

USE OF A MAIL SURVEY TO DETERMINE PRESENT MAMMAL DISTRIBUTIONS IN SOUTH DAKOTA

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ABSTRACT

A state-wide mail survey was conducted in 1992 to determine the present distribution by county, of 42 mammals. Questionnaires (n = 834) were sent to natural resource managers, trappers, and others with knowledge of the distribution of mammals in South Dakota. Return rate of questionnaires was 37%. Species distribution maps were developed to compare past species distributions to mail survey results. Ranges of nine mammals studied expanded, seven decreased, and 13 were similar to those previously published for the species. Temporal changes in species distribution were uncertain for 13 species because of questionable sightings reported by survey respondents and voids in the literature and museum records. Study results indicated that with some modifications, a mail survey showed potential as an effective technique to assess the distribution of medium- to large-sized mammals by county.

INTRODUCTION

Except for a few ungulate species (e.g., white-tailed deer; scientific names occur in Table 1) that are annually inventoried to set hunting seasons, information on the current distribution of mammals in South Dakota is generally lacking (Wilhelm et al. 1981). Most publications (Chapman and Feldhamer, 1982; Hall and Kelson 1959; Jones et al., 1983, 1985; Armstrong et al. 1986) that address statewide distribution of mammals provide distribution maps for each species, but none map the occurrence of species by county. Benefits of determining mammal distributions by county are: (1) natural resource professionals usually manage areas by county; and (2) this method enables a more accurate description of species distributions as, for example, there are 66 counties but only 12 physiographic regions in South Dakota.

Species distribution maps in earlier accounts from South Dakota were derived mostly from museum specimen collections and records in published lit-

erature, a standard procedure for accumulating such data (Hazard, 1982:16). However, this procedure has two major limitations; one is the lack of a data set based on one simultaneous, statewide collection effort and the second is the difficulty in accessing museum specimens, which are dispersed across the United States. Furthermore, many collection trip diaries or logs of specimens are in repositories located across the United States and many collections are not computerized. Past findings also indicate that the sole use of specimen collections to document mammal occurrence may misrepresent present mammal distribution (Hazard 1982:16).

The goal of this study was to determine the current county distribution of 42 of the most common mammal species found in South Dakota (Table 1). Study objectives were to determine the utility of a mail survey for determining mammal distributions, to identify where and when past surveys and major museum or institution collections of mammals were made in South Dakota, and to compare mail survey data to data from published literature and listings of museums or reference collections. Information from this study will identify gaps where future systematic mammal collections should be made in the state.

MATERIALS AND METHODS

Study Area

The study area included all of South Dakota, which encompasses 199,552 km² (Fig. 1). Before 1941, South Dakota had 69 counties. Presently, the state has 66 counties as Washington County was incorporated into Shannon County, Armstrong County became a part of Dewey County, and Washabaugh County was added to Jackson County. Because of name changes of counties and

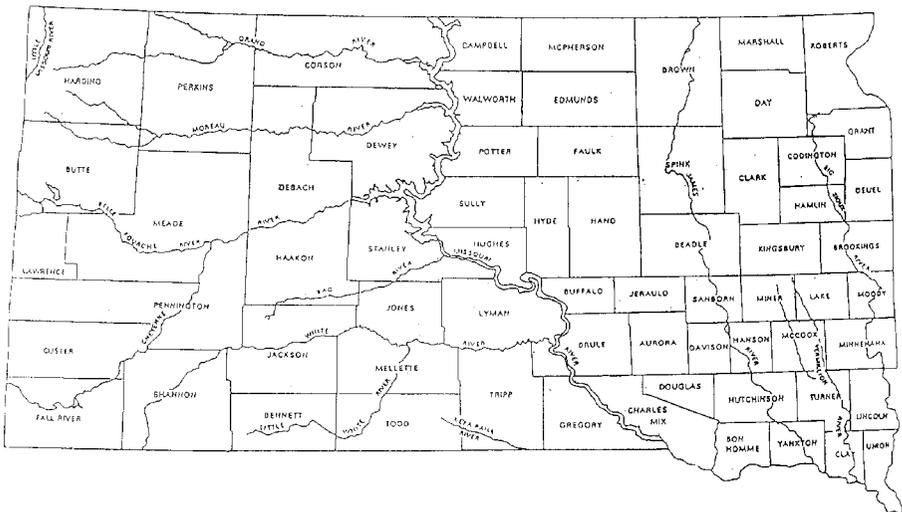


Figure 1. Locations of the 66 counties of South Dakota.

towns since the 1800's, locations of mammal collections and observations indicated by some literature sources and museum listings were sometimes difficult to assess. Sneve (1973) was particularly helpful for locating physiographic areas and counties or towns in South Dakota that no longer exist or have had names changed, such as the old forts and ghost towns.

Literature Search

A comprehensive literature search was initiated in 1992 for available information on mammals of South Dakota. Computer and visual searches were used to find references on mammals of South Dakota from the Bibliography of Agriculture (1942-1992), Biosis Previews (1969-1992), Zoological Record (1978-1992), and Wildlife Review (1935-1957, 1985-1993) indexes. Studies or documents written prior to these years were gathered by searching the literature cited sections of natural history studies, books, and documents. We corresponded with government institutions to request bibliographies and publications of available mammal documents or studies conducted in South Dakota.

To determine changes in the county distribution of mammals of South Dakota from Jones et al. (1983) until this study, distribution maps for each of the 42 mammal species were xeroxed from that publication, enlarged to a standard size, and overlaid with a mylar template containing county boundaries of South Dakota. Comparisons of mammal distributions from Jones et al. (1983) and our study were used to assess temporal changes in mammal distributions.

Museum Collections

National and state museums and institutions having mammal collections were identified from the literature (Turner 1974; Yates et al. 1987), from returned questionnaires, and from the South Dakota Game, Fish and Parks Department. Lists of museums that have specimens from South Dakota were gathered from the South Dakota Natural Heritage Program in Pierre. Copies of lists and computer printouts of data relative to South Dakota mammals were requested from museums and institutions. In our study, a major mammal collection was defined as one having specimens of more than seven small to large mammals collected by a single person or institution, during one year, and at the same location. The decision to choose seven species was arbitrary. Only collections having species covered in this study (Table 1) were included. Personal visits were made to some museums and institutions in South Dakota when information could not be obtained by other means.

Mail Survey

A statewide mail survey was conducted in 1993 to determine county distributions of the 42 mammals. A pilot-survey form was reviewed by South Dakota Game, Fish and Parks personnel and other professionals relative to the publics surveyed and the objectives of the project. The survey included a cover letter explaining the study and a statement of how the results would be

Table 1. Mammal species (n = 42) surveyed for distribution in South Dakota. Species common and scientific names are from Jones et al. (1992).

Common Names	Scientific Names
1. Virginia Opossum	<i>(Didelphis virginiana)</i>
2. Desert Cottontail	<i>(Sylvilagus audubonii)</i>
3. Eastern Cottontail	<i>(Sylvilagus floridanus)</i>
4. Mountain Cottontail	<i>(Sylvilagus nuttallii)</i>
5. Snowshoe Hare	<i>(Lepus americanus)</i>
6. Black-tailed Jackrabbit	<i>(Lepus californicus)</i>
7. White-tailed Jackrabbit	<i>(Lepus townsendii)</i>
8. Eastern Gray Squirrel	<i>(Sciurus carolinensis)</i>
9. Eastern Fox Squirrel	<i>(Sciurus niger)</i>
10. Red Squirrel	<i>(Tamiasciurus hudsonicus)</i>
11. Northern Flying Squirrel	<i>(Glaucomys sabrinus)</i>
12. American Beaver	<i>(Castor canadensis)</i>
13. Common Muskrat	<i>(Ondatra zibethicus)</i>
14. Coyote	<i>(Canis latrans)</i>
15. Gray Wolf	<i>(Canis lupus)</i>
16. Swift Fox	<i>(Vulpes velox)</i>
17. Red Fox	<i>(Vulpes vulpes)</i>
18. Common Gray Fox	<i>(Urocyon cinereoargenteus)</i>
19. Black Bear	<i>(Ursus americanus)</i>
20. Common Raccoon	<i>(Procyon lotor)</i>
21. American Marten	<i>(Martes americana)</i>
22. Ermine	<i>(Mustela erminea)</i>
23. Least Weasel	<i>(Mustela nivalis)</i>
24. Long-tailed Weasel	<i>(Mustela frenata)</i>
25. Black-footed Ferret	<i>(Mustela nigripes)</i>
26. Mink	<i>(Mustela vison)</i>
27. Wolverine	<i>(Gulo gulo)</i>
28. American Badger	<i>(Taxidea taxus)</i>
29. Spotted Skunk (civet)	<i>(Spilogale putorius)</i>
30. Striped Skunk	<i>(Mephitis mephitis)</i>
31. Northern River Otter	<i>(Lutra canadensis)</i>
32. Mountain Lion	<i>(Felis concolor)</i>
33. Lynx	<i>(Lynx lynx)</i>
34. Bobcat	<i>(Lynx rufus)</i>
35. Elk	<i>(Cervus elaphus)</i>
36. Mule Deer	<i>(Odocoileus hemionus)</i>
37. White-tailed Deer	<i>(Odocoileus virginianus)</i>
38. Moose	<i>(Alces alces)</i>
39. Pronghorn (antelope)	<i>(Antilocapra americana)</i>
40. Bison (buffalo)	<i>(Bison bison)</i>
41. Mountain Goat	<i>(Oreamnos americanus)</i>
42. Bighorn Sheep	<i>(Ovis canadensis)</i>

used, which was brief and self-explanatory (Sommer and Sommer 1991). Respondents were asked if each species occurred in their county or in surrounding counties and for supporting evidence for those sightings. Subsequent to the pilot survey, a revised three-page, two-sided questionnaire was designed for the mail survey in the fall of 1992 (Blumberg 1993).

The survey targeted natural resource managers and furbearer trappers because those individuals were assumed to be most knowledgeable of the state's mammals. A total of 834 questionnaires was sent statewide to the following selected personnel or targeted publics: South Dakota Game, Fish and Parks Department ($n = 192$), Cooperative Extension Service ($n = 60$), trappers ($n = 394$), and others ($n = 188$) who were recommended as having knowledge or interest of mammals in South Dakota. "Others" consisted of personnel from the U.S. Forest Service, U.S. Fish and Wildlife Service, Bureau of Indian Affairs, and individuals suggested by the survey respondents after the first mailing. Because nonrespondents are often individuals who have a low interest in the subject matter (Filion 1975), the targeted publics were chosen to obtain high response rates and to avoid receiving misleading survey responses.

The first survey mailing of the questionnaire was in February 1993. A second mailing was sent to trappers ($n = 297$) in April 1993, and to other individuals ($n = 8$) who did not respond to the first mailing in June 1993. In other surveys, follow-up letters have proven effective at increasing response rates (Kanuk and Berenson 1975; Linsky 1975; Benson 1988)

Completed questionnaires were reviewed for obvious errors or abnormalities immediately after receiving them. Conversations with respondents were used to correct obvious errors. Questionable records that had no evidence or weak evidence (e.g., unsure of the species sighted) for sightings were deleted from the final data set. The occurrence of each species by county was mapped on state maps with county boundaries. Mammal observations dated prior to 1990 by respondents were not included in the final distribution maps but were used in the discussion of each species when they provided unique information. Respondents unwilling to complete questionnaires were deleted from the mailing list and from any data analyses. Mammal distributions were compiled as the number of counties in which each species occurred. These data were compared to those of Jones et al. 1983 using chi-square analysis with Bonferonni confidence intervals (Systat 1990). Alpha was set at 0.10.

RESULTS

Literature Search

A total of 521 references was found that contained information on mammals in South Dakota. Many earlier documents listed collections by regions, such as the Black Hills (i.e., Pennington, Custer, and Lawrence counties). References to mammal collections were found for 22 of 66 (33%) counties in South Dakota from 1857 to the present (Fig. 2). Most published accounts of the 42 species were from studies conducted in Custer ($n = 45$), Pennington ($n = 23$), Brookings ($n = 19$), and Harding ($n = 14$) counties. No published accounts were

found for any of the studied species for Bon Homme and Douglas counties and only one published account was found for each of 11 counties in eastern South Dakota (Fig. 3). Perkins, Meade, Ziebach, Dewey, Hand, Charles Mix, Corson, and Tripp counties are among the largest in area in South Dakota, yet only one to five published accounts of the 42 species exist for these counties.

Published accounts were most frequent for white-tailed deer, mule deer, black-footed ferret, and red fox; these are either federally protected or eco-

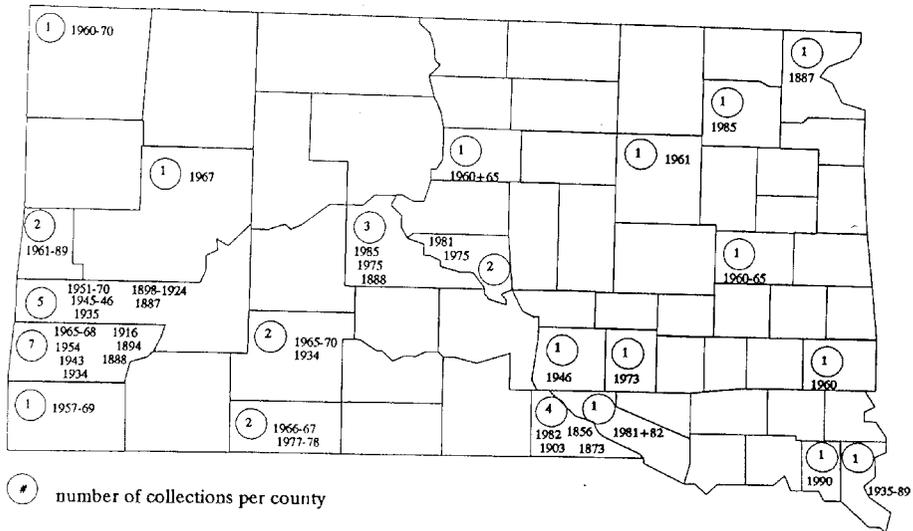


Figure 2. County locations of major mammal collections in South Dakota obtained from the literature, 1980 to present.

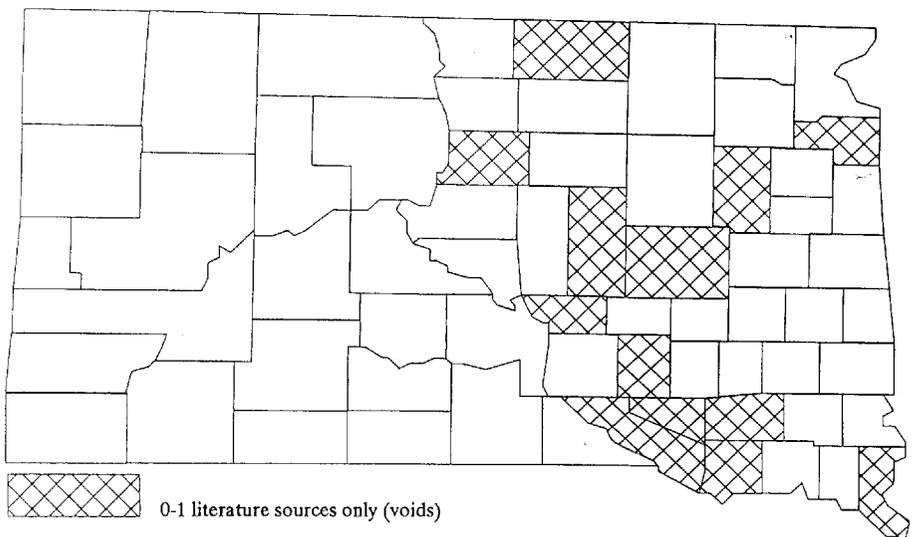


Figure 3. Literature voids by county for 42 medium to large mammals in South Dakota.

nominally important species in South Dakota. Except for Ashton and Dowd (1991), literature does not exist or is not specific on county of occurrence for gray squirrels, northern flying squirrels, American marten, northern river otter, mountain goat, mountain lion, or wolverine.

Museum Collections

Major collections of South Dakota mammals that are still available are primarily located in 12 museums and institutions outside of South Dakota (Table 2). The largest collection ($n = 4,983$) of small- to large-sized South Dakota mammal specimens is located at the University of Kansas. Major collections of the 42 mammal species were mainly from the Black Hills region.

From 1946 to 1987, 535 specimens of the 42 mammals were collected from 19 South Dakota counties. Most of these collections occurred in the 1960's; temporal voids in collecting occurred prior to 1940 and after 1990. Mammal specimens from nine counties are represented in major collections at seven museums other than the University of Kansas.

On the basis of useable listings provided by museums, institutions, and private individuals with known collections of any South Dakota mammals, major collections (seven or more mammals collected at the same location by the same collector) of the 42 species occurred in 22 of 66 (33%) counties (Fig. 2). Most museum collections occurred from 1951-1975 ($n = 46$). From 1980 to the present there have been eight major collections. The Black Hills is the location of most mammal collections and studies (1856 to the present) (Fig. 2). The least amount of mammal collecting has occurred in east-central and west-central counties within the state (Fig. 2).

Mail Survey

Three hundred and nine of 834 questionnaires mailed were completed and returned (response rate = 37%) (Table 3). Most (258 of 306, 84%) questionnaire returns occurred during the first month following the initial mailing. Members from all publics did not specifically differentiate species of certain groups of mammals: squirrels (Sciurids), rabbits and hares (Lagomorphs), and weasels (Mustelids). For example, survey results indicated that red squirrels occurred in most counties of the state, however, based on the literature and habitat requirements for these species, they only occur in counties in the Black Hills region including nearby woodlands (Table 4).

Survey data on 28 of the 42 mammals selected for study were useable; the squirrels, weasels, and lagomorphs were not included in analyses. In addition, the wolverine was not included in analyses because it was not reported in South Dakota by either Jones et al. (1983) or survey respondents. Number of counties inhabited by mammals based on Jones et al. (1983) differed ($\chi^2 = 308.441$, $df = 27$, $P < 0.001$) from those generated from the mail survey. Of the 28 mammal species, 7 had expanded distributions relative to species distribution boundaries reported by Jones et al. (1983), 11 had similar distributions, and 13 had reduced distributions (Table 5).

Table 2. Chronological listing of South Dakota mammal collections by county or area based on data obtained from museums and institutions.

Date	Collector	Area/Cty	Institution
1856 1873 1887 1888	Dr. Hayden E. Coues V. Bailey V. Bailey	Gregory Gregory Pennington Roberts Stanley Custer	National Museum Natural History (USNM)
1894	W. H. Granger	Custer	Illinois Field Museum Natural History (FMNH)
1898 to 1924	H. Behrens	Pennington	Minnilusa Pioneer Museum (MHM)*
1903 1910 1916	M. Cary A. H. Howell N. Dearborn T. C. Beach	Gregory Central Black Hills Custer	National Museum Natural History (USNM)
1929	P. Moulthrop G. W. Phillips	Central Black Hills	Cleveland Museum Natural History (CMNH)
1934	V. H. Cahalane	Custer	Wind Cave National Park (WCNP)*
1934 1935	A. M. Stebler L. R. Dice	Jackson Pennington	University Michigan Museum Zoology (UNMZ)
1943	W. H. Osgood	Custer	Illinois Field Museum Natural History (FMNH)
1945 1946	J. A. King J. A. King	Pennington Pennington	University Michigan Museum Zoology (UNMZ)
1946-87	(Table 5)	Throughout South Dakota	University Kansas Museum Natural History (KU)
1954	G. Barnes	Custer	National Museum Natural History
1973	L. Klaudt	Aurora	World Wildl. Adventures*
1975	S. L. Williams S. H. Genoways	Stanley	Texas Tech University
1975	R. C. Dowler M. De La Fuente	Hughes	Museum (TTU)
1977 1978	R. B. Wilhelm	Bennett	Fort Hays State University Museums (MHP) & (FHSM NH)
1981 1982 1985	W. W. Goodpaster	Charles Mix Hughes Gregory Charles Mix Stanley Day	University Illinois Museum Natural History (UIMNH)

*South Dakota Institutions

Table 3. Mail survey return rates by different respondents for the mammals of South Dakota study, 1993.

Publics	# Sent	# Returned	% Returned
South Dakota Department Game, Fish and Parks personnel	192	103	53.6
South Dakota Trappers	394	156	39.5
South Dakota Cooperative Extension Service personnel	60	21	35.0
Others	188	29	15.4
Total	834	309	37.1

Trappers:	
<u>Mailing</u>	<u># Received</u>
1	111
2	45

Table 4. Questionable reports of occurrence (- response) for 3 squirrel species in South Dakota from a 1993 questionnaire survey.

Species	Total Reports	+ Response	- Response
Red squirrel	151	63	88
Gray squirrel	33	22	11
Eastern fox squirrel	99	97	2

+ Response = identified correctly according to known distribution

- Response = identified incorrectly according to known distribution

Table 5. Relative distribution changes of mammal species in 66 counties in South Dakota, between that reported by Jones et al. (1983) and this study, 1993.

Species	Number of counties of occurrence in Jones et al. (1983) [A]	Number of counties of occurrence in this study, 1993 [B]	% change $\frac{[A-B]}{66} \times 100$
1. Virginia Opossum	58	55	-4.5
2. Desert Cottontail	20	7	-19.6
3. Eastern Cottontail	65	65	0.0
4. Mountain Cottontail	5	9	+6.0
5. Snowshoe Hare	0	0	0.0
6. Black-tailed Jackrabbit	27	42	+22.7
7. White-tailed Jackrabbit	66	66	0.0
8. Eastern Gray Squirrel	0	--	--
9. Eastern Fox Squirrel	65	--	--
10. Red Squirrel	5	--	--
11. Northern Flying Squirrel	5	6	+1.5
12. American Beaver	66	66	0.0
13. Common Muskrat	66	66	0.0
14. Coyote	66	66	0.0
15. Gray Wolf	0	11	+16.7
16. Swift Fox	55	14	-62.1
17. Red Fox	66	65	-1.5
18. Common Gray Fox	59	29	-45.4
19. Black Bear	--	2	--
20. Common Raccoon	66	66	0.0
21. American Marten	0	8	+12.1
22. Ermine (short-tailed weasel)	5	34	+43.9
23. Least Weasel	62	35	-40.9
24. Long-tailed Weasel	66	59	-10.6
25. Black-footed Ferret	38	6	-48.4
26. Mink	66	66	0.0
27. Wolverine	--	0	--
28. American Badger	66	66	0.0
29. Spotted Skunk (civet)	65	54	-16.6
30. Striped Skunk	66	66	0.0
31. Northern River Otter	66	7	-89.3
32. Mountain Lion	--	23	--
33. Lynx	66	8	-87.8
34. Bobcat	66	37	-43.9
35. Elk	--	30	--
36. Mule Deer	66	64	-3.0
37. White-tailed Deer	66	66	0.0
38. Moose	--	25	--
39. Pronghorn (antelope)	19	47	+42.4
40. Bison (buffalo)	--	31	--
41. Mountain Goat	--	2	--
42. Bighorn Sheep	--	8	--

DISCUSSION

Literature Search

Although published accounts about South Dakota mammals are available from the mid-1800's to the present, information voids exist relative to certain species and geographical areas of the state. These voids also varied with respect to time, making it difficult to assess general temporal trends in species distribution patterns. Voids in mammal collection areas were apparent for most counties in the state ($n = 44$), but particularly for northern, central, and eastern South Dakota (Figs. 2, 3). Furthermore, there is about a two-year lag between data collection and publication during which mammal populations may change. Even with nearly 600 references, present distribution of mammal species within counties could not be determined without the use of Hall and Kelson (1959), Jones et al. (1983) and Chapman and Feldhamer (1982), which indicated a need for periodic review and synthesis of recent published literature.

Published literature on South Dakota mammals also lacked information concerning where and when past surveys and museum collections were conducted. This was most often found with historical documents where reporting detail was insufficient to determine the actual collection site, or whether specimens were preserved. Several documents stated that mammals were collected, but did not mention the species. Often only common names or scientific nomenclature were included in documents and either may have changed. "Observations" of mammals, rather than the collection of specimens, were common in many documents.

Museum Collections

Museum records provided important information on past collections of South Dakota mammals. Most museums only collected small mammals (e.g., *Microtus*) which were not included in our study. Because only collections containing medium to large mammals were considered, major collections of all mammal species collected in South Dakota were likely underestimated.

Mail Survey

Mail surveys are one of the least understood techniques for data collection because many have not been related to scientific theory and no experimental studies exist to determine their effectiveness (Kanuk and Berenson 1975). Although our return rate (37%) was adequate for this study, clear empirical evidence on response rates does not exist (Babbie 1979; Filion 1980). We used follow-up methods as suggested by Kanuk and Berenson (1975), Linsky (1975), Babbie (1979) and Filion (1980). However, response rates might have been higher if three mailings had been sent to all the publics sampled. Furthermore,

higher return rates from trappers and others may have resulted if a pre-paid postage and pre-addressed return envelope had been provided.

Most mammalian distribution maps are generated from museum specimen collections. Specimens are used for developing maps because this method is assumed to be objective (i.e., it substantiates the occurrence of mammals by the use of their skins and skeletal remains). Specimens provide positive proof of species identification and the exact date and place of collections (Hazard 1982:8-9). Specimens also enable researchers to investigate physical variations within and among populations (sex, age, and seasonal difference) and to roughly document geographical range expansion and reduction (Hazard 1982:8-9). Specimens also may include information on reproduction, anatomy, pelage, molting, microevolution, ectoparasitism, dental pathology, and environmental chemistry (Jones et al. 1983:6). Therefore, museum specimens are a vital tool for developing distribution maps.

Problems arise, however, when specimens are the sole information source for developing distribution maps. Disadvantages of only using museum specimens are: many species are poorly represented and areas exist where species have been infrequently collected (Hazard 1982:16). A lack of information may indicate rare occurrence of widespread species or the misrepresentation of rare species (Hazard 1982:16). Furthermore, Yates et al. (1987) stated that changes in institution management and administration of collections in repositories may modify access to specimens.

Additional sources of information may indicate the presence of mammals in an area. These sources may include reported sightings of live mammals, road kills (Hazard 1982:16), skeletal remains in owl and raptor pellets, feces, and tracks (Jones et al. 1983:5). Reported sightings are likely the most abundant source of information, yet there have been few attempts to standardize this method.

Although there is a lack of published research on wildlife mail survey techniques, Filion (1978) and Benson (1988) suggested that social science techniques can be applied to wildlife survey methods. Mail surveys can be efficient, fast, and inexpensive when information on a large geographical area must be obtained (Sommer and Sommer 1991). Surveys are efficient because they can be objective, standardized, and quickly sent to potential respondents. The cost of mailing surveys is minimal compared to the cost of travel and time it would take to acquire this type of information from personal interviews (Sommer and Sommer 1991, Filion 1978) or field collections. Surveys also are useful when conducting descriptive studies of large populations (Babbie 1979). They can empower traditional wildlife field survey techniques by providing additional information from people who know wildlife species and where they occur. Although survey use is not a precise technique, it can indicate trends from the acquired data (Hoinville and Jowell 1978).

Other researchers have used mail surveys to determine wildlife distributions, but results have been inconclusive (Boshoff 1980, Bigale and Bateman 1962). However, those studies sampled farmers and landowners in South Africa, many of which may have had limited knowledge of mammalian species. Jobman and Anderson (1981) used a mail survey targeted to natural

resource managers to assess distribution of the black-footed ferret in the United States. Questionnaires were sent to 62 offices within the historic range of the black-footed ferret; responses were received from 60 of those offices. That study, however, did not discuss the total number of questionnaires sent and received from individual offices, nor the utility of using a survey to determine the current distribution of the black-footed ferret.

The increase in the distribution of gray wolves in South Dakota indicated by our mail survey is supported by 10 mortalities that were reported from 1981 to 1992 (Light and Fritts 1994). Most ($n = 8$) of these individuals were ≤ 2 years of age, suggesting they were dispersers. Furthermore, the majority of these wolves were believed to have dispersed from Minnesota. The increase in the distribution of moose may have occurred for similar (i.e., dispersal) reasons as gray wolf. Jones et al. (1983) and Hall and Kelson (1959) noted that moose were rare or extinct in South Dakota. American marten were reintroduced in the Black Hills in 1980 and 1981 (Ashton and Dowd 1991) and reintroductions of bighorn sheep and elk have occurred in western South Dakota since the early 1900's (Turner 1974). Hence, increases in these species are likely related to those activities. Other increases (mountain lion, pronghorn) may have resulted from dispersal of individuals from surrounding states or for other unknown reasons.

Declines in species distributions were most common for mustelids (striped skunk, least weasel, black-footed ferret, river otter) and small canids (swift fox, gray fox) and felids (lynx and bobcat). These reductions are possibly related to changes in land use patterns (e.g., swift fox), prey availability/disease (e.g., black-footed ferret) or other reasons.

Mail surveys were a useful, non-destructive technique for obtaining information concerning a select group of 42, commonly known, medium- to large-sized mammals in South Dakota. Modifications that would enhance surveys should include the addition of the descriptions of species or photos to differentiate similar species of a genus (e.g., three species of weasels), use of colloquial (local) names, and better advertisement of the mail survey prior to mailing. Our survey was limited to 42 species that were assumed to be commonly known and easily identifiable. A similar survey for small mammals that are less frequently known or seen (e.g., mice, voles, gophers, shrews, and bats) might be less effective. However, with innovative modifications to survey procedures (e.g., use of photos) and distinct selection of survey publics, mail surveys could be useful in assessing distributions of all mammal species.

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LITERATURE CITED

- Ashton, D. E., and E. M. Dowd. 1991. Fragile legacy. S.D. Dep. Game, Fish and Parks Report No. 91.04. 55pp.
- Armstrong, D.M., J.R. Chaote, and J.K. Jones, Jr. 1986. Distributional patterns of mammals in plains states. Texas Tech University Press, Museum Occasional Paper No. 65. 27pp.
- Babbie, E. R. 1979. The practice of social research. Second ed. Wadsworth Publishing Company, Inc. Belmont, California 596pp.
- Benson, D. E. 1988. Successful methods for human dimension surveys: 1985 RSA game farmer survey example. South Africa Journal of Wildlife Research 18:61-64.
- Bigale, R. C. and J. A. Bateman. 1962. On the status and distribution of ungulate mammals in the Cape Province, South Africa. Annals of the Cape Providence Museum 2:85-109.
- Boshoff, A. F. 1980. Some socio-economic aspects of a bird of prey questionnaire survey. South Africa Journal of Wildlife Research 10:71-81.
- Chapman, J. A. and G. A. Feldhamer, editors. 1982. Wild mammals of North America. Johns Hopkins University Press, Baltimore, Md. 1147pp.
- Filion, F. L. 1975. Estimating bias due to nonresponse in mail surveys. Public Opinion Quarterly 39(4):482-492.
- Filion, F. L. 1978. Increasing the effectiveness of mail surveys. Wildlife Society Bulletin 6:135-141.
- Filion, F. L. 1980. Human surveys in wildlife management. Pp. 441-453 in Wildlife management techniques manual (S. D. Schemnitz, ed.). The Wildlife Society, Washington D.C. 686pp.
- Hall, E. R. and K. R. Kelson. 1959. The mammals of North America. Ronald Press Company, New York, Vols. I and II. 1083pp.
- Hazard, E. B. 1982. The mammals of Minnesota. University of Minnesota Press, Minneapolis, Minn. 280pp.
- Hoinville, G. and R. Jowell. 1978. Survey research practice. Heinemann Educational Books Ltd., London. 228pp.
- Jobman, W. G., and M. E. Anderson. 1981. Current black-footed ferret range as indicated by questionnaire survey. U.S. Fish and Wildlife Service Unpubl. Rept. 63pp.
- Jones, J. K., Jr., D. M. Armstrong, R. S. Hoffmann, and C. Jones. 1983. Mammals of the northern Great Plains. University of Nebraska Press, Lincoln. 379pp.

- Jones, J. K., Jr., D. M. Armstrong, and J. R. Choate. 1985. Guide to mammals of the plains states. University of Nebraska Press, Lincoln. 371pp.
- Kanuk, L. and C. Berenson. 1975. Mail surveys and response rates: a literature review. *Journal of Marketing Research* 12:440-451.
- Light, D. S., and S. H. Fritts. 1994. Gray wolf (*Canis lupus*) occurrences in the Dakotas. *American Midland Naturalist* 132:74-81.
- Linsky, A. 1975. Stimulation responses to mailed questionnaires: a review. *Public Opinion Quarterly* 39(1):82-101.
- Sneve, V. D. H. 1973. South Dakota geographic names. Brevet Press, South Dakota 639pp.
- Sommer, B. and R. Sommer. 1991. A practical guide to behavioral research. Third edition. Oxford University Press, New York, N.Y. 362pp.
- Turner, R. W. 1974. Mammals of the Black Hills of South Dakota and Wyoming. University of Kansas Miscellaneous Publications No.60. 177pp.
- Wilhelm, R. B., J. R. Choate, and J. K. Jones, Jr. 1981. Mammals of Lacreek National Wildlife Refuge, South Dakota. Special Publications Museum of Texas Tech University No. 17. 39pp.
- Yates, T. L., W. R. Barber and D. M. Armstrong. 1987. Survey of North American collections of recent mammals. *Journal of Mammalogy* 68:1-76.