STATUS OF MOUNTAIN LION MANAGEMENT IN NORTH DAKOTA, 2020

North Dakota Game and Fish Department

October 2020

Time Period Covered

1 July 2019 – 30 June 2020

SUMMARY

We used a combination of reports of occurrence, harvest locations, and hunter and trapper questionnaires to determine the distribution of mountain lions in North Dakota. We examined abundance of mountain lions in relation to previous years (i.e. trend information) via these same methods, as well as previous habitat analysis and population modeling. Additionally, we necropsied mountain lion carcasses to collect demographic, dietary, and genetic information. Necropsies indicate a small, but healthy population of mountain lions occurring in western North Dakota.

INTRODUCTION

Historically, mountain lions (*Puma concolor*) 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, NDGFD) had increased such that it became apparent there was a continued presence of mountain lions in western North Dakota (NDGFD 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, NDGFD 2006, NDGFD 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).

The first regulated hunting season for mountain lions in North Dakota occurred in 2005-2006 with a harvest limit of 5. This first hunting season was considered experimental with the goal being to acquire biological and distributional information about the population of mountain lions occurring in the state (NDGFD 2006). The second regulated hunting season (2006-2007) was modified 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 4 months later in the season. Changes to the 2007-2008 regulations included dividing the state into 2 management zones (Figure 1; Zone 1 had a harvest limit of 5, Zone 2 had no harvest limit), no longer counting incidental or depredation removals towards the harvest limit, and Fort Berthold Reservation (hereafter, Reservation) having a separate harvest limit. During the 2008-2009 hunting season, the harvest limit for mountain lions in Zone 1 was increased to 8 while the harvest limit within the Reservation was 5. The harvest limit in Zone 1 was again increased to 10 in the 2010-2011, 14 in 2011-2012, and 21 in 2012-2013 harvest seasons. In 2015-2016, the harvest limit within the Reservation was increased to 10. In 2016-2017, the harvest limit in Zone 1 was lowered to 15.

METHODS

Reports of mountain lion occurrence (e.g. sightings, tracks, etc.) were recorded by NDGFD personnel, and included reports from the general public, deer hunters, fur hunters and trappers, United States Department of Agriculture-Wildlife Services, Theodore Roosevelt National Park, and Reservation Fish and Wildlife employees (Figure 2). Reports were classified 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.

We required hunters to turn in the entire intact carcasses of all harvested mountain lions after they removed the pelts. Additionally, we collected data from mountain lions killed on the Reservation, when feasible. From the mountain lion carcasses, we estimated age (Anderson and Lindzey 2000, NDGFD 2018) and collected morphological measurements, reproductive tracts, stomachs, and tissue samples. We examined reproductive tracts for placental scars to determine pregnancy rates and litter sizes. We extracted an upper premolar and sent them to Matson's Laboratory (Manhattan, Montana, USA) to confirm age via counts of cementum annuli.

In early-April 2020, we mailed a questionnaire to 5,000 individuals who bought either a furbearer or combination license for the 2019-2020 harvest season (Tucker 2020). We asked hunters to indicate the number of days spent pursuing mountain lions and number of individual mountain lions they harvested. From this, we estimated mean number of days hunting and total number of mountain lions harvested. We also graphed the number of mountain lions taken per day hunting to illustrate trends in catch per unit of effort (CPUE) across years.

In 2020, 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 2020). We summarized visual observations of mountain lions by deer hunting unit.

To estimate trends in abundance of mountain lion in North Dakota, we analyzed age-at-harvest and radio-collar data using statistical population reconstruction (SPR; Johnson 2017, Johnson et al. 2019). We updated the SPR model to include age-at-harvest data from the 2019-2020 season.

Our SPR model assumes that known age mountain lions included in the data set were produced from our breeding population in the Badlands region. However, we felt we may be violating this assumption by including individuals in the model from Zone 2, as these mountain lions are generally dispersing subadults. 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 model analysis.

Occasionally, opportunities to mark live-captured mountain lions become available when they are incidentally caught in traps set for coyotes or bobcats. To mark live-captured mountain lions, we anesthetized and ear-tagged them following protocol described by Wilckens et al. (2015). If mountain lions are incidentally live-captured outside the known breeding range in North Dakota, we may radio collar them as well, to track behavior and habitat use of dispersing mountain lions.

RESULTS

From 1 July 2019-30 June 2020, we recorded 53 reports of mountain lions (Table 1; Figures 3-4). Of those, 24 reports (45%) were classified as Verified (Table 2, Figures 4-5). This was a similar number of reports of mountain lions compared to the previous year. The Verified reports consisted of 75% carcasses (i.e. mountain lions harvested during the regulated hunting season, dispatched for protection of property, or killed by automobiles), 12.5% photographs or videos, and 12.5% mountain lion signs (i.e. tracks, scat, kills, or scrapes; 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 5).

The hunting season for mountain lions opened on 30 August 2019. Zone 1 had a harvest limit, whereas Zone 2 had no harvest limit and remained open for hunting until 31 March 2020. In Zone 1, the harvest limit was split between consecutive early- (30 August 2019-24 November 2019) and late-seasons (25 November 2019-31 March 2020). 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. The harvest limit for the early-season was not reached prior to 24 November 2019, therefore 5 days after the late-season harvest limit was reached, a conditional season opened in Zone 1 to allow additional mountain lion harvest until the early-season harvest limit was reached or 31 March 2020, whichever came first. Use of dogs to pursue mountain lions was prohibited during the conditional season.

The early-season in Zone 1 closed on the last day of the season with 6 mountain lions (4 F, 2 M) being harvested (Table 3; Figure 6). The late-season in Zone 1 closed on 15 December 2019 after the harvest limit was surpassed due to two mountain lions being taken on the last day.

The harvest for the late-season in Zone 1 was 8 mountain lions total (2 F, 6 M). A conditional season opened on 21 December 2019, but no more mountain lions were taken before closing on 31 March 2020. Additionally, 3 mountain lions (1 F, 2 M) were legally harvested in Zone 2. Therefore, the total legal harvest consisted of 7 females and 10 males.

Internal examination of mountain lion carcasses indicated mountain lions in North Dakota are generally healthy. 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 2019-30 June 2020 was 0.6 females per male and age was 2.7± 2.0 ($\bar{x}$ ± SD) years. In comparison, the sex ratio of all mountain lion carcasses we have examined to date in North Dakota (*n* = 242) was 1.2 females per male and mean age was 2.8 ± 2.3 years. Mean weights for mountain lions ≥1 year of age was 88 (range 56, 126) and 121 (range 79, 170) pounds for females and males, respectively.

Results from the questionnaire mailed to furbearer and combination license holders indicated that 1.3% of license holders hunted mountain lions during the 2019-2020 season. Results from the questionnaire also indicated that individual hunters spent an average of 5.5 ± 6.2 ($\bar{x}$ ± SD) days pursuing mountain lions with an estimated statewide harvest of 0 mountain lions during the 2019-2020 hunting season. The associated trend in CPUE for mountain lions remained low, as expected with an estimated statewide harvest of 0 (Figure 7).

Responses from the deer hunter questionnaire resulted in <1% of people indicating they saw a mountain lion while deer hunting (Figure 8). Two of the units where mountain lion observations were reported (4C and 4D) contained habitat considered suitable for a breeding population of mountain lions (Johnson 2017).

We had genetic analysis conducted on tissue samples from 4 mountain lions (1F, 3M) from Zone 2, to calculate population assignments (Ortloff et al. 2019). Results indicated 3 (75%) were assigned to the Black Hills population and 1 (25%) to Montana (Figure 9). Probability of assignment was high, ranging from 92.9-99.9%. Subsequently, all 4 individuals were removed from our SPR analysis.

Trends in annual abundance from our SPR model resulted in estimated mountain lion numbers ranging from a low of 32 total mountain lions in 2005-2006 to a high of 189 in 2011-2012 (Figure 10). The average total abundance was estimated at 80 mountain lions over the course of 15 years.

DISCUSSION

We monitored mountain lions in North Dakota via reports of occurrence, mandatory carcass returns, harvest surveys, and population modeling. All these methods of monitoring indicated that mountain lion numbers were low compared to their respective peaks (Figures 4, 6-7, 9). Population trends developed via statistical population reconstruction indicated that the

number of mountain lions found in Zone 1 (breeding population) peaked in 2011-2012, then declined and stabilized since that time.

Report trends decreased slightly compared to the previous year and were 78% less than the average number (*n* = 242) received annually during peak years of reporting from 2006-2008 (Table 1, Figure 4). 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 considerably since 2005 and shows no obvious upward or downward trends (Table 1, Figure 4). 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 (Figure 9). Therefore, reports of occurrence should be interpreted with caution and not be used as a true index of population trends.

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. Subadult 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.

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 of mountain lions. 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. 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).

Genetic analysis confirmed a majority (77%) 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.

It is also apparent that data obtained from the questionnaire regarding mountain lion hunting activity is not a reliable estimate of true harvest at this time. Therefore, mandatory reporting of harvest should continue.

LITERATURE CITED

Adams, A. W. 1961. Furbearers of North Dakota. North Dakota Game and Fish Department, Bismarck, North Dakota, USA.

Anderson, C. R. Jr., and F. G. Lindzey. 2000. A photographic guide to estimating mountain lion age classes. Wyoming Cooperative Fish and Wildlife Research Unit, Laramie, Wyoming, USA.

Bailey, V. 1926. A biological survey of North Dakota. North American Fauna, No. 49. United States Department of Agriculture, Bureau of Biological Survey, Washington, D.C., USA.

Johnson, R. D. 2017. Mountain lion (*Puma concolor*) population characteristics and resource selection in the North Dakota Badlands. Thesis, South Dakota State University, Brookings, South Dakota, USA.

Johnson, R. D., J. A. Jenks, S. A. Tucker, and D. T. Wilckens. 2019. Mountain lion (*Puma concolor*) population characteristics in the Little Missouri Badlands of North Dakota. American Midland Naturalist 181:207-224.

Logan, K. A., and L. L. Sweanor. 2001. Desert puma: evolutionary ecology and conservation of an enduring carnivore. Hornocker Wildlife Institute, Island Press, Washington, D.C., USA.

McKenna, M., J. Ermer, S. Hagen, S. Dyke, R. Kreil, G. Link, and M. Johnson. 2004. Mountain lions in North Dakota: A report to the Director. North Dakota Game and Fish Department, Bismarck, North Dakota, USA.

North Dakota Game and Fish Department. 2006. Status of mountain lions (*Puma concolor*) in North Dakota: A report to the Legislative Council. North Dakota Game and Fish Department, Bismarck, North Dakota, USA.

North Dakota Game and Fish Department. 2007. Status of mountain lion management in North Dakota, 2007. North Dakota Game and Fish Department, Bismarck, North Dakota, USA.

North Dakota Game and Fish Department. 2018. Mountain lions in North Dakota. North Dakota Game and Fish Department, Bismarck, North Dakota, USA.

Ortloff, I., K. Pilgrim, and M. Schwartz. 2019. North Dakota mountain lion (*Puma concolor*) samples analysis, 2019. Report, National Genomic Center for Wildlife and Fish Conservation, USFS Rocky Mountain Research Station, Missoula, Montana, USA.

Seabloom, R. W., M. G. McKenna, and R. D. Crawford. 1980. Recent records of mammals from southwestern North Dakota. Prairie Naturalist 12:199-123.

Stillings, B., and W. Jensen. 2020. Study No. C-I: Deer population studies. Project No. W-67-R-60, Report No. A-266, North Dakota Game and Fish Department, Bismarck, ND, USA.

Thompson, D. J. 2009. Population demographics of cougars in the Black Hills: survival, density, morphometry, genetic structure and interactions with density dependence. Dissertation, South Dakota State University, Brookings, South Dakota, USA.

Tucker, S. A. 2020. Study No. E-II: Furbearer harvest regulations study. Project No. W-67-R-59, Report No. C-489, North Dakota Game and Fish Department, Bismarck, North Dakota, USA.

Wilckens, D. 2014. Ecology of mountain lions (*Puma concolor*) in the North Dakota Badlands: population dynamics and prey use. Thesis, South Dakota State University, Brookings, South Dakota, USA.

Young, S. P., and E. A. Goldman. 1946. The puma: Mysterious American cat. Dover Publications, Inc., New York, New York, USA.

Table 1. Number of mountain lion reports recorded by classification in North Dakota, 1 July 2000 through 30 June 2020.

Fiscal year[a]	Verified[b]	Probable unverified[c]	Improbable unverified[d]	Unfounded[e]	Total
2000-2001	4	2	0	0	6
2001-2002	8	6	4	0	18
2002-2003	3	7	10	5	25
2003-2004	4	6	11	4	25
2004-2005	16	36	31	13	96
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

[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 2020.

Fiscal year [a]	Sign	Carcass	Visual observation	Incidental capture	Photograph/ Video	Total
2000-2001	3	1	0	0	0	4
2001-2002	4	0	3	0	1	8
2002-2003	2	0	0	0	1	3
2003-2004	3	0	0	0	1	4
2004-2005	6	2	4	0	4	16
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

[a]July 1 through June 30.

Table 3. Mountain lion mortalities in North Dakota, 1 July 2018 through 30 June 2019.

ID	Cause of death	Date	Sex	Estimated age class (yr)[a]	County
F307	Legal harvest	10/12/2019	F	3-4	Billings
M309	Legal harvest	11/10/2019	M	1-2	Dunn
M310	Legal harvest	11/12/2019	M	2-3	Billings
F129	Legal harvest	11/20/2019	F	2-3	Billings
F311	Legal harvest	11/21/2019	F	2-3	Billings
M312	Legal harvest	11/22/2019	M	1-2	Slope
F313	Legal harvest	11/23/2019	F	4-5	McKenzie
M314	Legal harvest	12/1/2019	M	1-2	Billings
M315	Legal harvest	12/9/2019	M	3-4	Billings
F316	Legal harvest	12/10/2019	F	3-4	McKenzie
M317	Legal harvest	12/10/2019	M	1-2	Dunn
M318	Legal harvest	12/11/2019	M	4-5	Dunn
M319	Legal harvest	12/15/2019	M	1-2	Dunn
M320	Legal harvest	12/15/2019	M	4-5	McKenzie
F321	Legal harvest	12/15/2019	F	8-9	McKenzie
F322	Legal harvest	12/26/2019	F	6-7	McLean
M323	Legal harvest	2/9/2020	M	1-2	Adams
M324	Protection of property/self	3/31/2020	M	1-2	Cass

[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).

Figure 1. Harvest zones for mountain lions in North Dakota during the 2019-2020 season.

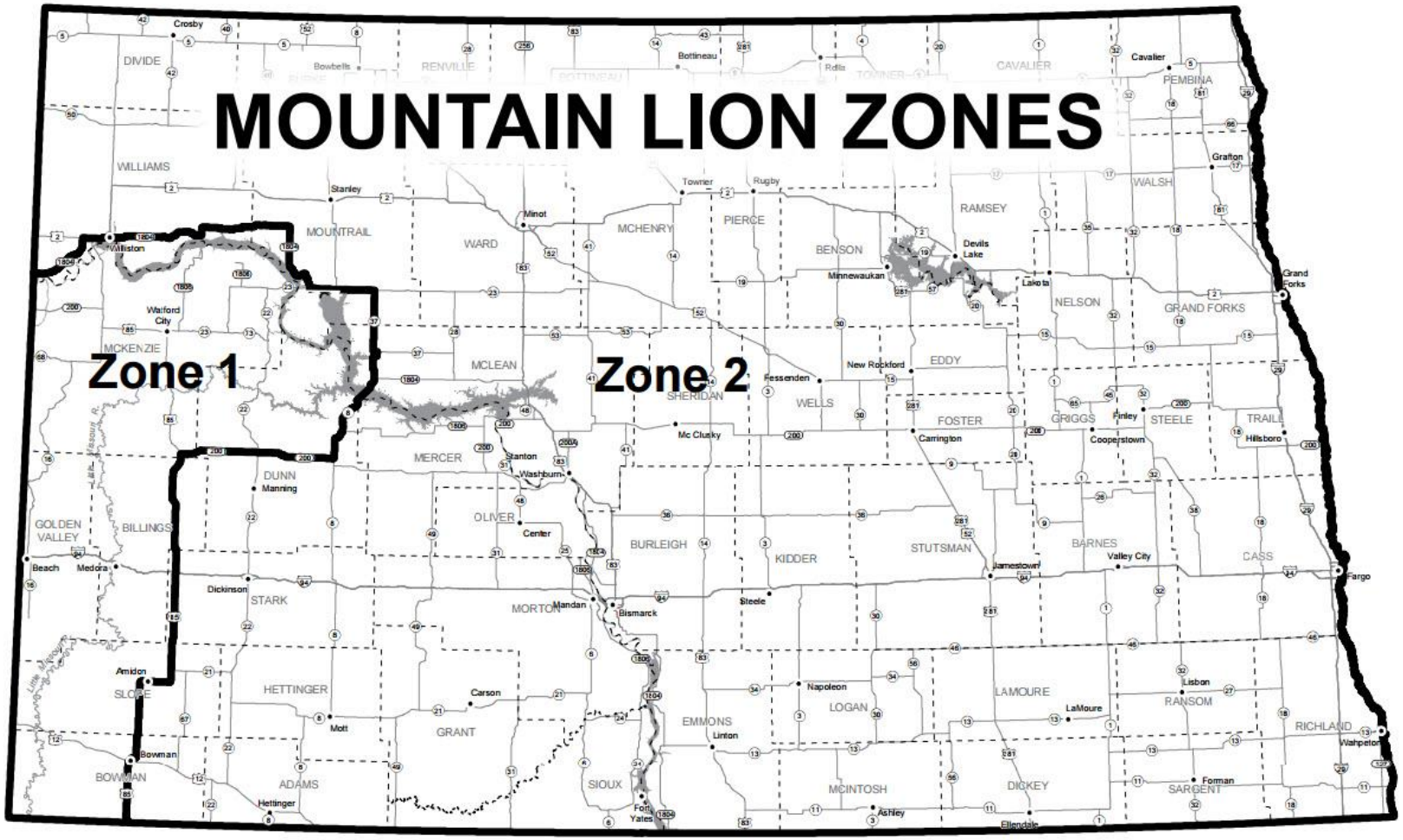
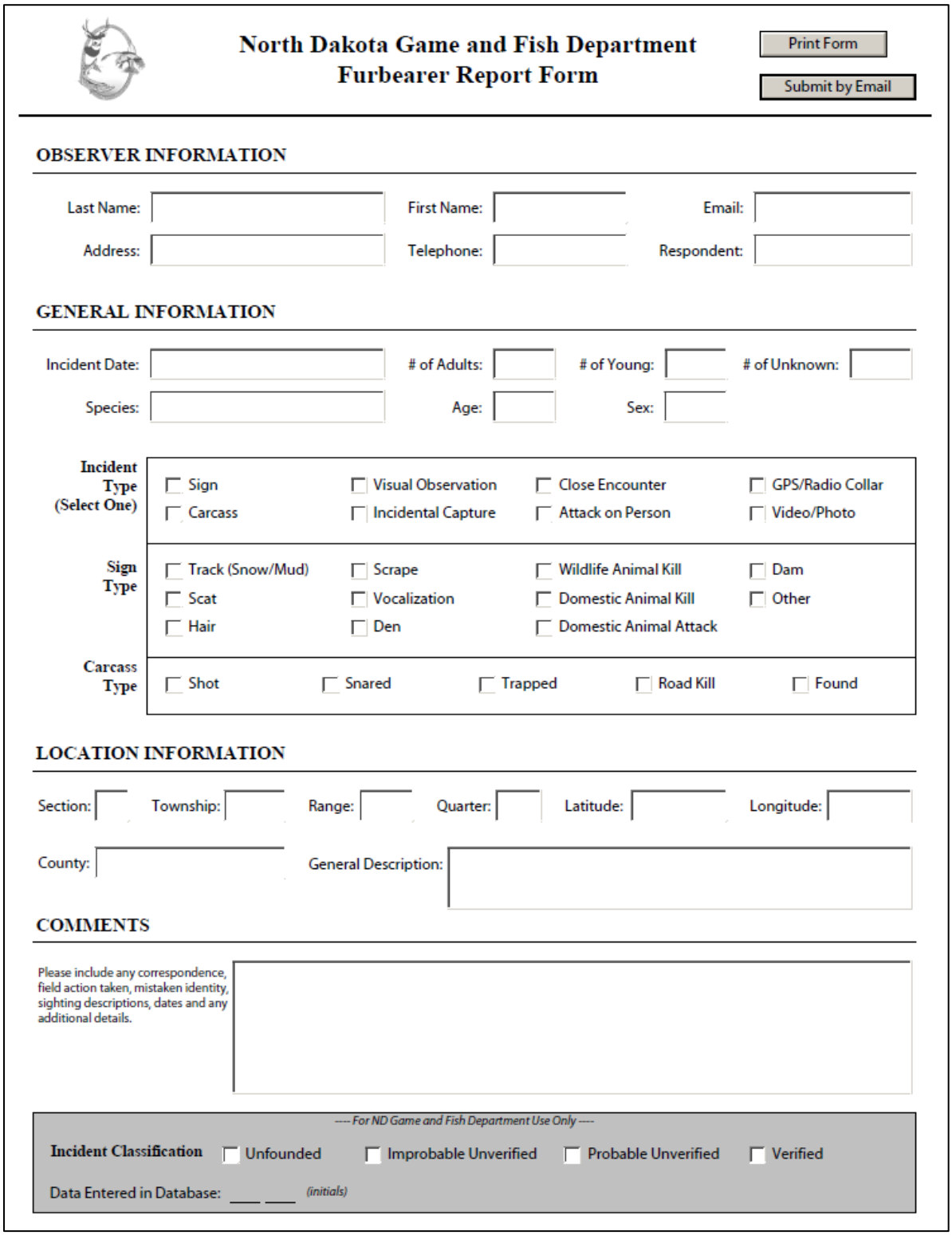


Figure 2. Report form used by North Dakota Game and Fish Department personnel to document the occurrence of mountain lions in the state.



North Dakota Game and Fish Department
Furbearer Report Form

Print Form
Submit by Email

OBSERVER INFORMATION

Last Name: First Name: Email:
Address: Telephone: Respondent:

GENERAL INFORMATION

Incident Date: # of Adults: # of Young: # of Unknown:
Species: Age: Sex:

Incident Type (Select One)

☐ Sign ☐ Visual Observation ☐ Close Encounter ☐ GPS/Radio Collar
☐ Carcass ☐ Incidental Capture ☐ Attack on Person ☐ Video/Photo

Sign Type

☐ Track (Snow/Mud) ☐ Scrape ☐ Wildlife Animal Kill ☐ Dam
☐ Scat ☐ Vocalization ☐ Domestic Animal Kill ☐ Other
☐ Hair ☐ Den ☐ Domestic Animal Attack

Carcass Type

☐ Shot ☐ Snared ☐ Trapped ☐ Road Kill ☐ Found

LOCATION INFORMATION

Section: Township: Range: Quarter: Latitude: Longitude:

County: General Description:

COMMENTS

Please include any correspondence, field action taken, mistaken identity, sighting descriptions, dates and any additional details.

---- For ND Game and Fish Department Use Only ----

Incident Classification ☐ Unfounded ☐ Improbable Unverified ☐ Probable Unverified ☐ Verified

Data Entered in Database: ___ ___ *(initials)*

Figure 3. Number of reports of mountain lion occurrence in North Dakota, 1 July 2019 through 30 June 2020.

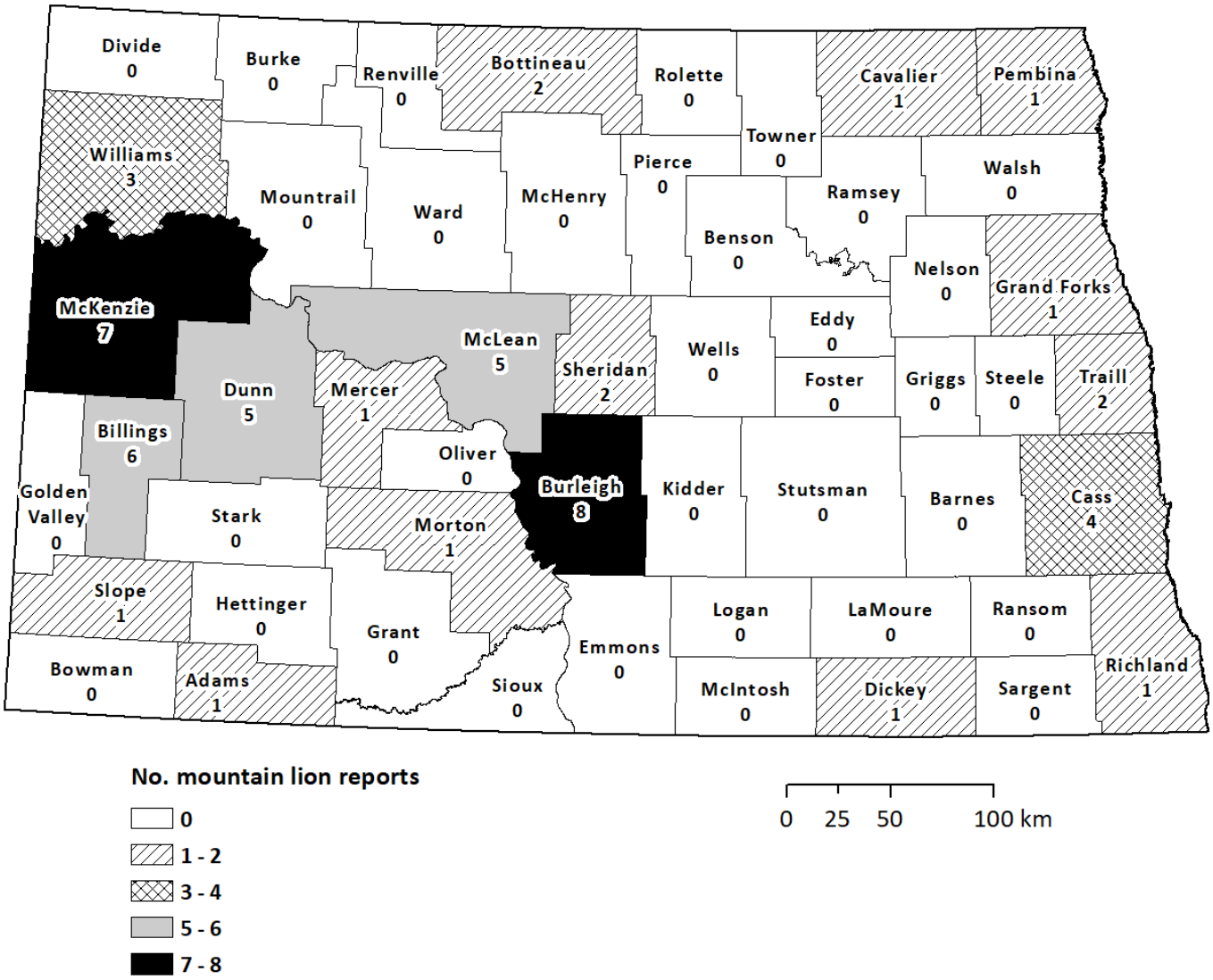


Figure 4. Number of reports of mountain lion occurrence in North Dakota, fiscal years (1 July-30 June) 2000-2001 through 2019-2020. Reports of occurrence were classified as Unfounded (evidence available to disprove the occurrence of a mountain lion), Unverified (no evidence available to prove or disprove the occurrence of a mountain lion), and Verified (evidence available to prove the occurrence of a mountain lion).

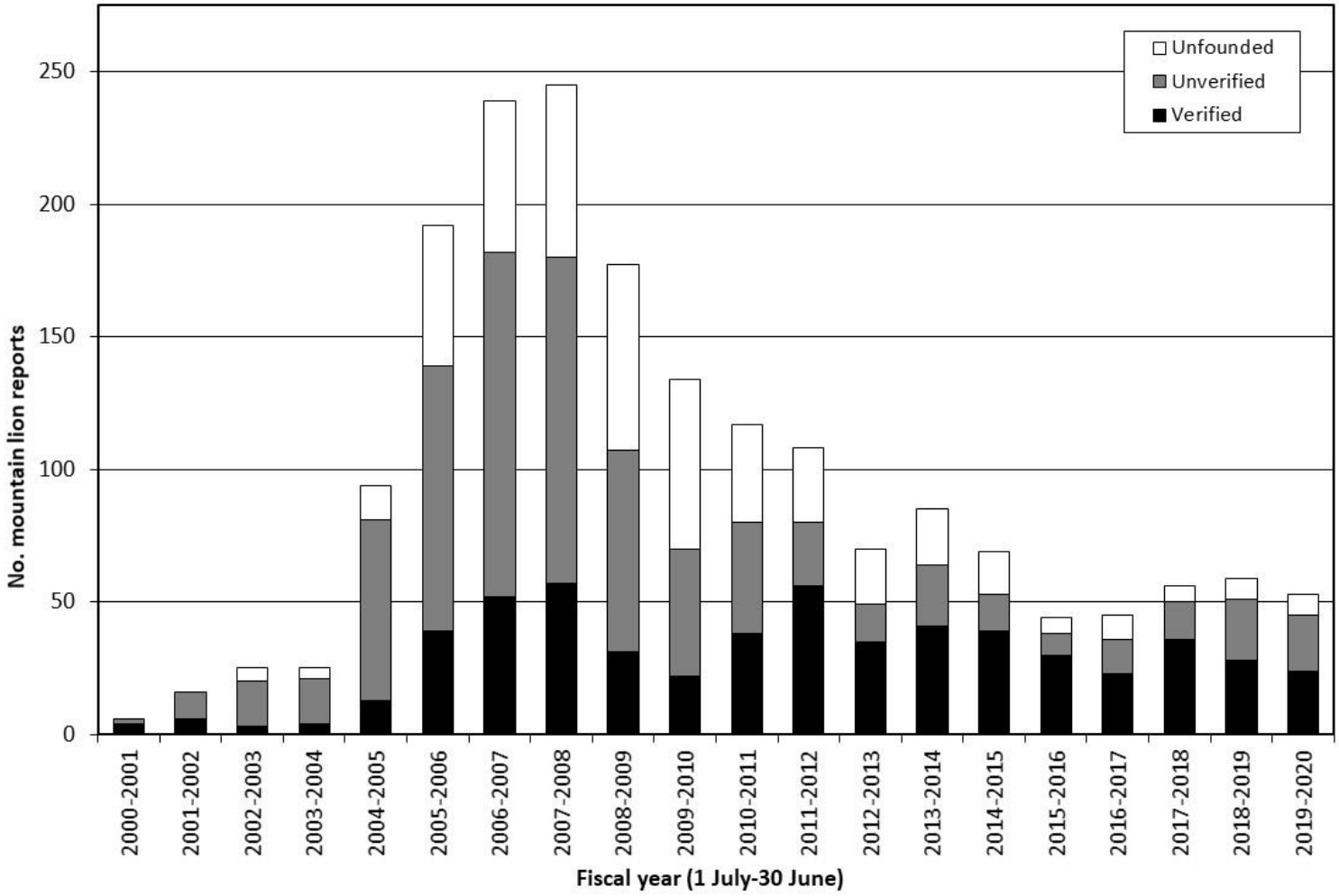


Figure 5. Locations of Verified reports of mountain lion occurrence in North Dakota, 1 July 2019 through 30 June 2020.

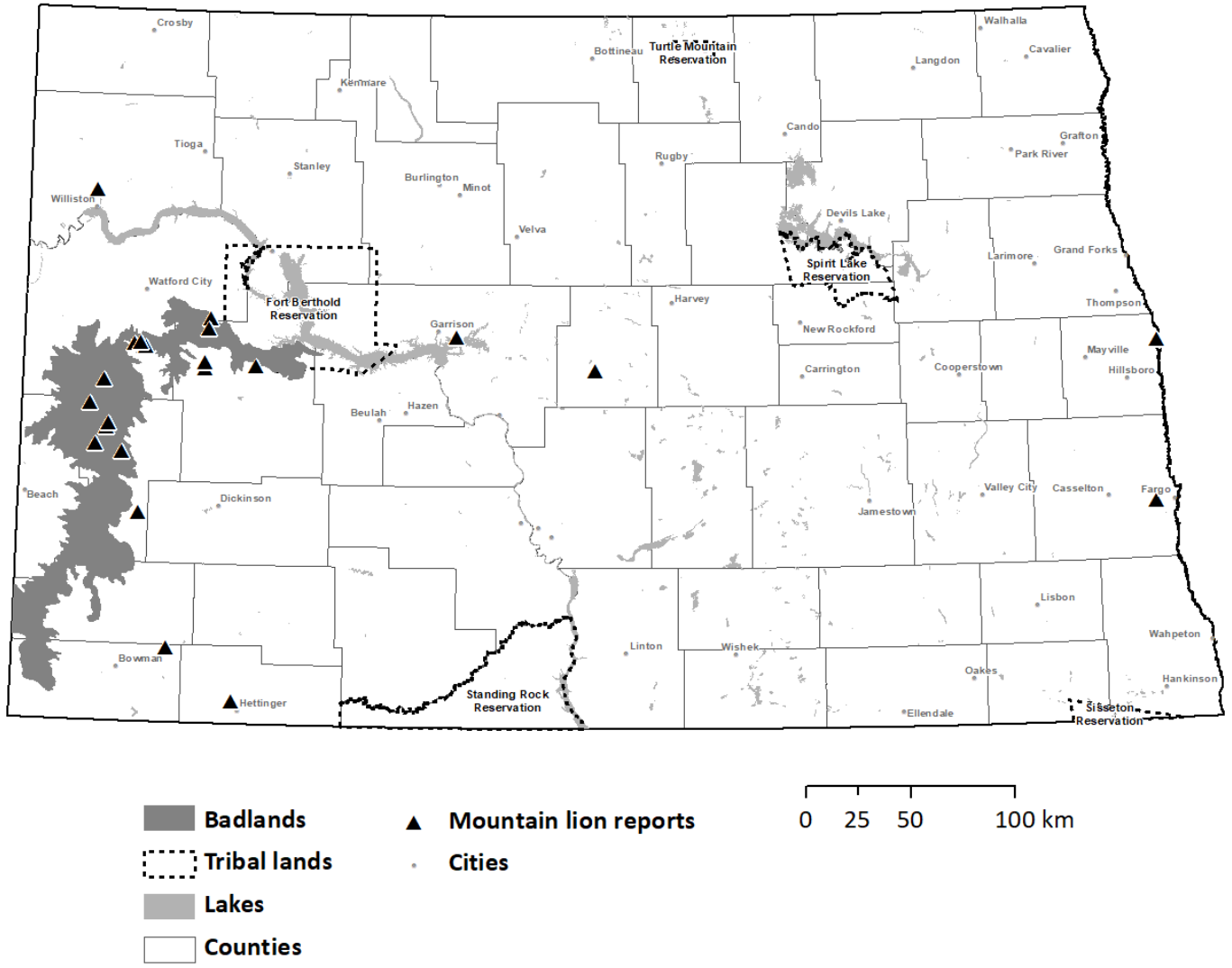


Figure 6. Number of documented mountain lion mortalities due to legal and illegal harvest, protection of property or self, incidental trapping or snaring, other or unknown human causes (automobile collisions, suspected poaching, etc.), and natural causes (predators, disease, etc.) in North Dakota, fiscal years (1 July-30 June) 2005-2006 through 2019-2020.

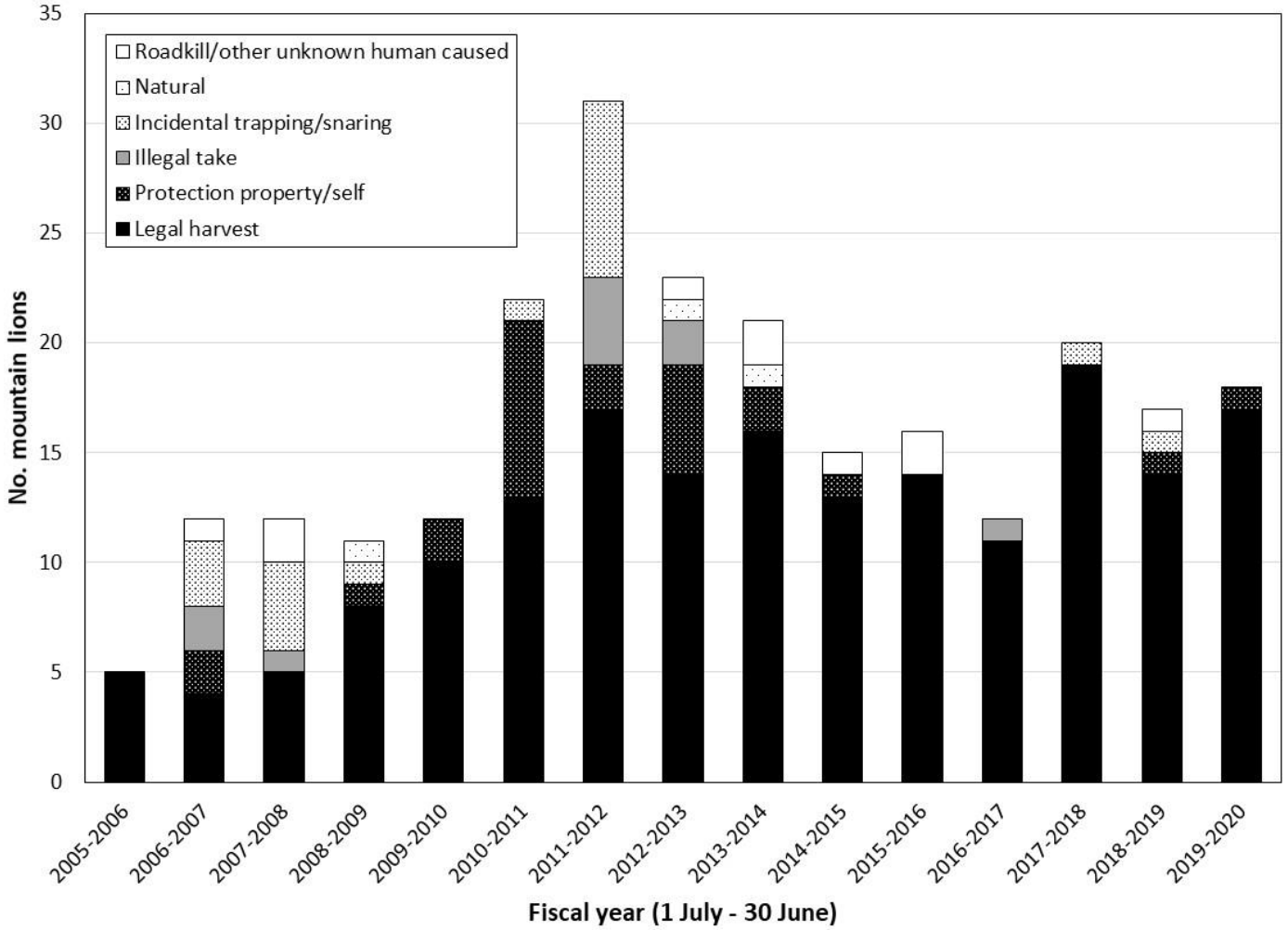


Figure 7. Trends in mountain lions taken per day spent hunting, also referred to as catch per unit effort (CPUE), as calculated from a questionnaire surveying a random sample of license holders after the hunting season closed.

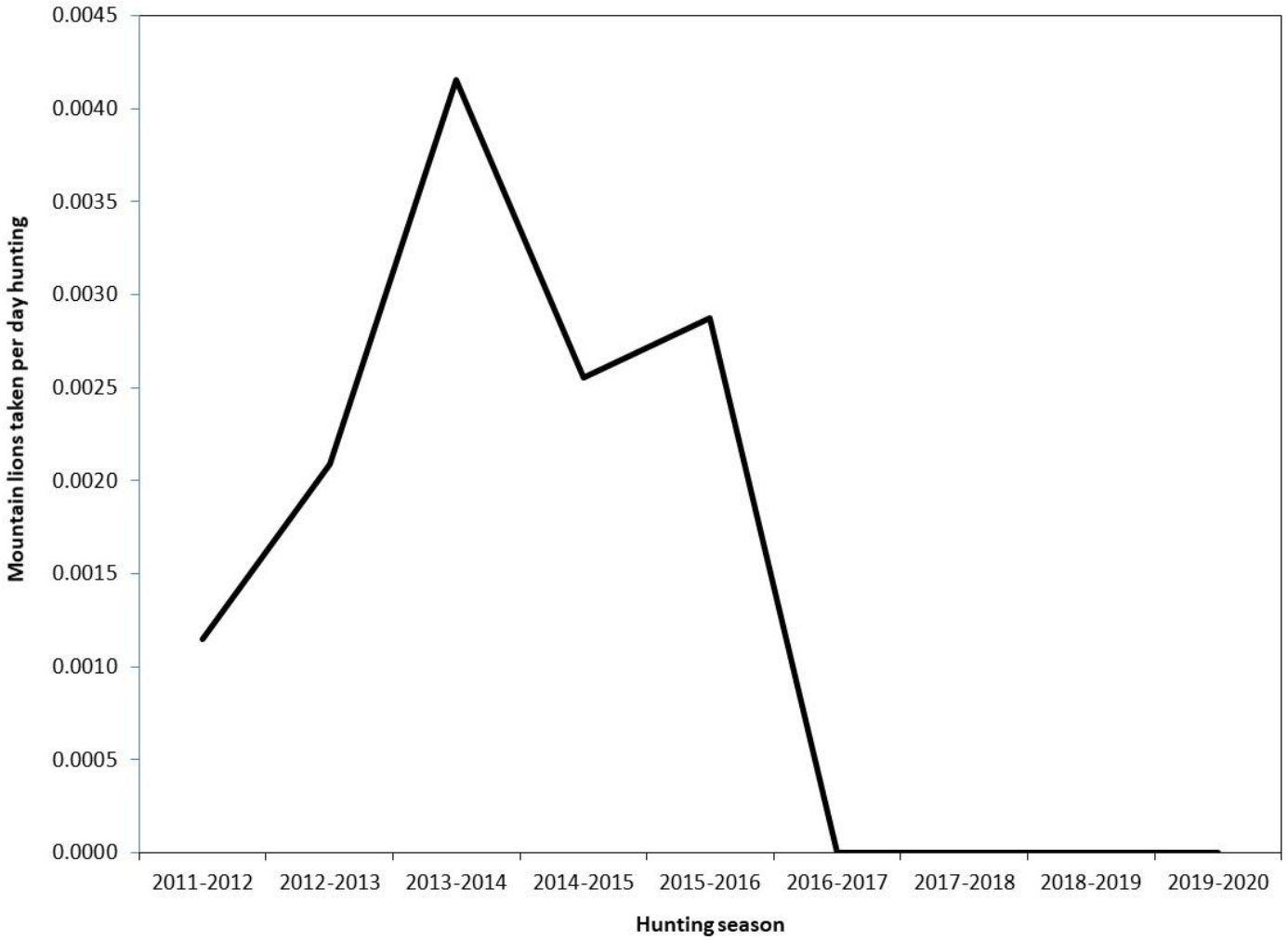


Figure 8. Deer management units where hunters reported observing a mountain lion while deer hunting in North Dakota, 2019.

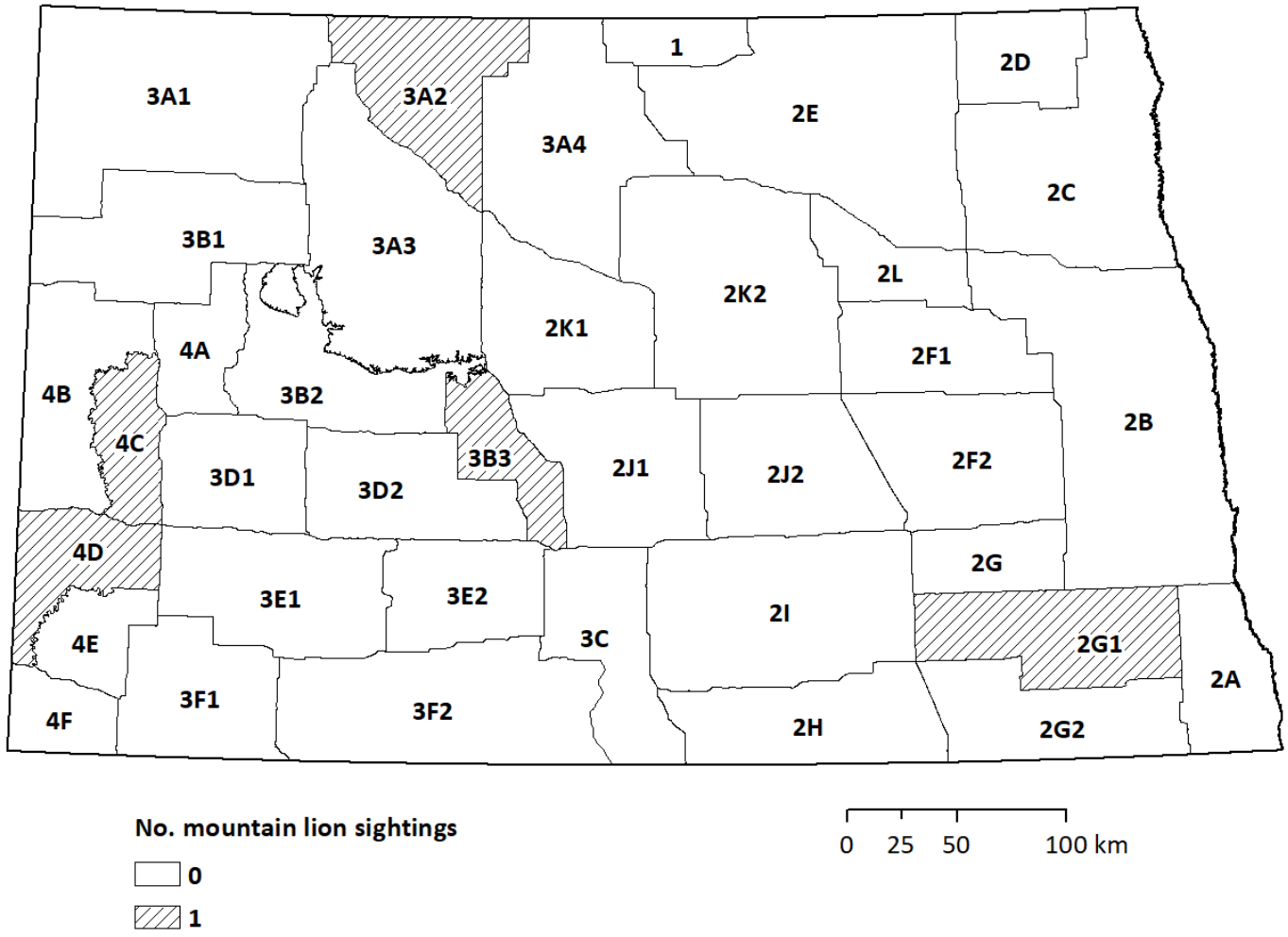


Figure 9. Population assignments of mountain lions from Zone 2 based on genetic analysis (Ortloff et al. 2019).

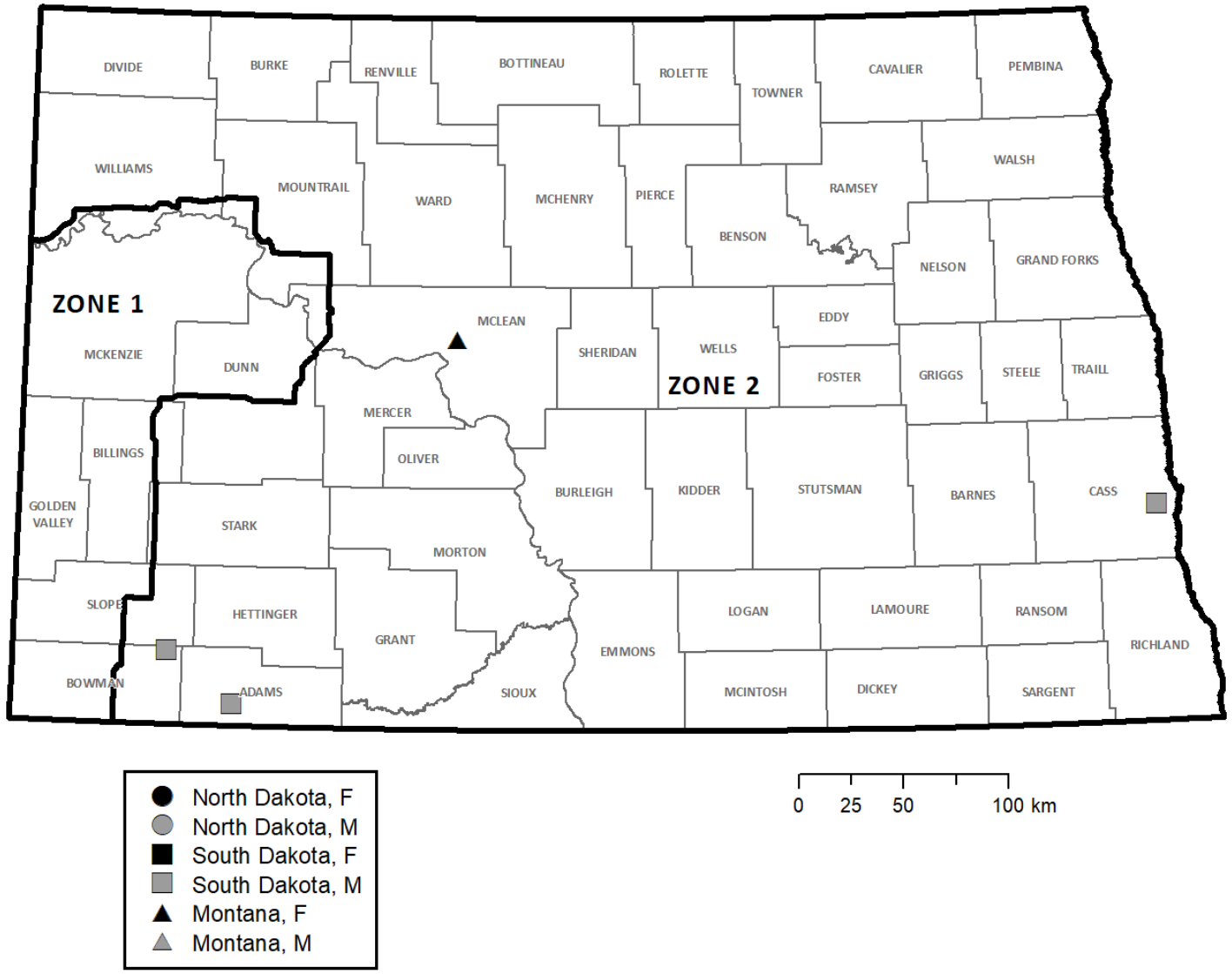


Figure 10. Annual estimates of mountain lion population abundance and associated 95% confidence interval in North Dakota, from 2005-2020, calculated using age-at-harvest data and statistical population reconstruction (Johnson et al. 2019).