Billings
M346	Legal harvest	9/10/2022	M	1	Dunn
M347	Legal harvest	11/9/2022	M	1	Dunn
F348	Legal harvest	11/13/2022	F	2	Wells
F350	Legal harvest	11/19/2022	F	1	Dunn
M349	Legal harvest	11/21/2022	M	3	McKenzie
F356	Illegal take	12/5/2022	F	1	Billings
M351	Legal harvest	12/24/2022	M	3	McKenzie
M352	Legal harvest	12/27/2022	M	2	Dunn
F353	Legal harvest	1/3/2023	F	6	Dunn
M354	Legal harvest	1/15/2023	M	2	Dunn
M355	Legal harvest	1/15/2023	M	1	Dunn
M358	Legal harvest	2/28/2023	M	2	Dunn
M359	Legal harvest	3/28/2023	M	3	McKenzie

[a]When possible, cementum analysis (Matson's Laboratory, Manhattan, Montana, USA) was used to determine age estimates. Otherwise, estimates of age followed that of Anderson and Lindzey (2000).

Table 2. Cause of death for known mountain lion mortalities in North Dakota, including legal harvest, incidental take, and road kills, for fiscal years (1 July-30 June) 2005-2006 through 2022-2023.

Fiscal year	Legal harvest[a]	Protection property/self	Illegal take	Incidental trapping/snaring	Natural[b]	Road kill	Total
2005-2006	5	0	0	0	0	0	5
2006-2007	4	2	2	3	0	1	12
2007-2008	5	0	1	4	0	2	12
2008-2009	8	1	0	1	1	0	11
2009-2010	10	2	0	0	0	0	12
2010-2011	13	8	0	1	0	0	22
2011-2012	17	2	4	8	0	0	31
2012-2013	14	5	2	0	1	1	23
2013-2014	16	2	0	0	1	2	21
2014-2015	13	1	0	0	0	1	15
2015-2016	14	0	0	0	0	2	16
2016-2017	11	0	1	0	0	0	12
2017-2018	19	0	0	1	0	0	20
2018-2019	14	1	0	1	0	1	17
2019-2020	17	1	0	0	0	0	18
2020-2021	10	0	1	1	0	1	13
2021-2022	8	0	0	0	0	0	8
2022-2023	13	0	1	0	0	0	14
Total	211	25	12	20	3	11	282

[a]Includes mountain lions legally taken by hunters in Zone 1, Zone 2, or within the Fort Berthold Reservation.

[b]Includes mountain lions that died of natural causes (e.g., drowning, infanticide, disease, etc.).

Figure 1. Management zones for mountain lions in North Dakota. Mountain lions within the Fort Berthold Indian Reservation are managed separately by the Three Affiliated Tribes Fish and Wildlife Division.

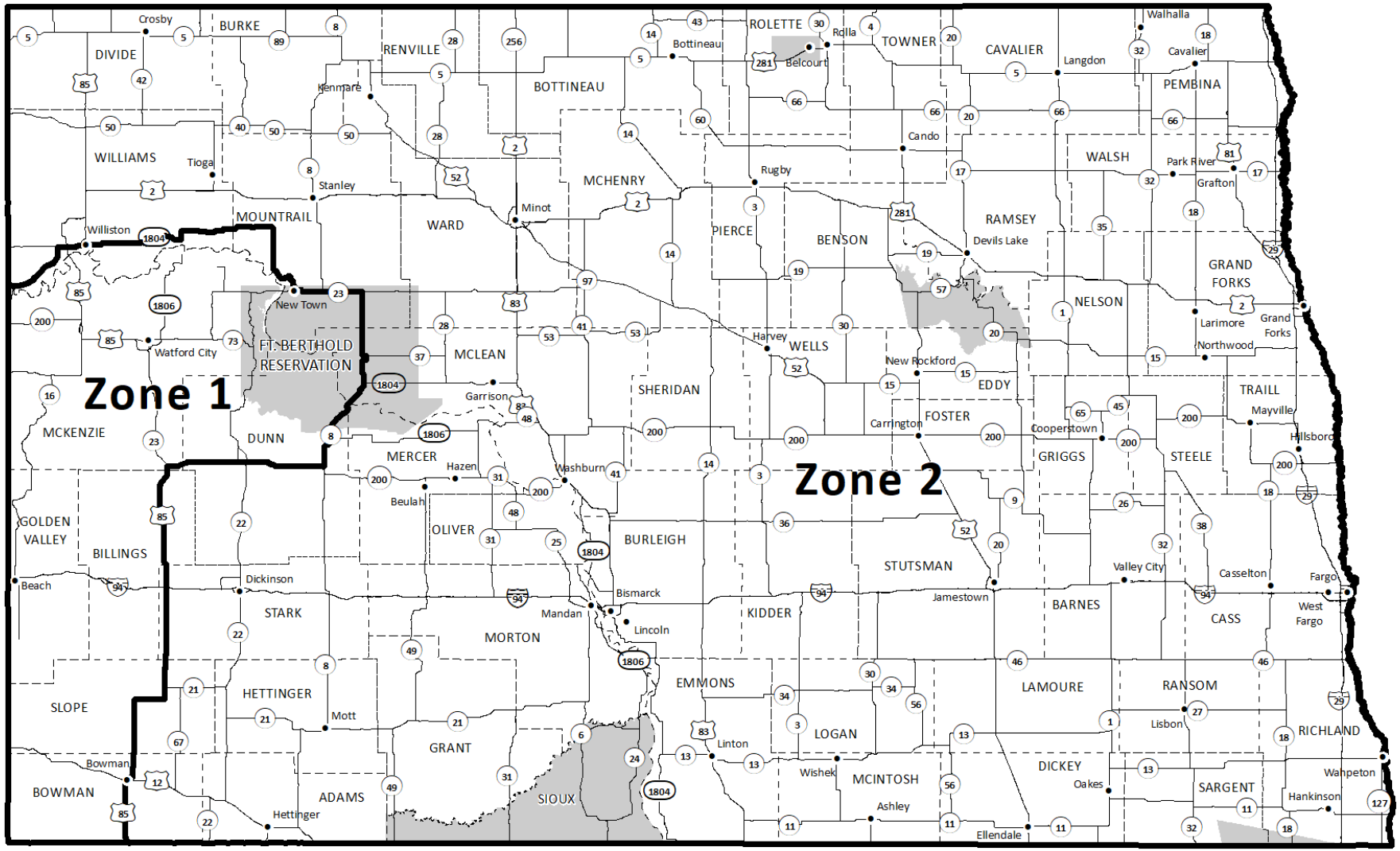


Figure. 2. Number of legally harvested mountain lions in North Dakota by management zone, 2005-2006 through 2022-2023 hunting seasons.

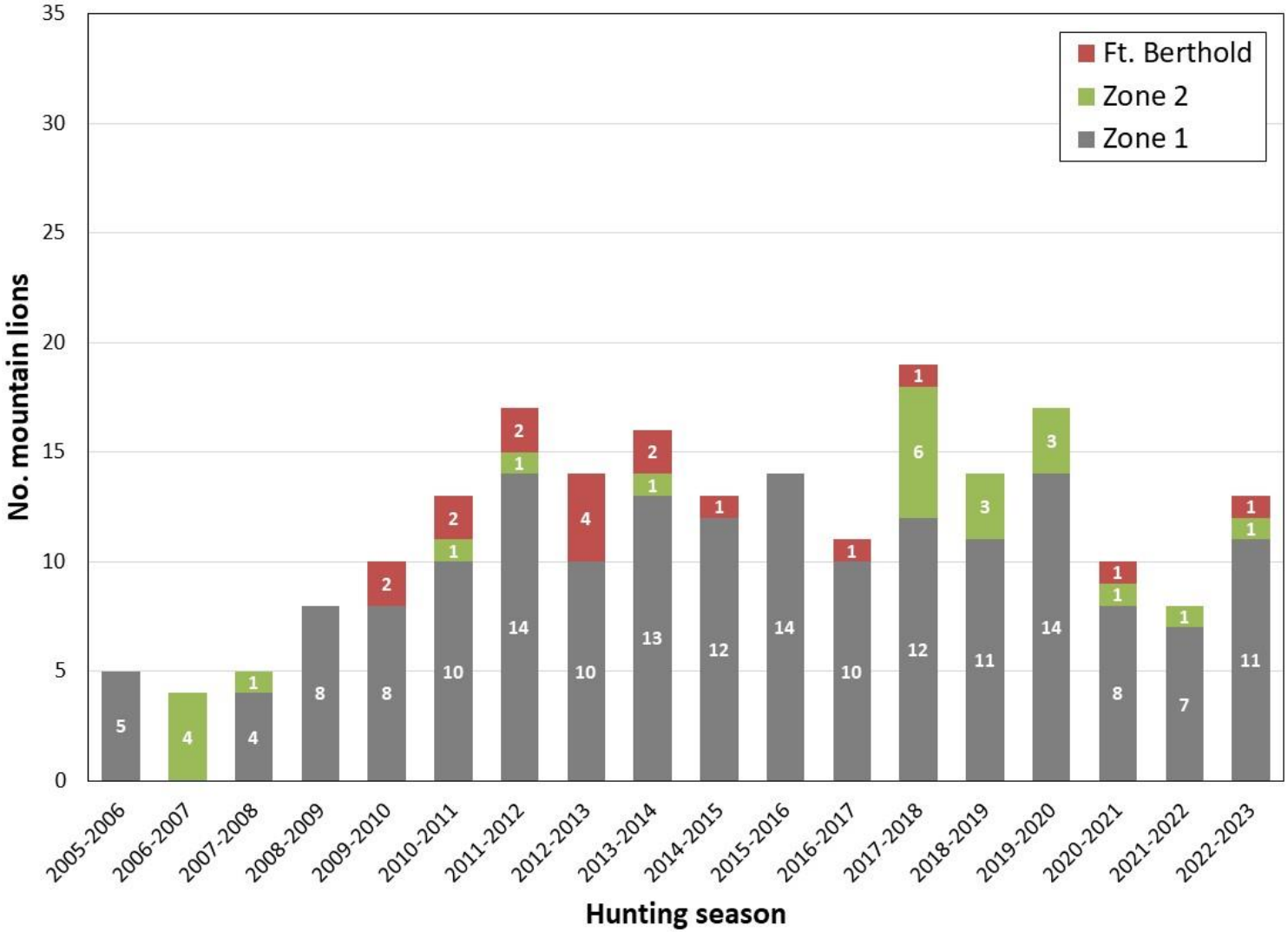
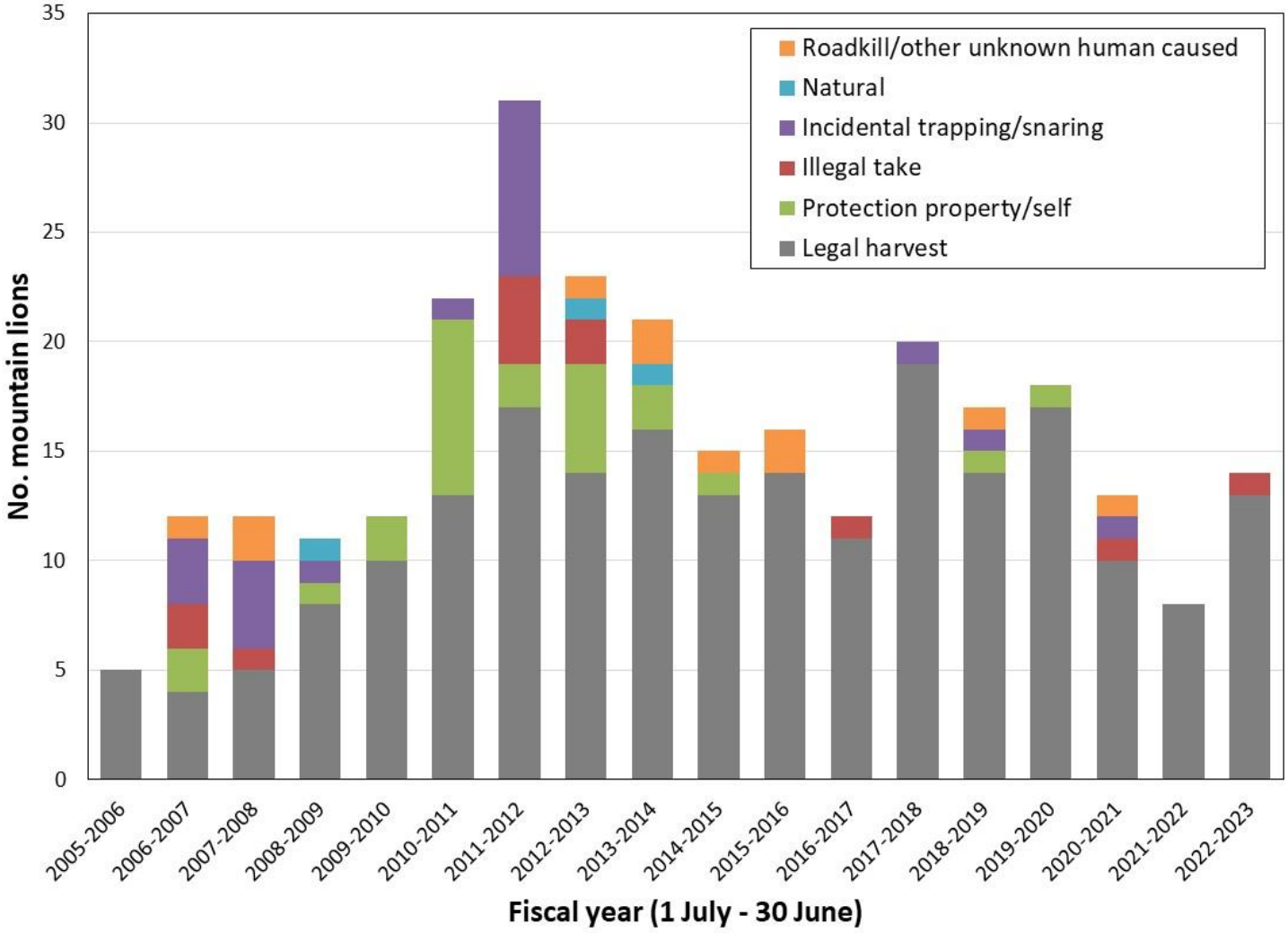


Figure 3. Number of documented mountain lion mortalities due to legal harvest, protection of property or self, illegal take, incidental snaring, other or unknown human causes (automobile collisions, suspected poaching, etc.), and natural causes (predators, disease, etc.) in North Dakota, fiscal years (1 July-30 June) 2005-2006 through 2022-2023.



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Personnel:	Stephanie Tucker, Cami Wight, Megan Seidl	
Submitted by:	Stephanie Tucker	

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OBJECTIVES

To determine the population demographics and trends in abundance of mountain lions (*Puma concolor*) in North Dakota.

INTRODUCTION

Mountain lions are difficult to survey due to their cryptic nature and low population densities (Logan and Sweanor 2001, Whittaker and Wolfe 2011). Therefore, population trends are typically estimated using other methods, such as population indices or population models (CMGWG 2005, Whittaker and Wolfe 2011). The latter of which is the primary method of monitoring population trends of mountain lions in North Dakota. Data needs for population models typically include sex, age, and reproductive metrics from animals collected during hunting seasons (Gove et al. 2002, Skalski et al. 2005).

METHODS

We required hunters to turn in the entire carcasses of all harvested mountain lions after they removed the pelts. We also collected carcasses from mountain lions found opportunistically (e.g., road kills) and those harvested on the Reservation, when feasible. We kept the carcasses frozen until delivery to our Wildlife Health Laboratory in Bismarck, where we thawed them for necropsy. During necropsy, we estimated age (Anderson and Lindzey 2000, NDGF 2018), examined reproductive tracts and stomach contents, and collected tissue samples. We extracted an upper premolar and sent them to Matson's Laboratory (Manhattan, Montana, USA) to confirm age via counts of cementum annuli. If mountain lion carcasses were received

with the pelt intact, we collected standard measurements such as weight, length, and shoulder height prior to necropsy.

For female mountain lions, we removed the reproductive tracts (uterus and ovaries) and examined them for placental scars or active pregnancy. Active pregnancy refers to a mountain lion who was carrying either embryo(s) or fetus(es) at the time of death. We calculated pregnancy rates as the proportion of each age class in each fiscal year (1 July – 30 June) for which we detected placental scars or embryos/fetuses. We calculated mean litter sizes as the mean number of placental scars or embryos/fetuses documented by age class for each fiscal year. We summarized the data by subadults (1 or 2 years of age) or adults (≥3 years of age).

To estimate trends in abundance of mountain lion in North Dakota, we analyzed age-at-harvest using statistical population reconstruction (SPR) and radio-collar data (Gove et al. 2002, Skalski et al. 2005, Johnson 2017, Johnson et al. 2019).

Our SPR model assumes that mountain lions included in the data set were produced from our breeding population in the Badlands region. However, we may be violating this assumption by including individuals in the model from Zone 2, as these mountain lions are generally dispersing subadults and may not have derived from the North Dakota population. Therefore, we sent tissue samples from all mountain lion mortalities having occurred in Zone 2 to the National Genomic Center for Wildlife and Fish Conservation at the USFS Rocky Mountain Research Station (Missoula, Montana, USA) to conduct genetic population assignments. Population assignments are reported as a probability that a mountain lion is from a particular population based the available genetic database (Ortloff et al. 2019). Those mountain lions that had a high probability (≥60%) assigned to a population other than North Dakota were subsequently removed from our SPR analysis.

RESULTS

Internal examination of mountain lion carcasses indicated mountain lions in North Dakota are generally healthy. The majority of mountain lion carcasses we examined were in good nutritional condition; fat content observed during necropsy was at or above expected levels and parasite loads were low. The sex ratio of mountain lion carcasses examined from 1 July 2022-30 June 2023 was 0.4 females per male and age was 2.3 ± 1.4 ($\bar{x}$ ± SD) years (Tables 1-2). In comparison, the sex ratio of all mountain lion carcasses we have examined to date in North Dakota was 1.1 females per male and (*n* = 278) mean age was 2.8 ± 2.2 years (*n* = 275; Tables 1-2).

In 2022-2023, we examined reproductive tracts from 4 female mountain lions that were ≥ 1 year of age (Table 3). None of the 3 subadult females we examined had placental scars indicating pregnancy within the past year. The 1 adult female we examined had 3 placental scars. To date, we have examined a total of 37 subadult females with a combined pregnancy rate of 24% and a mean litter size of 2.67 (SD = 1.12; Table 3). The pregnancy rate for all 57 adult females examined thus far was 91% with a mean litter size of 3.33 (SD = 0.94; Table 3).

We present the mean ($\bar{x}$) of standard measurements (e.g. weight, length, height, etc.) by sex for mountain lions aged ≥ 2 years (Table 4), which is the age when mountain lions are about full-grown.

Genetic analysis was conducted on a tissue sample from 1 female mountain lion from Wells County in Zone 2, to determine a population assignment (Ortloff et al. 2019). Results indicated the mountain lion was assigned to the North Dakota population (Figure 1). Probability of assignment was high, 99%. Subsequently, this individual was included in our SPR analysis.

Mountain lion abundance trended upward slightly from the previous year (Figure 2), but confidence intervals remained wide due to our low sample sizes. Trends in annual abundance from our SPR model have fluctuated from a high of 167 (95% CI = 92-242) in 2011-2012 to a low of 20 (95% CI = 9-31) mountain lions in 2021-2022 (Figure 2). The average annual abundance of mountain lions since we began collecting this data in 2005-2006 was estimated at 65.

DISCUSSION

We monitored mountain lion population trends in North Dakota via mandatory carcass returns and population modeling. Population trends indicated that the number of mountain lions found in Zone 1 (breeding population) peaked in 2011-2012, then declined and has been relatively stable since that time (Figure 2).

The breeding population of mountain lions in North Dakota is found only in Zone 1 and within the boundary of the Reservation. A lactating female or female accompanied by kittens has not been confirmed in any other part of the state. Mountain lions that have dispersed out of Zone 1 or the Reservation have effectively removed themselves from the breeding population in North Dakota. This is primarily why we do not manage mountain lions in Zone 2 with a harvest limit, as there is no population that we are trying to sustain in that region of the state.

Genetic analysis confirmed a majority (68%) of mountain lions killed in Zone 2 since 2006 were not offspring from the population of mountain lions in North Dakota (Ortloff et al. 2019). This further corroborates the ability of mountain lions to disperse long distances. Additionally, it should caution managers before using the mere presence of dispersing individuals as any evidence of what may be happening (e.g. high reproduction, high densities, etc.) in a nearby breeding population.

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Table 1. Sex ratio of mountain lions in North Dakota as determined by examination of known mortalities (e.g., legal harvest, illegal take, road kills, etc.), fiscal years (1 July-30 June) 2005-2006 through 2022-2023.

Harvest season	Known sex		
	F	M	Sex ratio (F:M)
2005-2006	2	3	0.7
2006-2007	6	6	1.0
2007-2008	9	3	3.0
2008-2009	5	5	1.0
2009-2010	6	6	1.0
2010-2011	11	11	1.0
2011-2012	23	8	2.9
2012-2013	16	6	2.7
2013-2014	9	11	0.8
2014-2015	8	7	1.1
2015-2016	7	9	0.8
2016-2017	7	4	1.8
2017-2018	10	10	1.0
2018-2019	6	11	0.5
2019-2020	7	11	0.6
2020-2021	8	5	1.6
2021-2022	4	4	1.0
2022-2023	4	10	0.4
Total	148	130	1.1

Table 2. Distribution of known-age mountain lions in North Dakota, fiscal years (1 July-30 June) 2005-2006 through 2022-2023. Age classes were determined using cementum analysis (Matson's Laboratory, Manhattan, Montana, USA).

Age class	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	≥10	Total
2005-2006	1	1	2	0	1	0	0	0	0	0	0	5
2006-2007	4	2	1	4	0	0	0	0	0	0	1	12
2007-2008	1	4	4	0	1	2	0	0	0	0	0	12
2008-2009	4	0	4	0	1	0	1	0	0	0	0	10
2009-2010	0	2	2	5	3	0	0	0	0	0	0	12
2010-2011	7	3	4	4	2	0	0	1	0	0	1	22
2011-2012	2	6	8	7	3	2	2	0	1	0	0	31
2012-2013	5	2	5	3	1	1	4	0	0	0	0	21
2013-2014	2	3	4	3	3	2	2	1	0	0	1	21
2014-2015	2	2	3	2	4	1	0	1	0	0	0	15
2015-2016	2	3	5	2	1	1	0	0	2	0	0	16
2016-2017	1	1	3	0	0	0	2	0	0	1	0	8
2017-2018	1	0	2	4	7	3	1	0	1	1	0	20
2018-2019	1	1	6	2	4	1	1	0	0	1	0	17
2019-2020	1	4	7	4	0	1	0	0	0	0	1	18
2020-2021	1	4	4	1	2	0	0	1	0	0	0	13
2021-2022	0	1	4	0	3	0	0	0	0	0	0	8
2022-2023	0	5	4	3	1	0	1	0	0	0	0	14
Total	35	44	72	44	37	14	14	4	4	3	5	275

Table 3. Pregnancy rates and litter sizes of female mountain lions by age and fiscal year (1 July – 30 June). Blanks indicate there was no data available. Age classes were determined by cementum analysis (Matson's Laboratory, Manhattan, Montana, USA).

	Pregnancy rate (*n*)[a]		$\bar{x}$ litter size (SD)[b]	
Harvest season	1-2	≥3	1-2	≥3
2005-2006				
2006-2007		100% (1)		4.00 (0.00)
2007-2008	100% (1)		4.00 (0.00)	
2008-2009				
2009-2010		80% (5)		2.00 (0.82)
2010-2011	0% (1)	100% (3)		3.33 (0.58)
2011-2012	33% (6)	100% (11)	1.50 (0.71)	3.36 (1.21)
2012-2013	60% (5)	80% (5)	2.33 (1.15)	3.50 (0.58)
2013-2014	0% (2)	100% (6)		3.17 (0.75)
2014-2015	60% (5)	100% (2)	3.33 (0.58)	3.50 (0.71)
2015-2016	0% (4)	100% (3)		3.33 (0.58)
2016-2017	0% (3)	100% (2)		4.50 (0.71)
2017-2018	0% (1)	86% (7)		3.00 (0.63)
2018-2019		80% (5)		3.50 (1.29)
2019-2020	0% (1)	100% (2)		3.50 (0.71)
2020-2021	0% (2)	67% (3)		4.00 (0.00)
2021-2022	0% (3)	100% (1)		5.00 (0.00)
2022-2023	0% (3)	100% (1)		3.00 (0.00)
Total	24% (37)	91% (57)	2.67 (1.12)	3.33 (0.94)

[a]Pregnancy rates were estimated as the proportion of females whose reproductive tracts had placental scars or embryos/fetuses.

[b]Litter sizes were estimated as the mean number of placental scars or embryos/fetuses within a reproductive tract.

Table 4. The mean ($\bar{x}$) of standard measurements of mountain lions aged ≥ 2 years, which is the age at which mountain lions are typically full-grown. Measurements were only collected from fully intact mountain lions with their pelt.

	F (*n*)	M (*n*)
Weight (kg)	44.0 (56)	56.3 (39)
Body length (cm)	120.1 (55)	128.2 (38)
Tail length (cm)	71.7 (55)	75.5 (37)
Total length (cm)	188.7 (55)	206.7 (37)
Shoulder height (cm)	60.3 (55)	65.0 (38)
Neck circumference (cm)	38.5 (52)	45.3 (37)

Figure 1. Population assignments of mountain lions from Zone 2 based on genetic analysis (Ortloff et al. 2019).

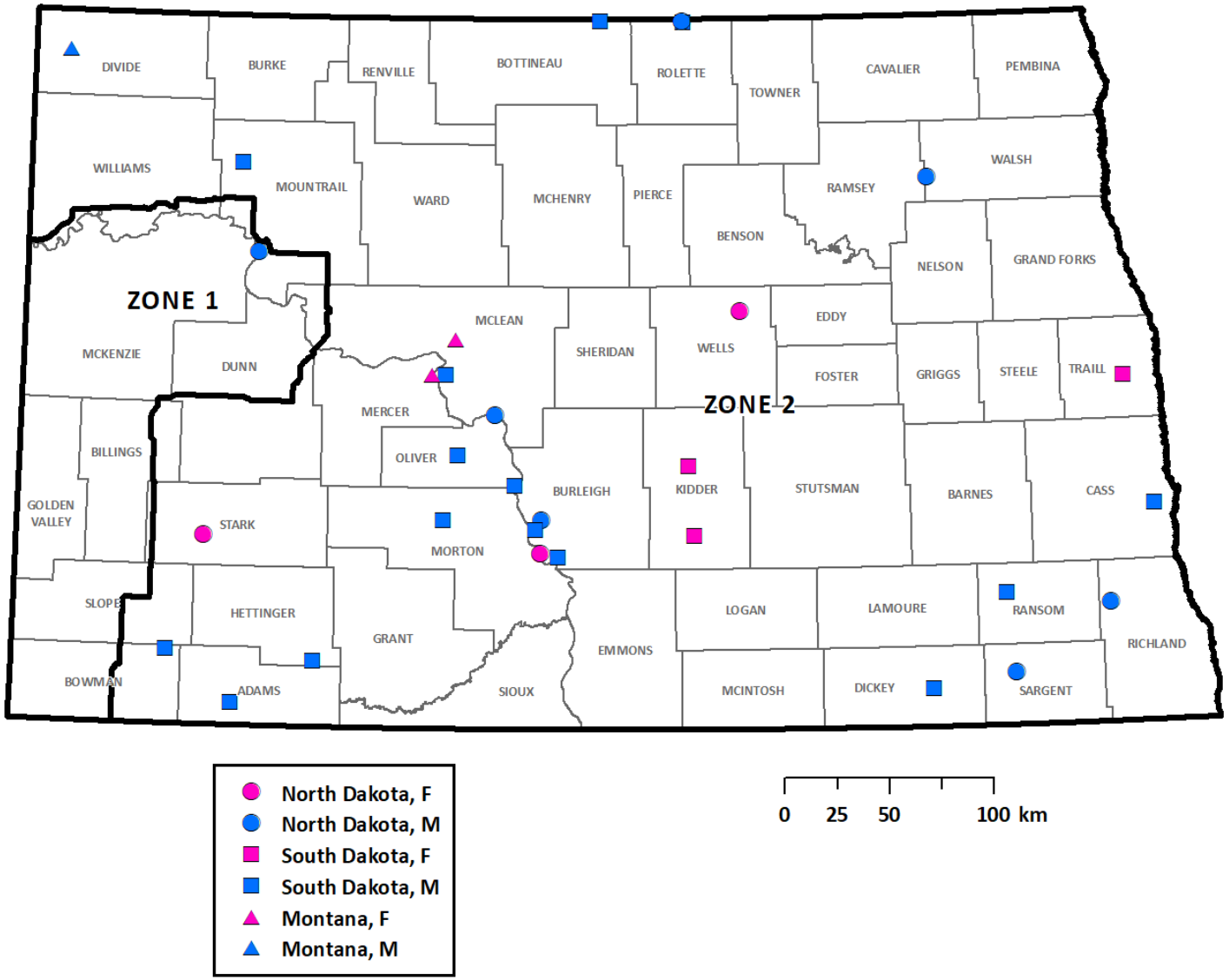
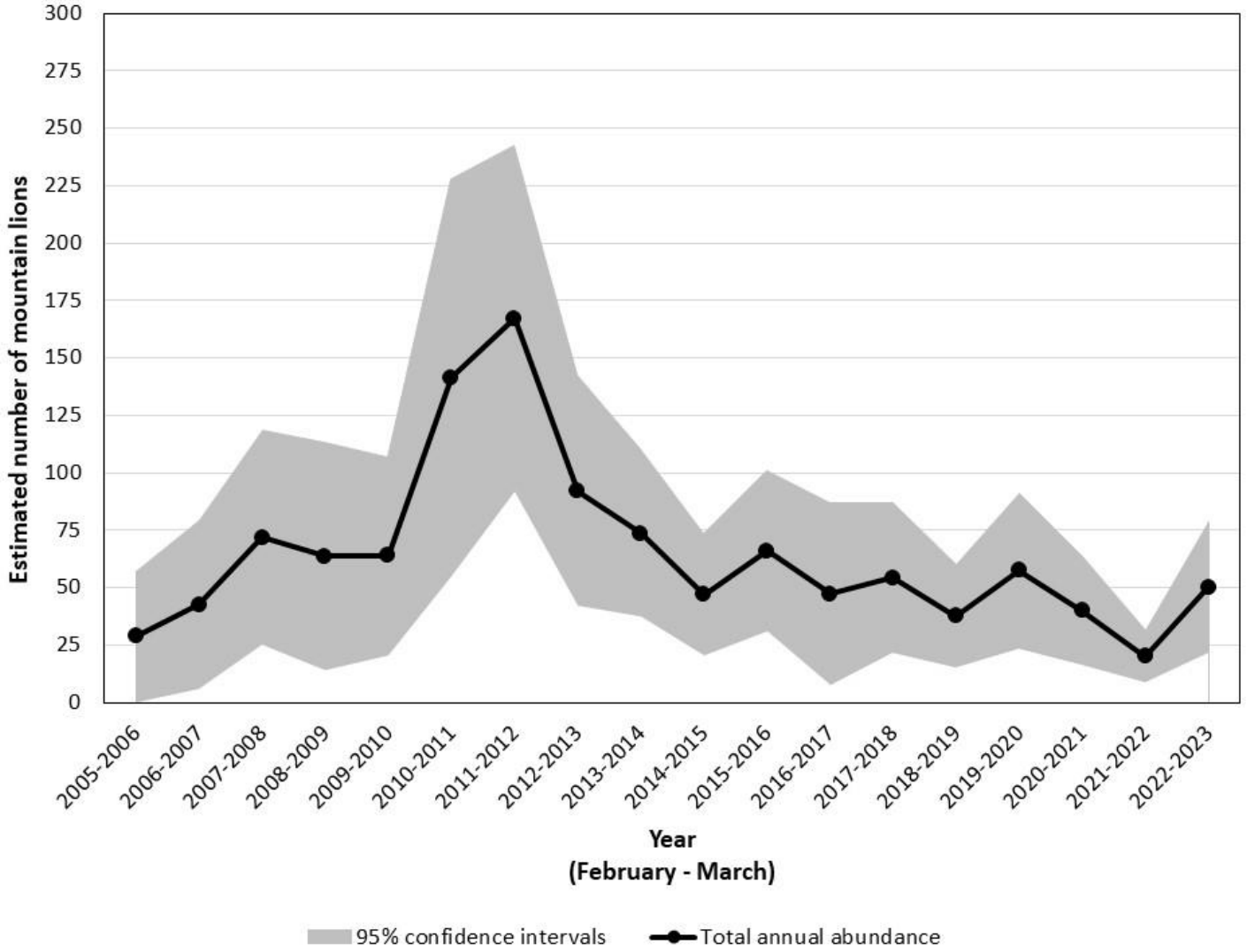


Figure 2. Annual estimates of mountain lion population abundance and associated 95% confidence interval in North Dakota, from 2005-2022, calculated using age-at-harvest data and statistical population reconstruction (Johnson et al. 2019).



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Job No.:	E-XI-3	Mountain Lion Distribution in North Dakota
Period Covered:	July 1, 2022 - June 30, 2023	
Personnel:	Stephanie Tucker, Cami Wight, Megan Seidl	
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OBJECTIVES

To determine the distribution of both harvested and non-harvested mountain lions (*Puma concolor*) in North Dakota.

INTRODUCTION

Historically, mountain lions once ranged over most of North Dakota, although they were considered scarce except in the Little Missouri Badlands region (Bailey 1926). Records indicate mountain lions disappeared from North Dakota in the early-1900s (Bailey et al. [1914] *in* Young and Goldman [1946]) with the last confirmed record of a mountain lion being harvested in 1902 along the Missouri River south of Williston (Bailey 1926). There has never been a bounty on mountain lions in North Dakota (McKenna et al. 2004). In 1961, Adams advised that mountain lions have the potential to show up in North Dakota, particularly the Little Missouri Badlands region. According to Seabloom et al. (1980), there were 10 reports of mountain lions in southwestern North Dakota between 1958 and 1980 and they felt the species should be considered extant in the state. In 1991, after a young female mountain lion was shot near Golva, mountain lions were classified as a “fur-bearer” in the state (North Dakota Century Code 20.1-01). Provisions were made to allow removal of individual mountain lions for protection of property and human safety concerns (North Dakota Century Code 20.1-07-04). Prior to this time, mountain lions were unprotected and could be killed legally (McKenna et al. 2004). By the early-2000s, the number of reports of mountain lion occurrences documented by the North Dakota Game and Fish Department (hereafter, NDGF) had increased such that it became apparent there was a continued presence of mountain lions in western North Dakota (NDGF 2006).

Currently, there is a relatively small population of mountain lions occurring in western North Dakota. Occasionally, individual mountain lions are documented in other parts of the state (McKenna et al. 2004, NDGF 2006, NDGF 2007, Johnson 2017). Estimates of habitat suitability indicated that the Badlands, Missouri River Breaks, and Killdeer Mountains regions (comprising 3.6% of total state area) provide suitable habitat for mountain lions (Johnson 2017).

Mountain lions in the Badlands of North Dakota are geographically isolated from the nearest breeding populations due to vast expanses of agricultural and grassland landscapes surrounding the region which are unsuitable to the species (Johnson 2017). The nearest breeding populations of mountain lions, measured as straight-line-distance from nearest edge of known breeding populations to the North Dakota state border, occur approximately 215 km and 167 km west, in Charles M. Russell National Wildlife Refuge and Wolf Mountains of northeastern and southeastern Montana, respectively, and about 304 km, south in the Black Hills of South Dakota. This isolation, coupled with current management decisions made by state agencies for mountain lion populations in Montana and South Dakota, likely have and will continue to influence dynamics of the mountain lion population in North Dakota. For example, immigration of mountain lions from other populations is important for maintaining genetically healthy individuals at a regional level (Culver and Schwartz 2011).

METHODS

Reports of mountain lion occurrence (e.g. sightings, tracks, etc.) could have been submitted to NDGF by calling or emailing agency personnel or by filling out an online form https://gf.nd.gov/hunting/furbearers/furbearer-observation.

We classified reports as:

a. Verified – Evidence available, including a carcass or live-captured mountain lion, photograph or video, DNA analysis results, or tracks, scat, kill or attack confirmed as being that of a mountain lion by a qualified wildlife professional.
b. Probable Unverified – No evidence available, but report, animal description, and/or location are plausible.
c. Improbable Unverified – No evidence available and report, animal description, and/or location are not plausible.
d. Unfounded – Evidence available which disproves the claim that it is a mountain lion, including carcass or live-captured animal, photograph or video, DNA analysis results, or tracks, scat, kill or attack disproved as being that of a mountain lion by a qualified wildlife professional.

Additionally, successful hunters were asked to provide the approximate location of where they harvested their mountain lion.

In 2022, we included in a survey to a random sample of deer hunters a question asking whether they saw any mountain lions while hunting deer (Stillings and Jensen 2022). We summarized visual observations of mountain lions by deer hunting unit.

RESULTS

From 1 July 2022-30 June 2023, we recorded 43 reports of mountain lions (Table 1; Figures 1-2). Of those, 16 reports (37%) were classified as Verified (Table 2, Figures 2-3). This was 20% lower than the number of mountain lions reported the previous year. The Verified reports consisted of 81% carcasses (i.e. mountain lions harvested during the regulated hunting season, dispatched for protection of property, or killed by automobiles) and 19% photographs or videos (Table 2). Similar to past years, the distribution of Verified mountain lion reports occurred primarily in western North Dakota, particularly the northern Badlands region (Figure 3).

Responses from the deer hunter questionnaire resulted in <1% of people indicating they saw a mountain lion while deer hunting (Figure 4). Two of the units where mountain lion observations were reported (4A and 4C) contained habitat considered suitable for a breeding population of mountain lions (Johnson 2017).

DISCUSSION

Although Verified reports of mountain lion occurrence are not a reliable trend index, these reports do provide us with valuable information regarding distribution, habitat use, and travel routes, especially those used for dispersal. Mountain lion dispersal is a tendency for subadults to move away from their natal home range to prevent inbreeding, and research has shown it occurs regardless of mountain lion density (Logan and Sweanor 2001, Thompson 2009). Dispersing subadult mountain lions, especially males, can turn up anywhere in the state during their travels. For example, in 2019-2020 there were 3 mountain lions legally taken by hunters in Zone 2, outside of the known breeding range for the population.

In 2022-2023, the report trend decreased 20% from the previous year and was 79% less than the average number (*n* = 213) received annually during peak years of reporting from 2005-2009 (Table 1, Figure 2). However, the high number of reports received during those peak years was likely due to the novelty of having a recently recolonized mountain lion population in the state and the opening of a hunting season, as much or more so than the result of an actual peak in mountain lion numbers. This is evidenced by looking at just Verified reports, where it appears the number has not fluctuated nearly as much since 2005 (Table 1, Figure 2). From rigorous research and development of population models, we know the population of mountain lions in North Dakota has experienced some significant upward and downward trends during this timeframe, with a peak in abundance occurring from 2010-2012 (Johnson et al. 2019). Therefore, reports of occurrence should be interpreted with caution and not be used as a true index of population trends.

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Table 1. Number of mountain lion reports recorded by classification in North Dakota, 1 July 2000 through 30 June 2023.

Fiscal year[a]	Verified[b]	Probable unverified[c]	Improbable unverified[d]	Unfounded[e]	Total
2000-2001	4	2	0	0	6
2001-2002	6	6	4	0	16
2002-2003	3	7	10	5	25
2003-2004	4	6	11	4	25
2004-2005	12	37	31	13	93
2005-2006	39	60	40	53	192
2006-2007	52	80	50	57	239
2007-2008	57	71	52	65	245
2008-2009	31	37	39	70	177
2009-2010	22	16	32	64	134
2010-2011	38	17	25	37	117
2011-2012	56	1	23	28	108
2012-2013	35	2	12	21	70
2013-2014	41	5	18	21	85
2014-2015	39	1	13	16	69
2015-2016	30	2	6	6	44
2016-2017	23	2	11	9	45
2017-2018	36	2	12	6	56
2018-2019	28	7	16	8	59
2019-2020	24	4	17	8	53
2020-2021	15	2	20	3	40
2021-2022	13	4	27	10	54
2022-2023	17	4	14	9	44

[a]July 1 through June 30.

[b]Evidence available, including a carcass or live-captured mountain lion, photograph or video, DNA analysis results, or tracks, scat, kill or attack confirmed as being that of a mountain lion by a qualified wildlife professional.

[c]No evidence available and the report, animal description, and/or location are plausible.

[d]No evidence available and the report, animal description, and/or location are not plausible.

[e]Evidence available which disproves the claim that it is a mountain lion, including carcass or live-captured animal, photograph or video, DNA analysis results, or tracks, scat, kill or attack disproved as being that of a mountain lion by a qualified wildlife professional.

Table 2. Reports of Verified mountain lion occurrence in North Dakota, 1 July 2000 through 30 June 2023.

Fiscal year [a]	Sign	Carcass	Visual observation	Incidental capture	Photograph/ Video	Total
2000-2001	3	1	0	0	0	4
2001-2002	3	0	2	0	1	6
2002-2003	2	0	0	0	1	3
2003-2004	3	0	0	0	1	4
2004-2005	4	2	3	0	3	12
2005-2006	22	5	11	0	1	39
2006-2007	32	12	6	1	1	52
2007-2008	30	12	8	0	7	57
2008-2009	10	11	4	0	6	31
2009-2010	5	12	3	0	2	22
2010-2011	14	22	0	0	2	38
2011-2012	14	33	3	0	6	56
2012-2013	14	20	0	0	1	35
2013-2014	10	22	0	0	8	41
2014-2015	13	23	1	0	2	39
2015-2016	6	17	0	0	7	30
2016-2017	3	11	0	0	9	23
2017-2018	5	24	0	0	7	36
2018-2019	4	17	0	1	6	28
2019-2020	3	18	0	0	3	24
2020-2021	1	12	0	0	2	15
2021-2022	1	8	0	0	4	13
2022-2023	0	14	0	0	3	17

[a]July 1 through June 30.

Figure 1. Number of reports of mountain lion occurrence in North Dakota, 1 July 2022 through 30 June 2023.

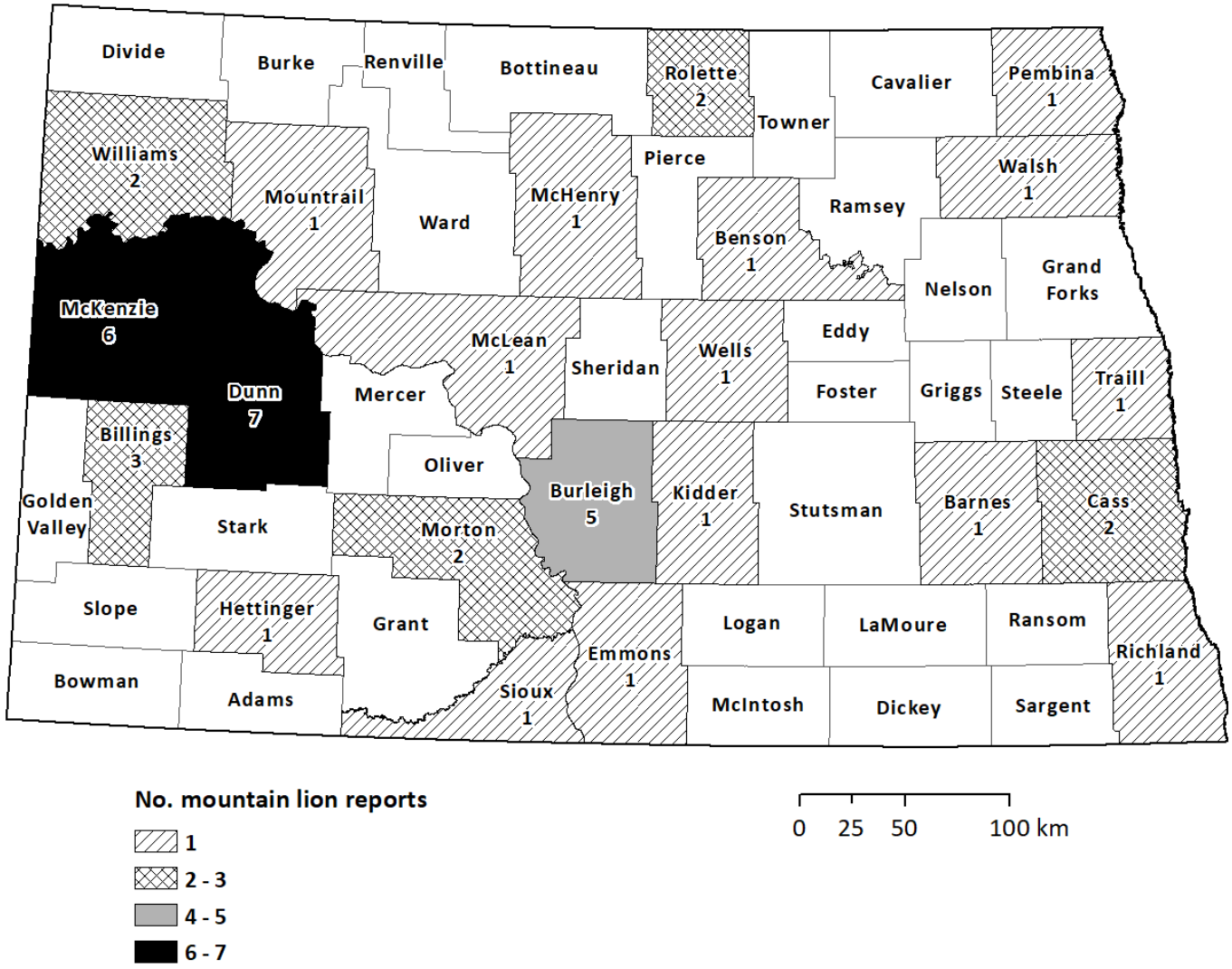


Figure 2. Number of reports of mountain lion occurrence in North Dakota, fiscal years (1 July-30 June) 2000-2001 through 2022-2023. Reports of occurrence were classified as Unfounded (evidence available to disprove the occurrence of a mountain lion), Unverified (no evidence available to prove or disprove the occurrence of a mountain lion), and Verified (evidence available to prove the occurrence of a mountain lion).

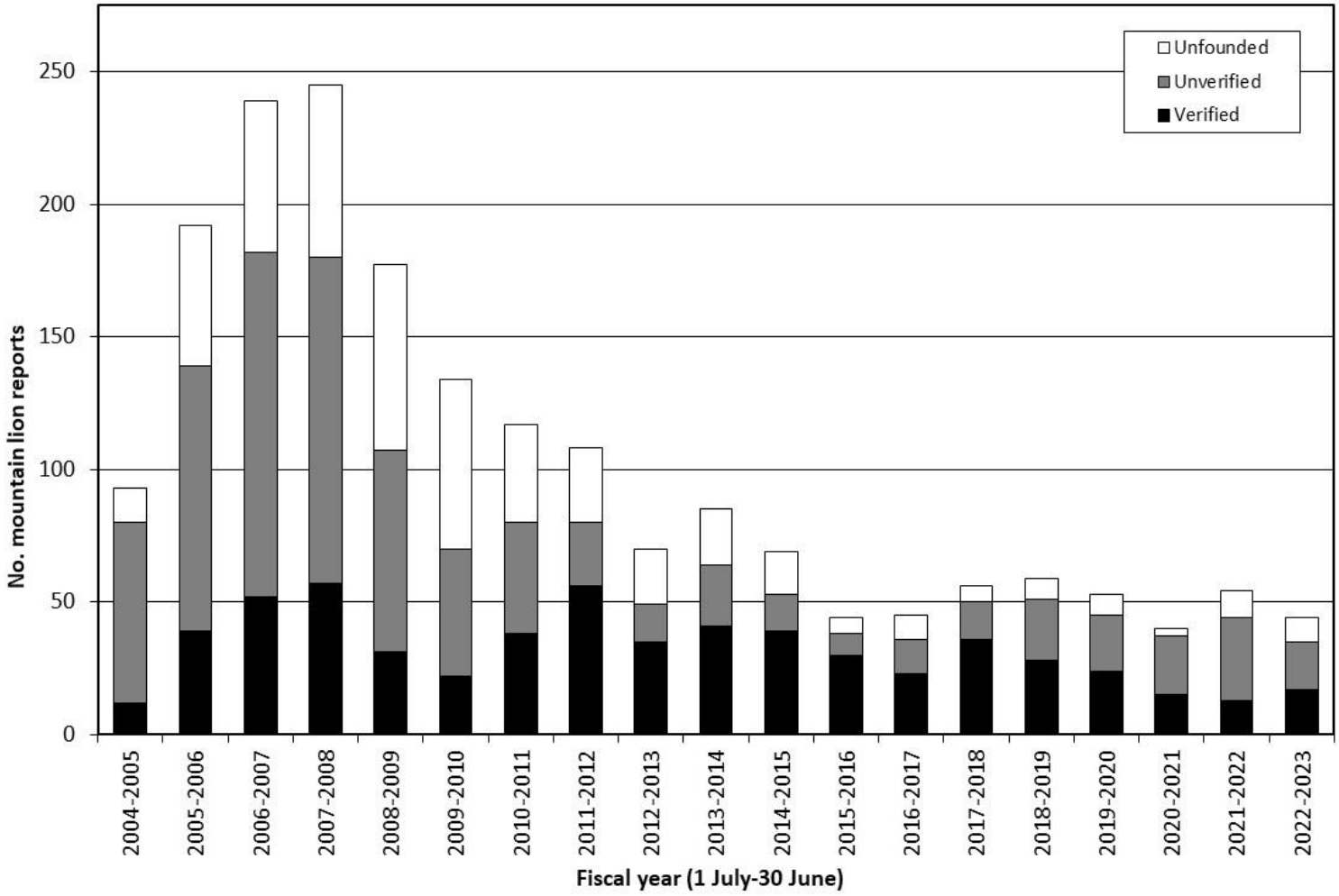


Figure 3. Locations of Verified reports of mountain lion occurrence in North Dakota, 1 July 2022 through 30 June 2023.

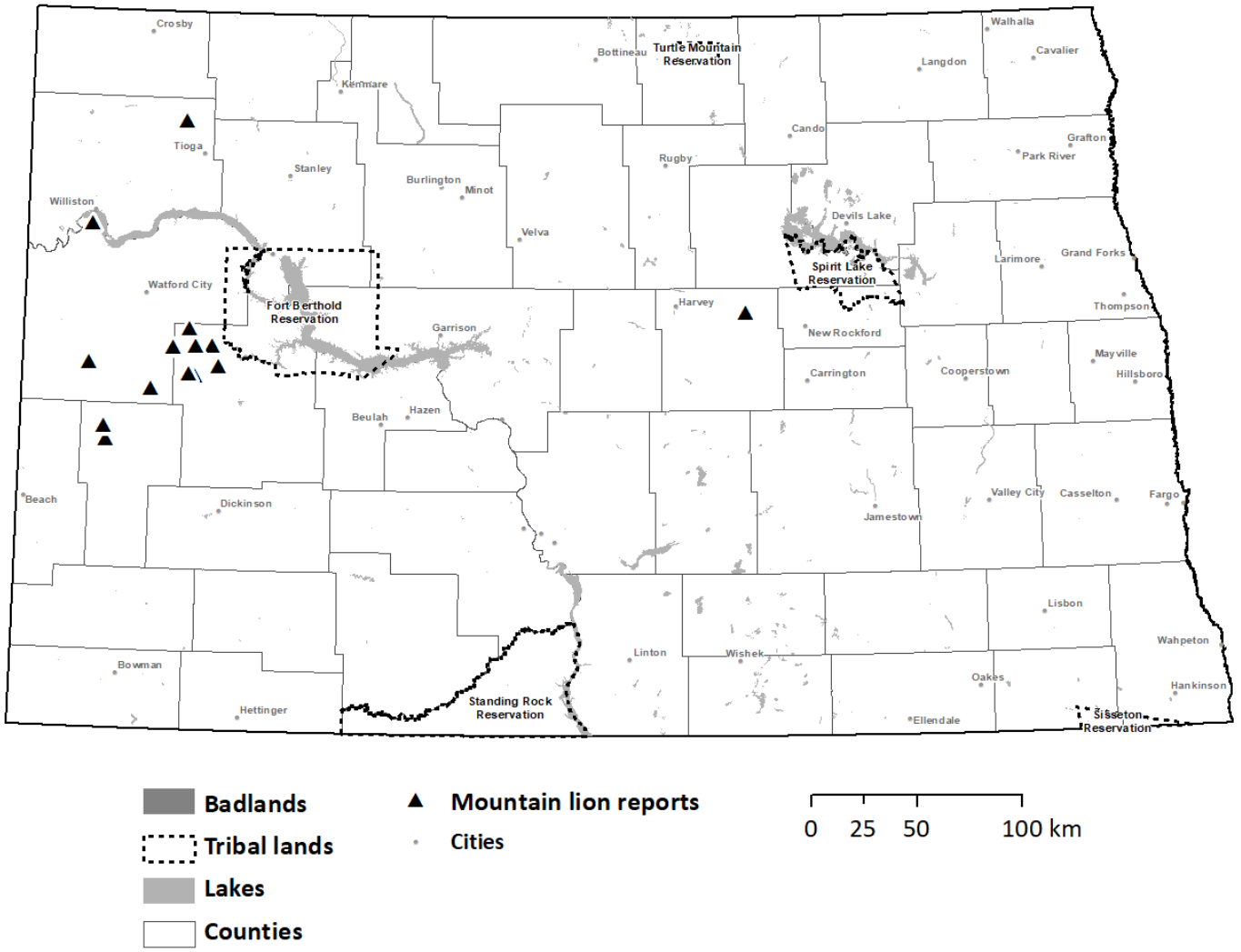
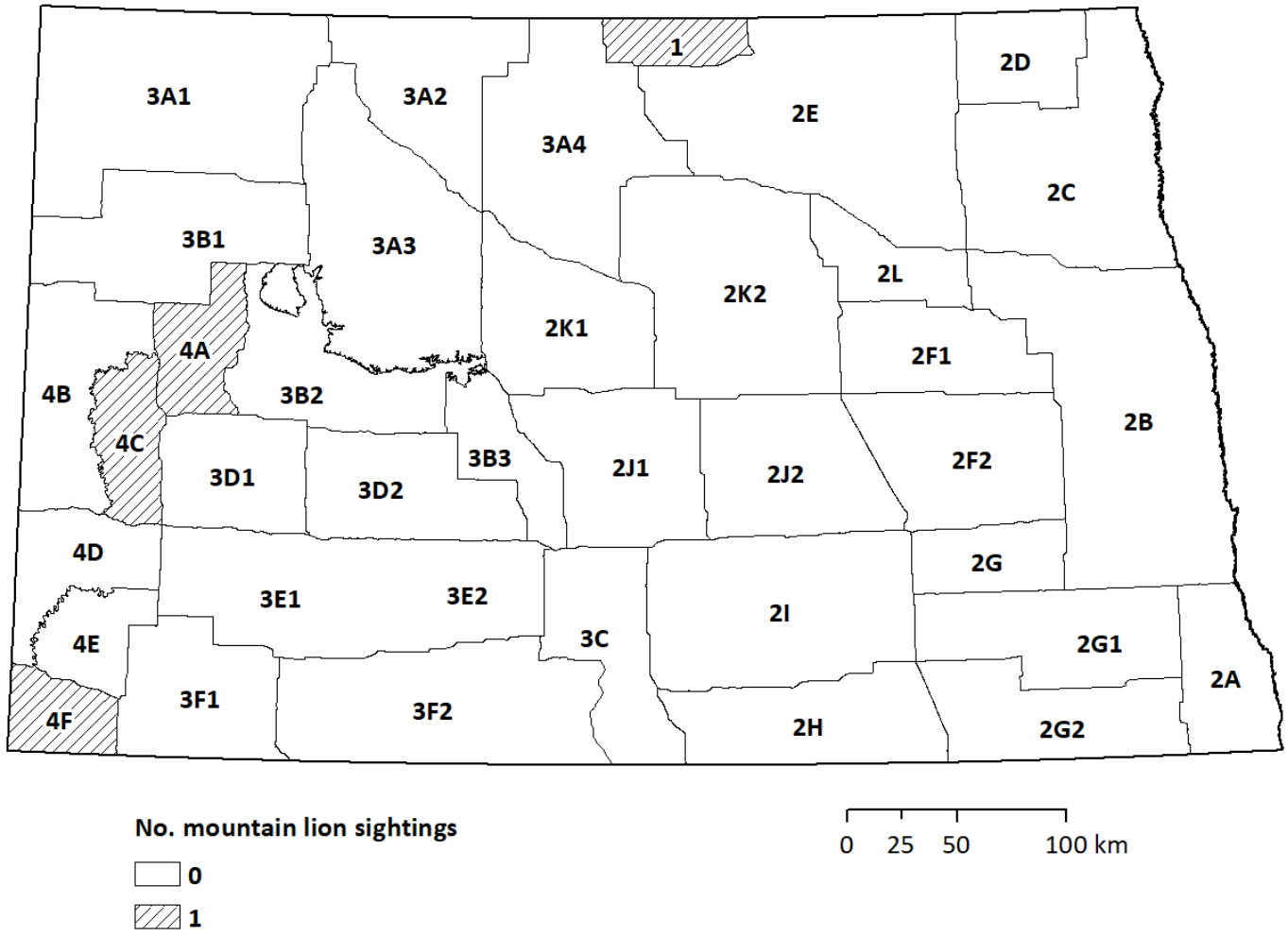


Figure 4. Deer management units where hunters reported observing a mountain lion while deer hunting in North Dakota, 2022.



State of:	North Dakota	
Project No.:	W-67-R-63	Wildlife Surveys and Investigations
Phase:	E	Furbearer Investigations
Study No.:	E-XI	MOUNTAIN LION POPULATION DATA
Job No.:	E-XI-4	Technical Assistance to Other Agencies and Public Regarding Mountain Lions
Period Covered:	July 1, 2022 - June 30, 2023	
Personnel:	Stephanie Tucker	
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OBJECTIVES

To provide technical assistance to committees, individuals, and organizations on mountain lion (*Puma concolor*) ecology and management, urban and rural conflicts, and harvest regulations.

INTRODUCTION

The presence of mountain lions in our state garners a considerable amount of interest from the public due to its charisma and predatory nature. Potential human-mountain lion conflicts may range from as minor as the mere presence of the animal where it is unwanted to as major of a conflict as an attack on a person. As such, we are committed to informing and educating people about the species ecology, distribution, and management in North Dakota, as well as conflict mitigation.

Additionally, prudent management of mountain lions requires information exchange both regionally and nationally about the species' status and science. Mountain lions do not adhere to human jurisdictions and should be managed at a regional level to ensure species health. Thus, we are also committed to not only learning what is known about mountain lions throughout their range, but sharing what we know about their ecology and status here in North Dakota.

METHODS

We will educate North Dakota residents about mountain lions (i.e., natural history and ecology, physical description of the animal and its tracks, how to live and recreate where large predators reside, what to do if you see a rare furbearer, etc.). These efforts will include giving public

presentations, conducting radio and television interviews, developing educational brochures, and attending other agency and non-governmental organization meetings.

To provide technical assistance to other agencies, organizations, and individuals we will communicate with and attend information exchange meetings both locally and regionally.

Additionally, we will cooperate with USDA-Wildlife Services personnel in North Dakota to investigate reports of livestock depredation by mountain lions and provide suggestions for mitigation.

RESULTS

Department personnel continued to give presentations to an array of audiences including students, general public, community organizations, and other state and federal agencies, regarding the ecology, management, and historical and current distribution of mountain lions. We also provided interviews to major newspapers and radio stations in the state regarding mountain lions and the mountain lion harvest season. Educational brochures were made available to the public at district offices, Theodore Roosevelt National Park, United States Department of Agriculture-Wildlife Services, United States Fish and Wildlife Service Refuges, and Fort Berthold Fish and Game offices. Game Wardens and Wildlife Service Specialists provided brochures to people who reported sightings or potential depredations to livestock. Additionally, biologists provided brochures at various events (e.g., North Dakota State Fair).

Submitted by: _____ Approved by: _____

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Dated: December 2023

NORTH DAKOTA GAME AND FISH DEPARTMENT