

North Dakota Mountain Lion Status Report

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Mountain lions were native to North Dakota, although they were considered scarce in the open prairie country (Bailey 1926). According to historic records, in the 1800s, lions were documented in the North Dakota Badlands (Badlands), Killdeer Mountains, and along the Missouri River (MR). The species was not protected from indiscriminant killing, and by the early 1900s, the population was believed to be extirpated from the state (Young and Goldman 1946). In 1991, the mountain lion was classified as a furbearer with a closed season in North Dakota. Whether or not remnant individuals continued to breed in the Badlands, or lions migrated into North Dakota from other populations, or a combination of the two scenarios occurred, was unknown. Beginning in the late 1950s through the 1990s, the North Dakota Game and Fish Department (NDGFD) received sporadic reports of lions throughout the state, and continued presence of the animal in North Dakota became apparent during the early 2000s.

In 2005, the NDGFD assessed the status of mountain lions in North Dakota based on: 1) a review of verified sightings from 2001-2005; 2) a habitat suitability map created for the species; and 3) an experimental state-wide season with a quota of five animals. It was determined that the Badlands and associated MR Breaks region, including portions of Fort Berthold Reservation, had a sufficient amount of suitable habitat (approximately 4,637 km²) to support a relatively small population, and that the species had either re-established or was in the process of re-establishing itself in the Badlands (NDGFD 2006). Since 2005, mountain lions have been managed as a furbearer with a limited annual harvest, with provisions in place to remove nuisance animals for protection of property and human safety purposes. Lion presence continues to be documented in the Badlands, and based on verified reported sightings, including documentation of a family group on the Badlands/MR Breaks region border, the population may be expanding into the adjacent MR Breaks region (NDGFD 2007). Current management activities include: 1) documenting reported sightings of mountain lions; 2) surveying deer hunters and trappers for sighting information; 3) collecting biological information from mortalities; 4) conducting field surveys (e.g., snow track survey); 5) educating residents about lions; 6) responding to mountain lion/human/property conflicts; and 7) conducting research on mountain lions. The majority of management practices involve the participation of one or more cooperating agencies: (USDA Wildlife Services [WS], Theodore Roosevelt

National Park [TRNP], Three Affiliated Tribes [TAT], USDI Fish and Wildlife Service [FWS], and South Dakota State University [SDSU]).

To understand the mountain lion population in North Dakota from a regional perspective, it was important to identify potential origins of these animals, assess the genetic health of the relatively isolated population in the Badlands, and determine likely migration routes among the Dakota states. Additionally, due to the large presence of ranching and agricultural operations in the Dakotas, it was appropriate to document the extent that domestic and livestock species occurred in diets of lions. Cooperative research between the NDGFD and SDSU was initiated to: 1) assess the genetic status of Dakota mountain lions; 2) create and test a habitat suitability map for lions in the Dakota states; and 3) Document food habits of mountain lions found in prairie and Badland landscapes. Additionally, in 2008, a cooperative research project between the NDGFD and TRNP was initiated to begin to collect additional ecological and demographic information (e.g., movements, habitat use, spatial relationships, food habits, survival and reproduction) on mountain lions in the Badlands. The initial objectives of the pilot project were to: 1) implement and evaluate mountain lion capture protocols developed in South Dakota and adapt as necessary for use in the Badlands; 2) gain preliminary insights about lion ecology in the Badlands (e.g., extent of animal movements, habitat preferences, kill rates; and 3) test methods and gain insights about feasibility, logistics, sampling variation, performance of equipment, and other issues that are critical considerations for study planning (Oehler et al. 2008). This report summarizes information collected from reported mountain lion sightings in 2007, the 2007-08 hunting season, and initial findings from ongoing cooperative research efforts with SDSU.

Methods

Reported mountain lion sightings (observation of the animal or its sign) by the public were documented and investigated by the NDGFD and/or WS, and ultimately entered into a Department web-based database for analysis and mapping. Sightings were classified according to their validity, as “Unfounded”, “Improbable unverified”, “Probable unverified” or “Verified”. Sightings were classified as “Verified” when there was physical evidence of the reported event (i.e., video of animal, photographs of lions or their tracks, scat, hair, scrapes, kill sites), or the reporting party was “vouched for” as a credible witness by Department personnel. Scat or hair found at reported sightings were shipped to the USDA Forest Service Rocky Mountain Research Station (FSRMRS), Missoula, Montana, to verify or refute lion presence via genetic analyses. Sightings were classified as “Probable unverified” when there was no physical evidence for the sighting but the description of the animal or the circumstance of the sighting was credible. Sightings were classified as “Improbable unverified” when there was no physical evidence for the sighting and the description of the animal or the circumstance of the sighting was suspect. In these instances, the probability of lion sighting was considered low. Sightings were classified as “Unfounded” when, upon investigation, they were determined to be something other than a mountain lion. In addition to sightings by the public, verified lion sightings documented by Department Biologists or other agency (WS, TRNP, TAT, and FWS) personnel, as well as locations of carcasses obtained from

illegal and legal shootings, and other incidentally killed animals, were recorded in the database.

The NDGFD carried out a state-wide mountain lion hunting season for North Dakota residents (31 August 2007 to 9 March 2008; 2007-2008 Small Game and Furbearer Hunting Proclamation). The state was divided into two management zones (Zone 1 and Zone 2; see Fig. 1). Zone 1 included the Badlands, associated MR Breaks and adjacent lands outside of Fort Berthold Reservation. Zone 2 included all areas outside of Zone 1 with the exception of tribal lands (Fort Berthold, Standing Rock, Turtle Mountain and Spirit Lake Reservations). A quota of five mountain lions was allowed in Zone 1; after the quota was filled, the season for this Zone was closed immediately. There was no limit on the number of animals taken in Zone 2, although the limit was one animal per season, per hunter. Any lion other than kittens (lions with visible spots) or females accompanied by kittens could be taken during the season. Beginning 1 December 2007, hunting with dogs was allowed. Any harvested lion that was taken was required to be reported to the NDGFD within 12 hours and the entire intact animal was submitted for analysis; legally taken animals were returned to the hunter following analysis. In addition to harvested lions, carcasses from legal and illegal shootings and incidentally-killed animals also were examined. As part of a cooperative agreement with TAT, mountain lions killed on the Fort Berthold Reservation also were provided to the Department for analyses.

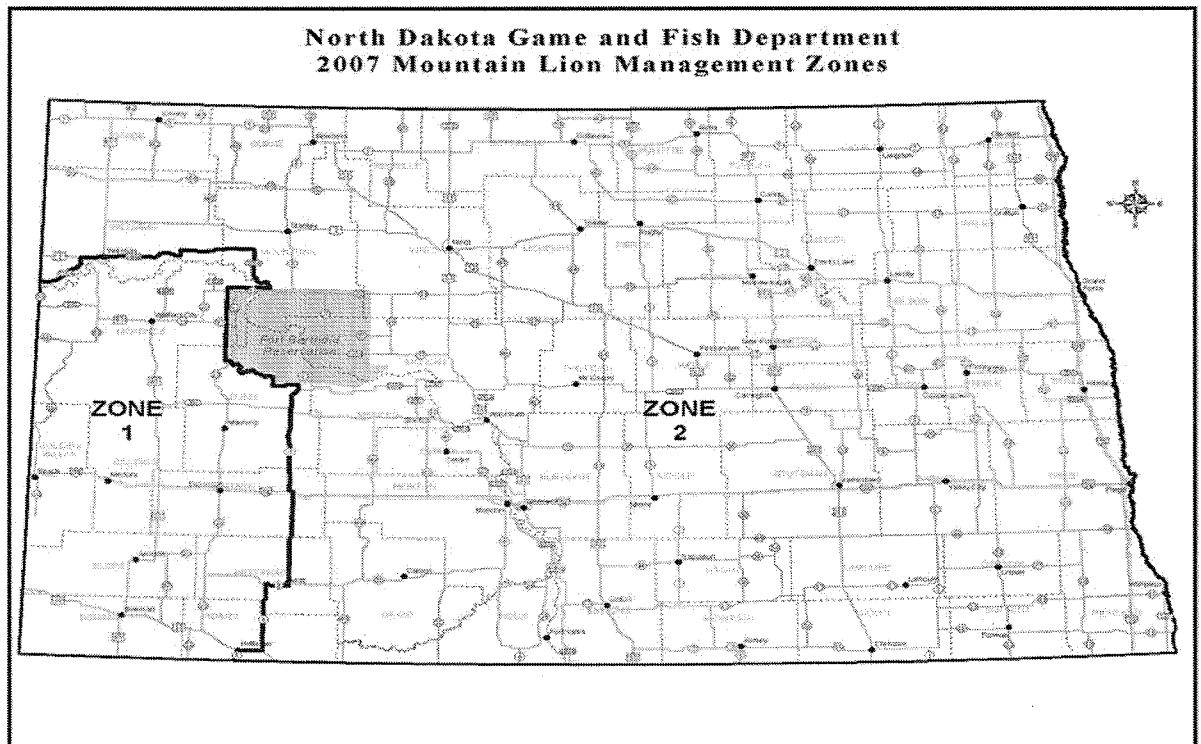


Figure 1. 2007 Mountain lion management zones in North Dakota. Zone 1 = Badlands, Zone 2=Prarie

Mountain lion carcasses were weighed, sex determined, and age estimated based on tooth wear and fur color characteristics. Females were examined for evidence of lactation (Anderson and Lindzey 2000). Measurements were taken (Logan and Sweanor 2001), and bodies examined for wounds and presence of porcupine quills. Necropsies were performed to assess nutritional condition (Riney 1955), examine the reproductive tracts of females for past litter sizes, and to collect biological samples for cooperative research purposes. Gastro-intestinal (GI) tracts were sent to SDSU for analysis. Muscle tissue samples were sent to the USDA FSRMRS, for genetic analyses. Blood samples were provided to WS to test for tularemia and sylvatic plague (*Yersinia pestis*) as part of their agency's ongoing disease monitoring efforts.

Results

A total of 230 reported mountain lion sightings were documented by the Department during 2007. Similar to the previous three years, sightings were reported in all months of the year with an overall higher number of sightings being reported during the fall/winter season (Table 1). However, the NDGFD documented a greater number of reports and higher percentage of verified reports than the previous three years (Table 2). By sighting classification, 61 reports (27%) were verified as being a lion (Table 2, Fig. 2). Of the 61 verified reports, 47 occurred in the Badlands, five in the adjacent MR Breaks region, and nine reports occurred outside of these two regions, in seven counties of central and western North Dakota. Verified reports included: 29 observations of tracks, 13 visual observations of the animal (four of which were verified based on credible witnesses that were "vouched for" by Department Biologists or Wardens), six wildlife kills made by lions (five radiocollared bighorn sheep (*Ovis canadensis*), one porcupine), six incidental kills of lions (four males, two females; Table 3), two domestic animal kills made by lions (cow and horse), one male found dead in Lake Sakakawea of unknown causes, one male found dead that was believed to be killed from a collision with a vehicle, one audio tape of a mountain lion, one male shot for protection of property purposes, and one female killed illegally. Seventy two reports (31%) could not be ruled out as being legitimate sightings, but lacked the evidence for verification. These 'Probable unverified' sightings occurred in 23 counties scattered throughout North Dakota. Fifty-three (23%) reports were classified as 'Unfounded'. Of the 'Unfounded' reports, the majority (36 reports [68%]) of people reporting mountain lion activity incorrectly confused canid tracks ($n = 23$), sightings ($n = 8$), wildlife kills ($n = 3$ deer), domestic animal attacks ($n = 1$ cow calf), or scat ($n = 1$) with those of mountain lions. On ten occasions (19%), people incorrectly confused domestic house cat tracks ($n = 1$), sightings ($n = 8$), or scat ($n = 1$) with those of mountain lions. The remainder of the reports classified as unfounded (seven reports [13%]) were due to visual observations of unknown animals ($n = 4$) being mistaken for lions, horse scratches by barb wire ($n = 2$) being mistaken for lion attacks, and tracks of livestock ($n = 1$) being mistaken for lion tracks.

Table 1. Number of reported mountain lion sightings, 2004 – 2007 (including all sighting classifications: “Unfounded”, “Improbable unverified”, “Probable unverified”, and “Verified”), in North Dakota by month.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
2007	12	17	15	15	13	20	17	15	26	34	19	26	229
2006	6	8	7	12	18	23	22	19	18	34	40	11	218
2005	9	6	5	3	5	8	17	14	12	12	14	15	118
2004	4	1	4	1	4	4	3	8	11	11	12	4	69
Total	31	32	31	31	40	55	59	56	67	91	85	56	634

Table 2. Number of reported sightings of mountain lions by sighting classification, 2004 – 2007 (column percentages are in parentheses).

Sighting Classification	2007	2006	2005	2004
Unfounded	53 (23)	53 (24)	30 (25)	13 (19)
Improbable Unverified	40 (17)	53 (24)	26 (22)	21 (30)
Probable Unverified	72 (31)	86 (39)	44 (37)	27 (39)
Verified	61 (27)	26 (12)	18 (15)	8 (12)
Pending*	3 (1)			
Total	229	218	118	69

*Reports have not yet been classified.

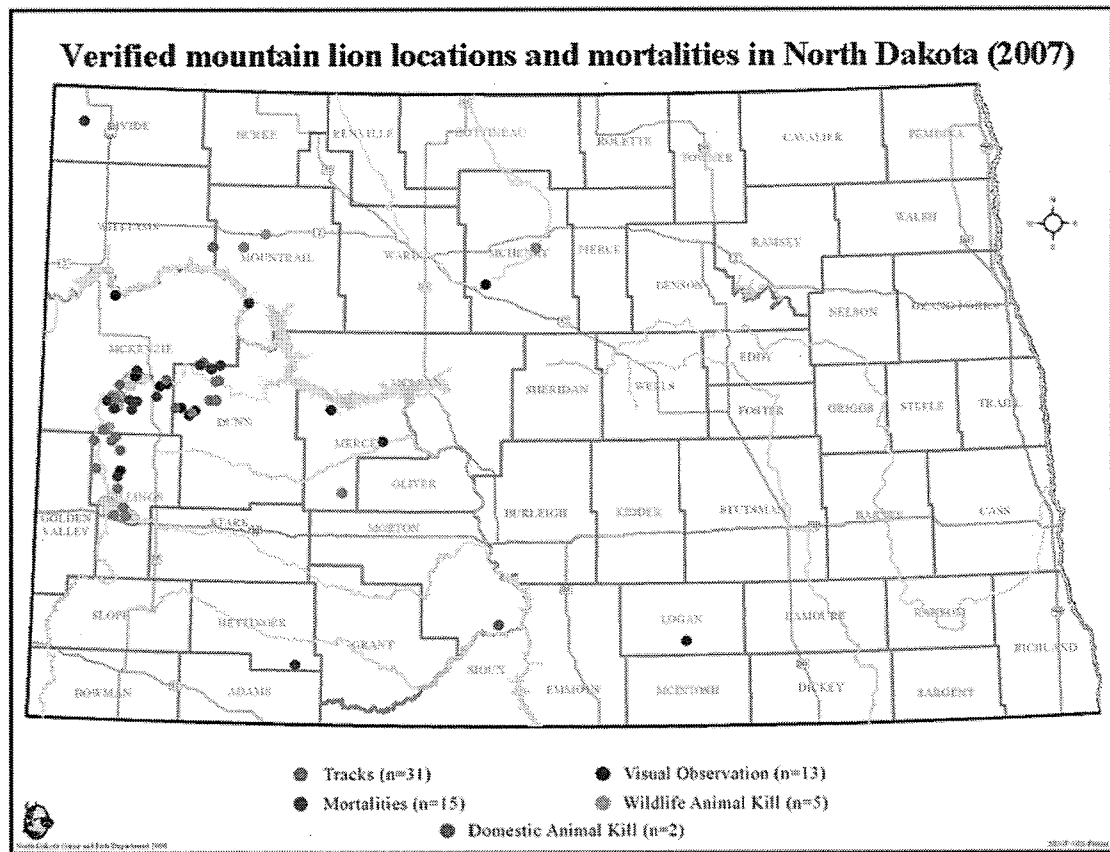


Figure 2. Verified mountain lion locations, and harvest and non-harvest mortalities in North Dakota (2007) $n=66$.

The NDGFD received results from three scat samples that had been found at locations of reported sightings and sent to the USDA FSRMRS for analyses. The first sample was collected on 22 June 2007 at a radiocollared bighorn sheep kill site in the Badlands. The scat was confirmed to be from a male mountain lion. The second sample was collected in the Badlands near a suspected lion track on 13 October 2007. This scat was identified as being from a coyote (*Canis latrans*). The third sample was collected on 29 November 2007, at a potential scrape site in the vicinity of several reported sightings of the animal near Jamestown, North Dakota (Stutsman County); this scat was identified as being from a domestic house cat.

A total of six mountain lions were harvested in North Dakota during the 2007-08 mountain lion hunting season. The season for Zone 1 ended on 10 November 2007, when the quota of five animals was filled. Five female mountain lions (1 adult; 4 subadults) were harvested in Zone 1 (Table 3). Two of the subadult females (F23 and F24) were reported to have been traveling with two other lions at the time of their deaths. Female lion F19 was estimated to be a 4-year-old animal that had a past litter of two

kittens based on examination of her reproductive tract. One subadult male lion (M28) was harvested in Zone 2.

Table 3. Mountain lion mortalities in North Dakota (2007 – 9 March 2008).

Lion ID	Cause of Death	Date Harvested	Sex	Age	Weight (lbs)	County
M13	Incidental kill	1/15/07	M	4-5 months	42	McKenzie
M14	Incidental kill	1/30/07	M	4-5 months	48	McKenzie
F15	Incidental kill	2/18/07	F	10+ years	80	McKenzie
M16	Carcass found (Lake Sakakawea)	5/12/07	M	1-2.5 year old	---	Montrail
F17	Illegal shooting (kitten shot out of season)	5/27/07	F	6-8 months	46	Dunn/ McKenzie
M18	Legal shooting: Protection of property	5/30/07	M	2.0-2.5 years	112	Divide
F19	Legal harvest (Zone 1)	9/1/07	F	4 years	97	McKenzie
M20	Carcass found (Collision with vehicle)	9/11/07	M	1-2.5 years	84	Hettinger
F21	Legal harvest (Zone 1)	9/16/07	F	1-1.5 years	72	McKenzie
F22	Illegal harvest (Zone 1)	9/17/07	F	1-1.5 years	60	Dunn
F23	Legal harvest (Zone 1)	10/30/07	F	1-2.5 years	71	McKenzie
F24	Legal harvest (Zone 1)	11/10/07	F	1.5-2.5 years	84	McKenzie
F25	Incidental kill	12/12/07	F	1-2 years	78	McKenzie
F26	Incidental kill	12/12/07	M	4-5 years	102	McKenzie
M27	Incidental kill	12/17/07	M	Adult	152	Billings
M28	Legal harvest (Zone 2)	1/1/08	M	1.5-2.5 years	101	Sargent
F29	Incidental kill	2/13/08	F	Kitten	45	McKenzie

In 2007, eleven mountain lions ($n = 6$ males, $n = 5$ females) died from causes other than hunting mortality (Table 3, Fig. 2 and 3). One lion (M18) was shot legally for protection of property purposes (the animal had killed a domestic house cat, and remains of a second house cat were found in the animal's stomach). Seven animals were caught incidentally by trappers; of these, four lions (M14, F25, F26 and M27) were found dead in neck-cable devices and the other three animals (M13, F15 and F29) were euthanized due to trap/cable-device-related injuries that were believed to inhibit their ability to survive in the wild. Two animals were provided to the Department by TAT; one lion (F17) was shot illegally, and another lion (M16) was found dead in Lake Sakakawea. One lion (M20) was found dead, most likely from a collision with a vehicle.

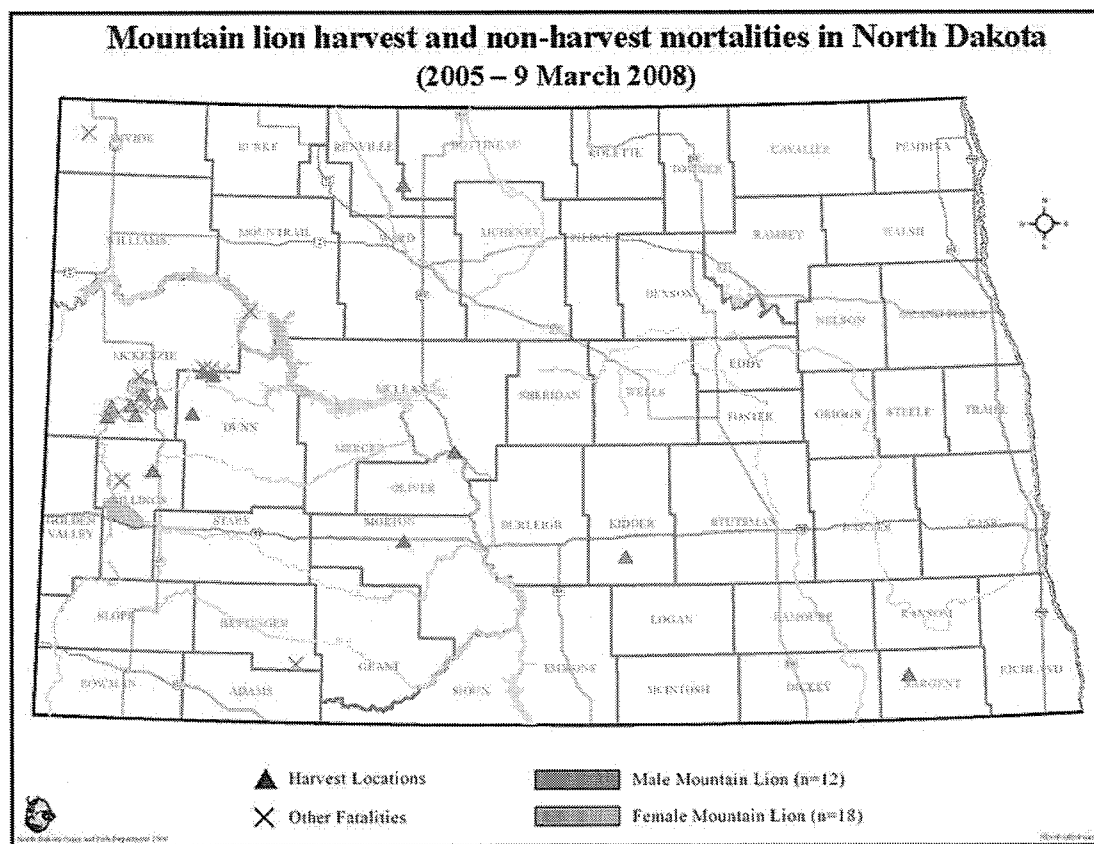


Figure 3. Mountain lion harvest and non-harvest mortalities in North Dakota by sex (2005 – 9 March 2008) $n=30$.

Stomach samples from mortalities of six mountain lions located in North Dakota outside of the Badlands (2005-2008; F8, M9, F10, M18, M20, M28) were analyzed at SDSU as part of a study to document diets of lions inhabiting prairie habitats in the Dakotas (see Thompson et al. 2008). Two of these animals (F8 and M20) had multiple species present in their stomachs; beaver and rodent were found in the stomach of F8, and deer and porcupine were found in the stomach of M20. Deer was documented in the stomachs of F10, M9 and M28, and domestic house cat was documented in the stomach of M18. Porcupine quills were found on the extremities of four animals (F8, M9, M18, M20).

A genetic analysis conducted at USDA FSRMRS, comparing the North Dakota Badlands lion population to the lion population in the Black Hills of South Dakota, was provided to the Department (K. Pilgrim and M. Schwartz, Unpublished Report; D. Thompson Unpublished Data). The North Dakota mountain lion population had six unique alleles from that of the Black Hills population, showed a marginally significant genetic bottleneck, and based on assignment tests, none of the 14 samples that came from the Badlands population were immigrants from the Black Hills. However, an F_{ST} value of 0.05 indicated gene flow between the two populations. Furthermore, two lions (M11, a 3-4-year-old male, and F10, a 3-4 year-old female) harvested in Morton and Kidder Counties, located well outside of the Badlands (Fig. 3), were assigned to the Black Hills population, indicating they were immigrants from this region. Additionally, F10, a 3-4 year-old female lion, also harvested outside the Badlands in Renville County, appeared genetically different from both the Badlands and Black Hills lions. These findings suggest that lions have traveled into North Dakota from the Black Hills, and from other source populations.

Discussion

Similar to past years, the distribution of verified lion sightings in 2007 occurred predominantly in western North Dakota, in the Badlands and vicinity, and to a lesser extent in other regions of the state. In general, the majority of reported sightings from 2004-2007 occurred during months associated with hunting activity (October and November), when a greater number of people traveling to, and hiking in, remote country throughout the state, increased the probability of mountain lion sightings. Of the 61 sighting reports that were classified as 'Verified', all were non-threatening observations of either the animal or its sign. In three cases, mountain lions were documented to have killed domestic animals, including a cow, a horse, and domestic house cats (killed by M18; Table 3). Kills of domestic species, occasionally occurring in North Dakota, continue to represent rare events. For example, of the 71 verified reports from 2001-2006, in only two cases were mountain lions documented to have killed domestic livestock; a sheep was killed by a mountain lion on one occasion, and a cow was killed on another occasion (NDGFD 2006 and 2007). Furthermore, of six gastrointestinal tracts analyzed from mountain lion mortalities in North Dakota, outside of the Badlands population (2005-present), five contained native prey, whereas only one animal (M18), as mentioned previously, had fed on a domestic house cat.

Although, the mountain lion population appears to be expanding its distribution into the MR Breaks region (NDGFD 2007), the greater number and higher percentage of verified reports recorded by the Department in 2007 is not indicative of state-wide population

increases or expansion. The overall increase in verified sightings is most likely due to increased efforts to document continued species presence in the Badlands, following harvest seasons, as well as part of an ongoing effort by the Department to assess lion predation on bighorn sheep. Verified reports in 2007 included those obtained by the Department Biologist conducting research on the bighorn sheep population ($n = 9$ reports from four bighorn sheep killed by lions, three sets of tracks seen, and one visual observation of the animal), tracks observed during snow track surveys for the species by TRNP employees ($n = 7$ reports), and two trappers who reported locations of lion snow tracks to the Department ($n = 9$ reports) during the trapping season.

While verified reports alone cannot be used to document population trends, reports have provided the Department with valuable information on distribution and range expansion of lions in suitable landscapes, and potential travel routes of transient animals (NDGFD 2006, 2007), and these reports continue to provide the NDGFD with interesting information about mountain lions in the state. For example, on 6 October 2007, the Department received a digital trail camera photograph of a mountain lion kitten taken in Mercer County, in an agricultural and prairie-dominated landscape (Figure 2). The location of the camera was verified by a Department Conservation Officer and the digital photo was sent to Pallotta Design Productions, McKeesport, PA, to verify its authenticity. Based on the photo, this animal would be too young to survive on its own, and represents a potential family group east of the Badlands and about 16 kilometers south of suitable lion habitat in the MR Breaks region. Whether this is an isolated incident, or marks the beginning of range expansion by the species into non-traditional habitats is unknown.

Since the ending of the 2007-08 season in Zone 1 (10 November 2007), mountain lion presence continues to be documented in the Badlands. There have been 24 verified reports of mountain lion activity in this Zone, nine of which have occurred since 1 January 2008. These sightings included documentation of two unique females (from genetic analyses of two scats found in the Badlands) and two separate family groups. In addition to documenting continued presence of mountain lions in the Badlands with verified reports, in an effort to monitor the Badlands population, the NDGFD analyzed age and sex composition of lion mortalities. Anderson and Lindzey (2005) suggested that the effect of harvests on populations would differ depending on the age and sex composition of lions removed, and that an annual harvest composed of 10-15% of adult females appeared sustainable for a population of mountain lions in Wyoming. However, they cautioned that more isolated populations may respond differently to similar harvest rates. Based on all documented harvest and non-harvest mortalities in the Badlands ($n = 20$ lions; two adults males, three adult females, two subadult males, seven subadult females, two male kittens and four female kittens), three females (15% of the mortalities) were breeding age and had produced at least one litter. While caution should be taken when drawing conclusions due to the limited sample size of harvested animals in a given year, based on initial analysis of age and sex composition data and continued documented presence in the Badlands, the lion population appears not to have been negatively impacted by the past three experimental hunting seasons and additional human-caused mortality.

The results of the genetic analyses indicated that lions likely recolonized the Badlands from multiple sources, which included individuals from the Black Hills population. The

fact that North Dakota has unique alleles from the Black Hills lions indicated multiple origins of this recently re-established population. Whether remnant individuals remained and bred in the Badlands in the 1900s, or immigrated from Montana and elsewhere, currently is unknown. The marginally significant genetic bottleneck that characterized the Badlands population is supported by the historic accounts of this species in North Dakota and years of unmanaged killing. Furthermore, the genetic analyses of two mountain lions (F10 and M11) harvested on the prairie in North Dakota during the 2006-07 season support the belief that lions traveling on the prairie-dominated landscapes are most likely dispersing or transient animals (NDGFD 2006, 2007), as apparently both animals migrated into North Dakota from the Black Hills population.

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Literature cited

- Anderson, C.R. Jr., and F.G. Lindzey. 2005. Experimental evaluation of population trend and harvest composition in a Wyoming cougar population. *Wildlife Society Bulletin* 33:179-188.
- Anderson, C.R. Jr., and F.G. Lindzey. 2000. A guide to estimating cougar age classes. Wyoming Cooperative Fish and Wildlife Research Unit, Laramie, USA
- Bailey, V. 1926. A biological survey of North Dakota. *North American Fauna*, No. 49.
- Logan, K.A. and L.L. Sweanor. 2001. Desert Puma: evolutionary ecology and conservation of an enduring carnivore. Island Press, Washington, D. C. 463 pp.
- 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, USA.
- North Dakota Game and Fish Department. 2007. Status of mountain lion management in North Dakota. North Dakota Game and Fish Department, Bismarck, USA.
- Oehler, M., G. A. Sargent, C. Sexton, and D. M. Fecske. 2008. Pilot Study: Ecology of mountain lions in the Badlands of southwestern North Dakota, Theodore Roosevelt National Park. 315 2nd Avenue, Medora, USA.
- Riney, T. 1955. Evaluating condition of free-ranging red deer (*Cervus elaphus*), with special reference to New Zealand. *New Zealand Journal of Science and Technology Section B*. 36:429-463.
- Thompson, D. J., D. M. Fecske, J. A. Jenks, and A. R. Jarding. 2008. Food habits of recolonizing cougars in the Dakotas: prey obtained from prairie and agricultural habitats. *American Midland Naturalist* 60: In Press.
- Young, S. P. and E. A. Goldman. 1946. The puma: mysterious American cat. Dover Publications, Inc. New York, NY, USA.