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Demography of the Burrowing Owl in Badlands National Park

Final Report

Mark S. Martell
Patrick T. Redig
Jill Nib

151339
bibkey:

The Raptor Center
of the University of Minnesota
970-5500000
ST. PAUL, MN 55106

1991 and 0.57 ($SE = 0.07$, $n = 129$) in 1992. Eighty-eight owls (10 adult, 78 young) were banded in BNP and Conata Basin during the 2 year study. No banded owls were seen or recovered in the years after their banding.

We were able to design a reliable, repeatable survey technique which should allow BNP biologists to monitor the long term stability of the Park's burrowing owl population. This will help form a framework for future management actions.

ABSTRACT

The burrowing owl (Speotyto cunicularia) is native to the short-grass plains of North America. They often nest in prairie dog towns and their response to various management practices is unknown. This study was conducted in Badlands National Park (BNP) and surrounding grasslands. The objective of this study was to: 1) develop a census technique to allow monitoring of the Park's owl population, 2) determine the number and distribution of owls in the Park, and 3) document the degree of natal and nest-site fidelity of burrowing owls in southwestern South Dakota.

The work was conducted on ten prairie dog towns in BNP and fourteen in the Conata Basin between June 1991 and July 1992. Point-transect surveys were done on towns and repeated to establish statistically valid comparisons. We used the "area occupied" method to analyze survey data. Adult and juvenile owls were trapped, banded, and color-marked on both the Conata Basin and in BNP.

In 1991, 12 broods with a total of 31 young were found on 5 towns in BNP. In 1992, we located 20 broods with 62 young on those 5 towns, and 11 broods with 37 young on 3 additional towns. The proportion of the area occupied was 0.34 (SE = 0.07, n = 75) in

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INTRODUCTION

Background

The burrowing owl (Speotyto cunicularia) is a grassland nesting owl native to both North and South America. Typically found in short grass prairies or pastures, they nest underground in the abandoned burrows of ground squirrels, prairie dogs (Cynomys sp.), or badgers (Taxidea taxus) (Bent 1938). They have also been known to dig their own burrows where soil conditions allow (Bent 1938). In the Great Plains they nest primarily in burrows created by prairie dogs. Burrowing owls also use burrows as evening roosts and daytime rest spots (Coulombe 1971, Thomsen 1971, Martin 1973). Burrowing owls are opportunistic in their feeding habits, preying primarily on arthropods, small mammals, birds, and to a lesser degree, amphibians and reptiles (Haug et al. 1993).

Burrowing owls are found in the western United States, east to a line extending from the western counties of Minnesota and Iowa, south through Texas. Breeding populations also occur in Florida, the West Indies, and southward into Central and South America (Amadon and Bull 1988, Johnsgard 1988).

The burrowing owl was once widely distributed throughout the western United States and Canada (Bent 1938), and was considered common on the prairie dog towns of South Dakota and Nebraska (Cooke 1888, Over and Thomas 1920). Recently however, concern over the bird's status has resulted in its being listed as; "endangered" in two states (Minnesota and Iowa), "threatened" across its range in Canada, and of "special concern" in seven states (Washington, Oregon, California, Montana, Wyoming, North Dakota, Florida) (Martell 1990). More recent declines in burrowing owl populations in various regions of North America (Erickson 1987, DeSante et al. 1992) have led to an increasing concern for the welfare of this bird. A detailed discussion of the species status in South Dakota is available in Martell (1991).

At the federal level, the burrowing owl was listed as "rare" as early as the 1966 edition of the U. S. Department of Interior's "Red Book"; it was not included in the 1968 edition. The National Audubon Society placed this species on its "Blue List" from 1971 through 1982 (Tate 1981, Tate and Tate 1982), and on their special concern list in 1986 (Tate 1986).

Study Objectives

Concern among the public and wildlife professionals for the welfare of non-game species and the preservation of biological diversity, has resulted in a need for techniques to monitor and manage a wide variety of species in National Parks.

Furthermore, private and public land management practices including grazing, shooting, and poisoning on prairie dog colonies, the primary nesting habitat of burrowing owls on the Great Plains, have the potential to greatly affect owl populations.

The first step in the management of a species is to establish a program of repeatable surveys. This allows a population to be monitored for changes which may occur due to natural events, local management efforts or changes on wintering and migration areas.

Many methods have been used to survey raptor populations including road transect counts, aerial counts, nest searches and call-playback techniques (Fuller and Mosher 1987). A method to efficiently and accurately make repeatable counts of breeding burrowing owls has, up to now, not been available to local wildlife managers.

Typically, population data on burrowing owls has fallen into one of 3 categories:

- 1) estimates of status at the state or provincial level, usually gathered through questionnaires or "best guesses" (Martell 1991, Martell 1990, Wedgewood 1976),
- 2) searches using call playback or road transect survey methods (Martell et al. 1990), or
- 3) in local areas, intensive searches sometimes burrow by burrow, often conducted during the course of a basic research project (MacCracken et al. 1985).

Most estimates of regional status are inaccurate and not suitable for responsible management decision making. While intensive searches can lead to finding most owls on a local area, they are time consuming, hard to repeat, and expensive, thus making them not very useful for long term monitoring or management purposes. Furthermore, burrowing owls share, although to a lesser degree, the traits of other raptors which make them difficult to accurately survey. That is they are wide-ranging, secretive, and occur at relatively low densities compared to most game animals (Iverson and Fuller 1989).

Information on population sizes and trends, the location of wintering areas, and the degree of nest site fidelity is needed to monitor and manage burrowing owls in National Parks and on other public lands. It was these needs which led to our attempt to develop monitoring techniques for burrowing owls and apply them to Badlands National Park.

The specific objectives of our 2-year project were to:

- 1) develop a census technique which would allow for continued monitoring of the Park's burrowing owl population within the framework of a limited research and management budget,
- 2) determine the number and distribution of burrowing owls in Badlands National Park and adjacent areas,
- 3) document the degree of natal and nest-site fidelity of burrowing owls in southwestern South Dakota.

STUDY AREA

Badlands National Park

This study was conducted in the North Unit of Badlands National Park (BNP) (Fig. 1) which covers 98,864.7 ha, and is located in Pennington and Jackson counties in western South Dakota. The Park is approximately 112.7 km east of Rapid City, So. Dakota and is a mosaic of rugged geological formations, or "walls", dating from the Oligocene through the lower Miocene epochs (O'Harra 1920). The rock beds are mainly fine partially consolidated clays with occasional beds of coarse argillaceous sands and gravels (O'Harra 1920). Volcanic ash is also found throughout the formations.

These walls surround short-grass plains which consist primarily of western wheatgrass (Agropyron smithi), Bromus spp., blue grama (Bouteloua gracilis), and threadleaf sedge (Carex filifolia). A herd of nearly 500 American bison (Bos bison) graze the plains in the western portions of the Park.

Colonies of black-tailed prairie dogs (Cynomys ludovicianus) create "towns" covered by buffalograss (Buchloe dactyloides) and needle and thread grass (Stipa comata) (Agnew et al. 1986), providing ideal habitat for burrowing owls. These towns are

widely distributed throughout the Park. Park personnel have named these towns which are used throughout this report (Table 1).

Conata Basin

We also conducted studies in the Conata Basin (Fig. 1) which is part of the Buffalo Gap National Grassland, administered by the U.S. Forest Service. The Conata Basin is located on the southern edge of BNP in Pennington and Jackson counties. The basin is a lowland area which according to MacCracken et al. (1985) is "... dominated by blue gramma, buffalograss, western wheatgrass, carices (Carex spp.), red three-awn (Aristida longiseta), scarlet globemallow (Sphaeralcea coccinea), wooly Indianwheat (Plantago spinulosa) and plains prickly pear (Opuntia polyacantha). The area is grazed by cattle, a practice which has occurred since 1900 (MacCracken et al 1985).

Prairie dog towns are common in the area, although they are subject to intensive poisoning programs and sport hunting. We assigned codes to the towns we worked on. These are listed on Fig. 1 and Table 2.

Figure 1 (overleaf)

Map of Badlands National Park (North Unit)
and the Conata Basin

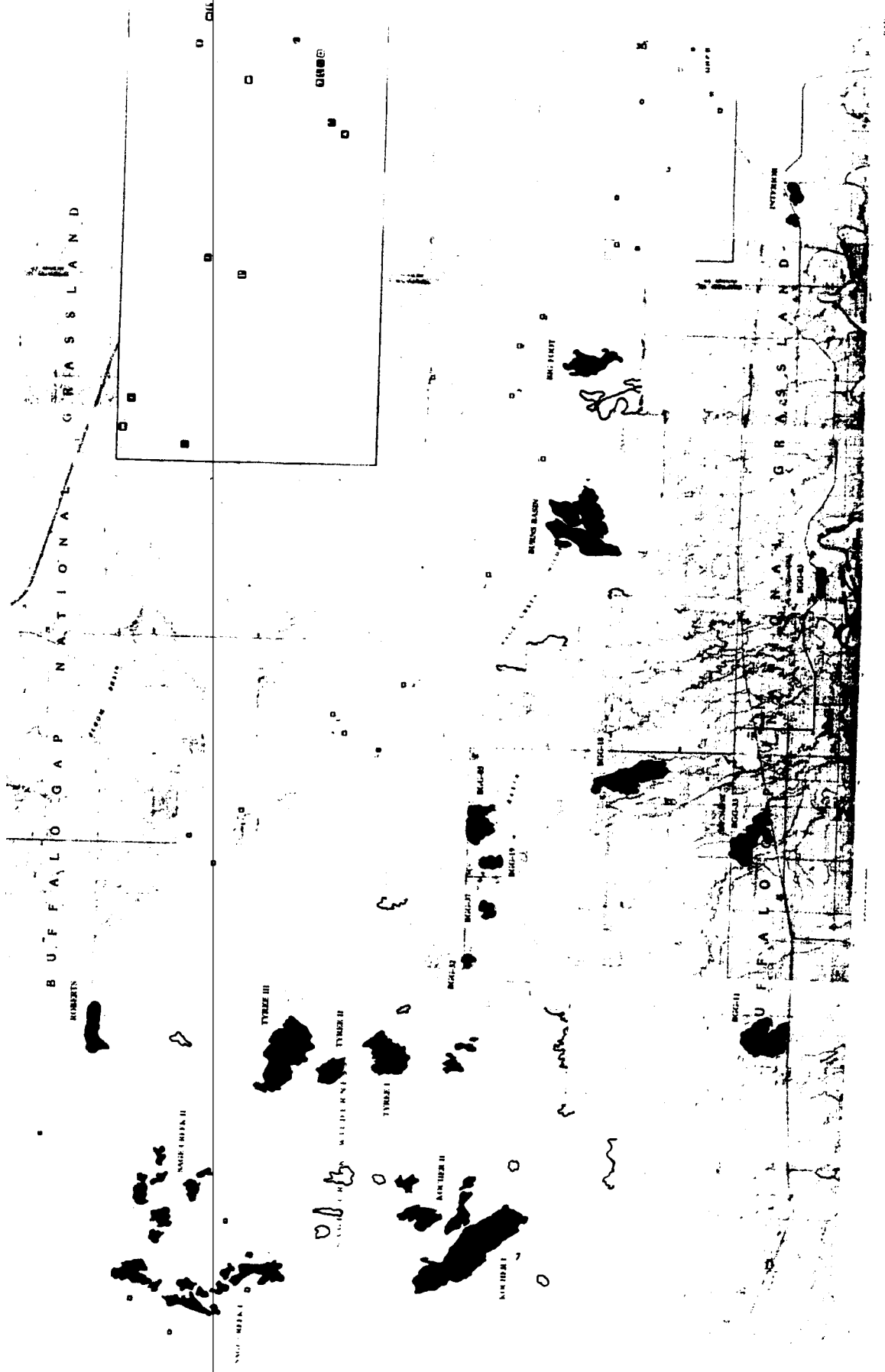
Prairie Dog Towns Outlined in:

Black = Conata Basin Sites

Blue = Censused in 1991 and 1992

Red = Censused in 1992 only

BADLANDS NATIONAL PARK (NORTH UNIT)



METHODS

Surveys

To develop and test a census technique, and obtain an estimate of burrowing owl numbers in BNP, a total of ten prairie dog towns were surveyed in BNP during the two year study (Fig. 1, Table 1). These towns were chosen because they represented a range of sizes, past management histories, and future management plans.

Burns and Tyree were surveyed six times in 1991 and seven times in 1992. Roberts and Sage, were surveyed six times in 1991 and twice in 1992. All of the other towns were surveyed once or twice in 1992.

Fourteen towns, covering 1,325.7 ha. were searched in the Conata Basin in 1991 (Table 2). Six of those towns, representing 399.7 ha., were re-visited in 1992. Burrowing owl numbers and productivity were recorded on each visit and owls were banded and color-marked.

Field work was conducted from 15 June through 15 July in both years. Surveys were conducted from dawn until approximately 1000 hrs and again from 1900 hrs until 2200 hrs, or until visibility was impaired by darkness. We did not do surveys in the rain when

it impaired vision or in our opinion would change the behavior of the owls.

straight line transects with points 300m apart were established through each prairie dog town (Ralph and Scott 1981). On smaller towns, one transect line was run through the center of the town. On larger towns multiple transect lines were run parallel to each other allowing for total coverage of the town.

We placed our observation points 300m apart along the transect line after conducting field tests which determined that a reasonable scanning distance of 150m from an observation point would allow most Park biologists to reliably locate and identify owls at their burrows. Each point along the transect was visited for 10 minutes, and using binoculars and 15 - 60X spotting scopes, owls were searched for within the 150m radius.

The location of each bird seen was recorded on 1:24000 USGS topographic maps. The age and sex of the birds, as determined by plumage patterns (Bent 1938, Grant 1965, Thomsen 1971), were noted when possible. Counts of juveniles were done after their emergence from the burrow. Active burrows (those with young) were marked with an orange wooden stake (placed 20m north of the burrow). We also searched for owls which had been banded and color-marked in past years (Martell et al. 1990).

Table 1

LOCATION AND ACREAGE OF SURVEY SITES IN BADLANDS NATIONAL PARK
1991 - 1992

Name	Ha	Location
Burns	204.4	T03S R17E S17,19,20
Big Foot	65.9	T03S R17E S14,23
Kocher I	327.2	T03S R14E S1,2,11,12,13
Kocher II	104.1	T03S R14E S1,12 T03S R15E S5,6,7
Roberts	129.5	T01S R15E S3
Sage I	229.0	T02S R15E S2,10,11,14,15,23
Sage II	79.7	T02S R15E S6,7,8 T02S R14E S12
Tyree I	118.4	T02S R15E S33,34
Tyree II	39.2	T02S R15E S28
Tyree III	208.6	T02S R15E S21,22,27,28
TOTAL	1506.0	

Table 2

LOCATION AND ACREAGE OF SURVEY SITES IN THE CONATA BASIN

1991 - 1992

Town	Ha	Location
BGG-03	11.9	T04S R17E S7
BGG-04	65.0	T04S R16E S4,5
BGG-05	50.4	T03S R16E S8
BGG-11	165.8	T04S R15E S3
BGG-12	51.6	T04S R15E S4
BGG-18	176.3	T03S R16E S21,28,33
BGG-19	8.3	T03S R16E S7
BGG-32	72.2	T03S R15E S11
BGG-33	229.2	T04S R16E S4,5
BGG-34	55.8	T03S R16E S3,10
BGG-36	33.9	T03S R16E S11
BGG-37	27.7	T03S R15E S12
BGG-42	293.8	T03S R15E S24
BGG-43	83.8	T04S R16E S2,3
TOTAL	1,325.7	

The relatively low densities of owls found on each survey made the use of standard statistical analysis associated with point-transect methods inappropriate and prompted us to use the "area occupied method" (AO) developed by Geissler and Fuller (1986). Originally developed for censusing diurnal woodland raptors (Iverson and Fuller 1989), we felt it could just as successfully be used with a grassland owl. The AO technique estimates the proportion of an area which is occupied by a species, thus providing an index of the species abundance.

To determine the AO, we recorded at each point on the transect (within a 150m radius) if an adult owl was detected during the 10 min. stop. The number of transect points (stops) on a town which were occupied by adult owls was divided by the total number of transect points then multiplied by a correction factor called the probability of detection (PD). The resulting statistic gave the proportion of the area surveyed which was occupied by owls.

The correction factor, PD, resulted from the repetition of surveys and yields an arithmetic mean (dl), which is the proportion of detections occurring after the first detection at each stop (Iverson and Fuller 1989). A bootstrap method was used to estimate Standard Error (SE) and 95% Confidence Intervals (CI). See Geissler and Fuller (1986) for a detailed explanation of AO and PD along with the equations necessary for computation.

Trapping and banding

Trapping and banding of owls was done after the emergence of the juveniles from the natal burrow, but before they could fly. This occurred during the last week of June and the first three weeks of July.

Haug-traps (Haug 1985, Martell 1990) were used to catch juveniles. The Haug trap consists of a piece of clear plexiglass attached by a hinge to a 30 cm section of black drainage pipe (10 cm diameter) (Fig. 2). This apparatus was positioned in the burrow entrance with the door opening out to allow the young birds to leave but not re-enter their burrow. The area above and immediately around the burrow entrance was covered with a chicken wire cage approximately 1.2 m in diameter and 80 cm in height (Fig. 2). Once the young owls were out of the burrows the cage allowed us to approach the birds and secure them without their escaping.

Adults were trapped using bal-chatri traps (Bloom 1987) placed in foraging areas or havahart two-way door traps covered with burlap and placed in the entrance of the burrows (Ferguson and Jorgensen 1981).

Birds were banded with standard aluminum U.S. Fish and Wildlife Service bands (adults on the right leg, juveniles on the left

leg) and yellow herculite bands (adults on the left leg, juveniles on the right leg). Morphometric measurements which included; length of 7th primary, wing chord, foot pad length, mid-tarsal thickness, beak depth and length, were taken at the time of banding (Baldwin et al. 1931).

Requests for information on sightings of the color-marked birds were sent to American ornithological organizations and to biologists at Universities and research organizations in Mexico.

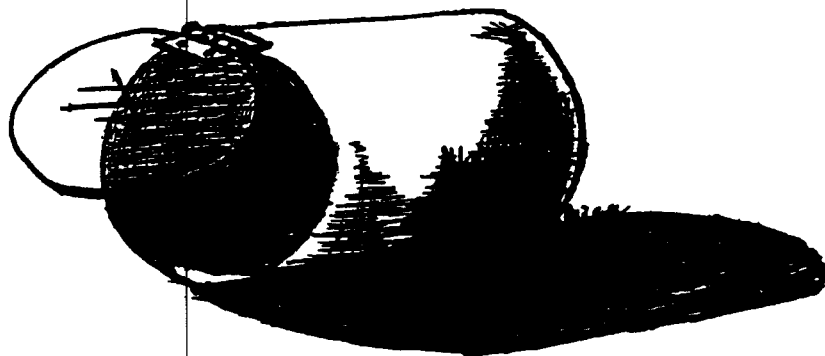
Figure 2

HAUG TRAP

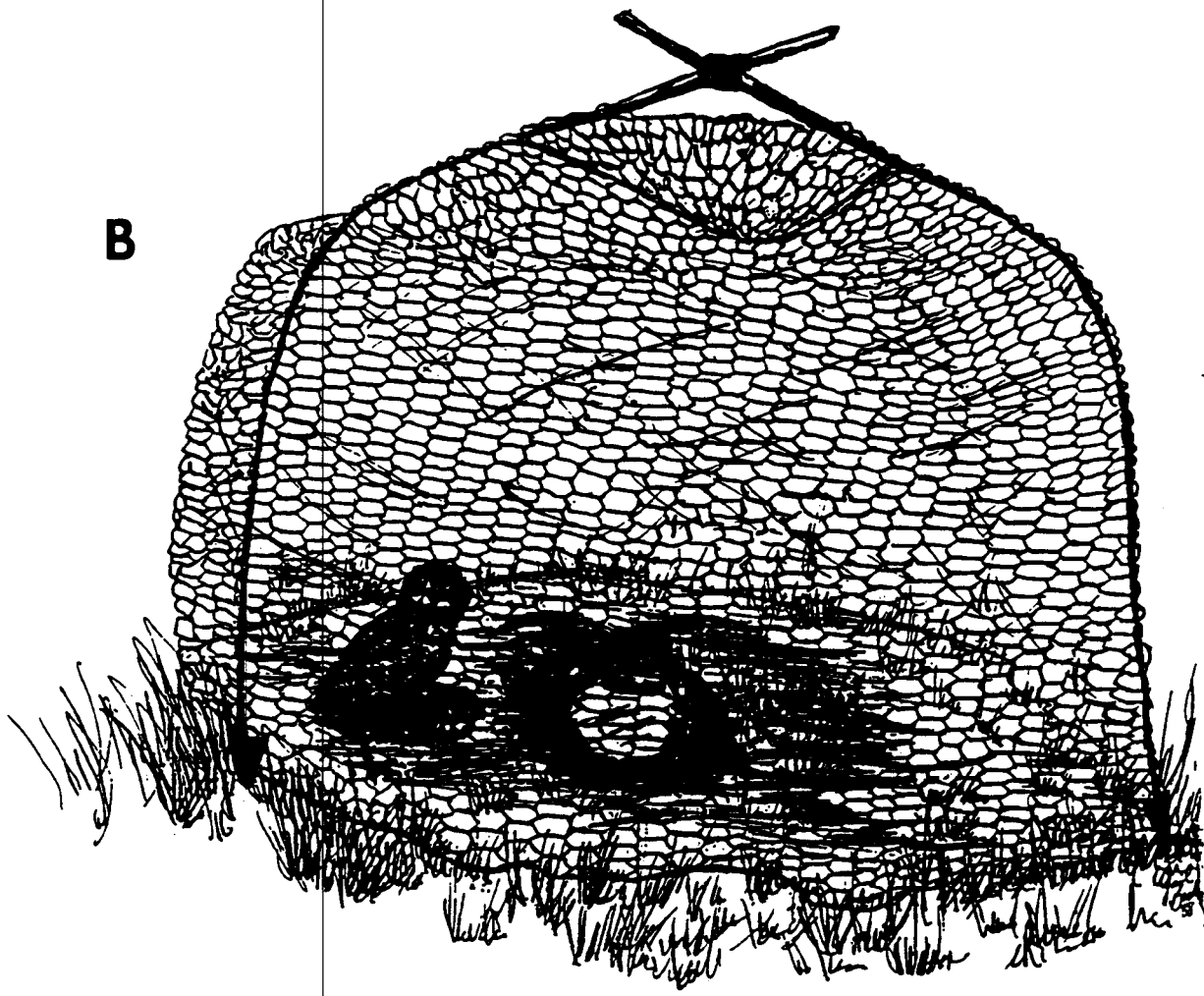
A. One-way opening door which was placed in the mouth of occupied burrow.

B. Chicken wire cage placed over burrow to catch young Burrowing owls

A



B



RESULTS

Surveys

In 1991 we located 12 broods and counted 31 young on five towns covering 818.7 ha., resulting in a density of one pair of breeding owls per 68 ha. In 1992, we located 20 broods and 62 young on those same five towns resulting in a density of one breeding pair per 41 ha.. We also located an additional 11 broods and 37 young on three additional towns (Table 3) covering 687.3 ha. (Figs. 3 - 7) resulting in a total density of one breeding pair per 48.5 ha. in 1992.

In the Conata Basin we located 14 broods with 33 young in 1991, and 11 broods with 34 young in 1992 (Table 4). An additional brood with five young in 1991, and four broods with 22 young in 1992 were located in the town of Interior, South Dakota (Table 5).

In BNP, the proportion of the area surveyed which was occupied by burrowing owls (AO) in 1991 was 0.34 (SE 0.07) ($n = 75$ stops) with a 95% CI between 0.186 - 0.499. In 1992 the AO increased to 0.57 (SE .07), 95% CI = 0.439 - 0.723 ($n = 129$ stops) (Table 6).

In 1991, using data from four BNP prairie dog towns ($n = 48$ stops), we determined the probability of detection (PD) was 0.448

(SE 0.097), with a 95% CI of 0.247 - 0.663. When we combined this with the data from the Tyree and Burns sites in 1992 (total $n = 75$ stops) we obtained a PD of 0.486 (SE 0.056) and reduced the 95% CI to 0.376 - 0.598 (Table 6).

Banding

Eighty-eight burrowing owls were banded and color-marked during the two year study. Twenty in BNP and 68 in Conata Basin and Interior, SD. Ten were adults and 78 were hatch year birds (Table 7). Appendices I and II list band numbers, locations and banding dates of all owls banded during this study. Adults were captured using bal-chatri and small live traps located in the mouth of the burrow. All juveniles were captured using Haug-traps. No owls were seen wearing color-bands from previous years.

Table 3

BURROWING OWLS FOUND IN BADLANDS NATIONAL PARK

1991 - 1992

TOWN	YEAR	NUMBER OF BURROWING OWLS		
		PAIRS	JUVENILES	BROODS
Burns	91	1	2	1
	92	4	21	4
Big Foot	91	-	-	-
	92	2	7	2
Kocher I	91	5	12	4
	92	9	19	9
Kocher II	91	-	-	-
	92	2	6	2
Roberts	91	0	0	0
	92	1	3	1
Tyree I	91	6	9	5
	92	5	16	5
Tyree II	91	2	6	2
	92	1	3	1
Tyree III	91	-	-	-
	92	7	24	7
TOTAL	1991	14	29	12
	1992	31	99	31

Table 4

BURROWING OWLS FOUND IN THE CONATA BASIN

1991 - 1992

TOWN	YEAR	NUMBER OF BURROWING OWLS		
		PAIRS	JUVENILES	BROODS
BGG				
03	91	2	4	2
	92	-	4	1
04	91	0	0	0
	92	-	-	-
05	91	6	9	3
	92	-	9	3
11	91	1	2	1
	92	-	-	-
12	91	0	0	0
	92	-	-	-
18	91	2	2	1
	92	-	-	-
19	91	1	3	1
	92	-	4	2
32	91	2	1	1
	92	-	6	1

(cont. on next page)

Table 4 cont.

TOWN	YEAR	NUMBER OF BURROWING OWLS		
		PAIRS	JUVENILES	BROODS
33	91	2	5	2
	92	-	8	2
34	91	0	0	0
	92	-	-	-
36	91	0	0	0
	92	-	-	-
37	91	1	4	1
	92	-	3	2
42	91	1	1	1
	92	-	-	-
43	91	1	2	1
	92	-	-	-
TOTAL 1991		19	33	14
1992		-	34	11

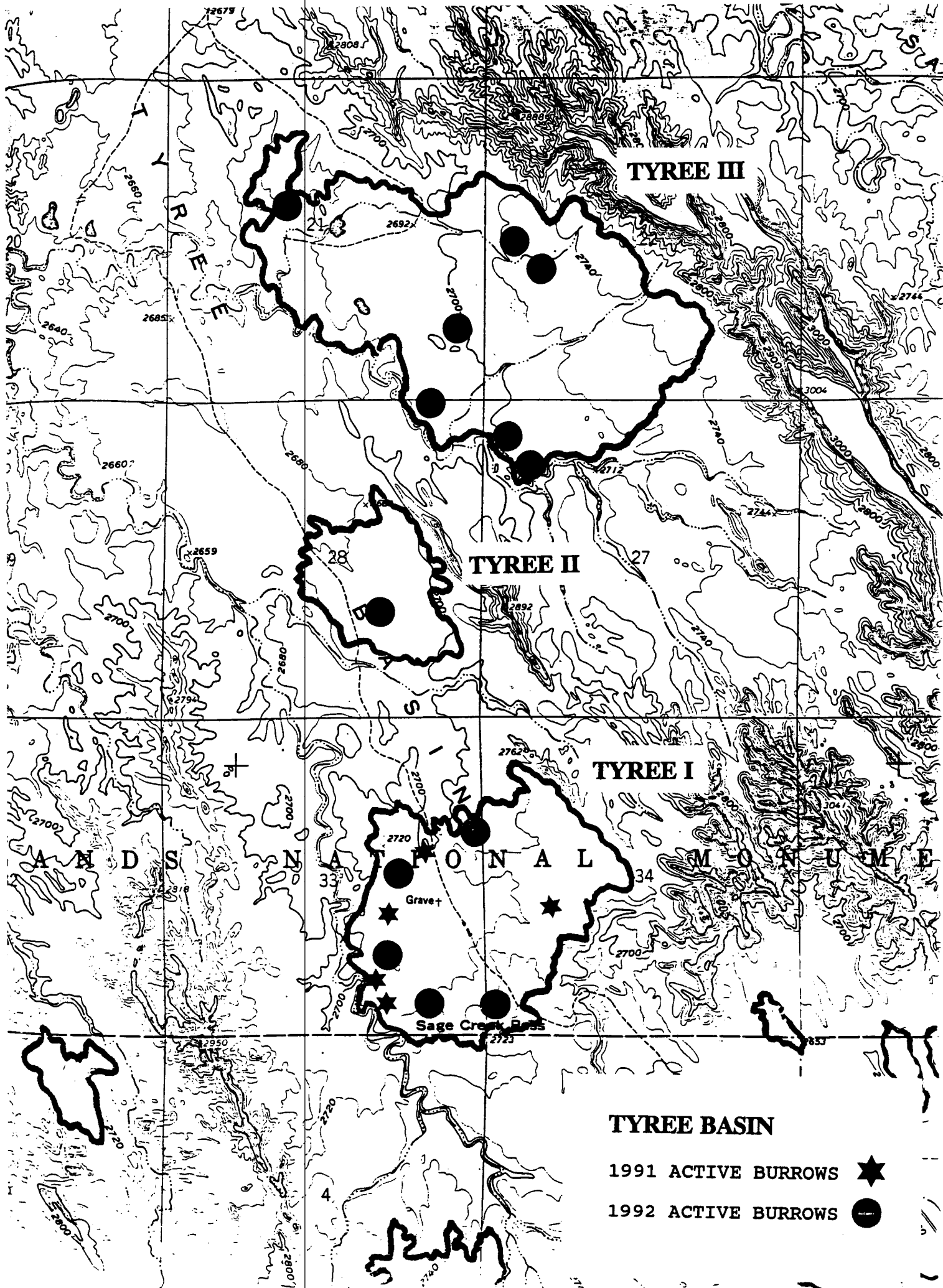
Table 5

Burrows located outside of study area in Interior, SD

		NUMBER OF BURROWING OWLS		
TOWN	YEAR	PAIRS	JUVENILES	BROODS
35	91	1	5	1
	92	-	22	4

Figures 3 - 7

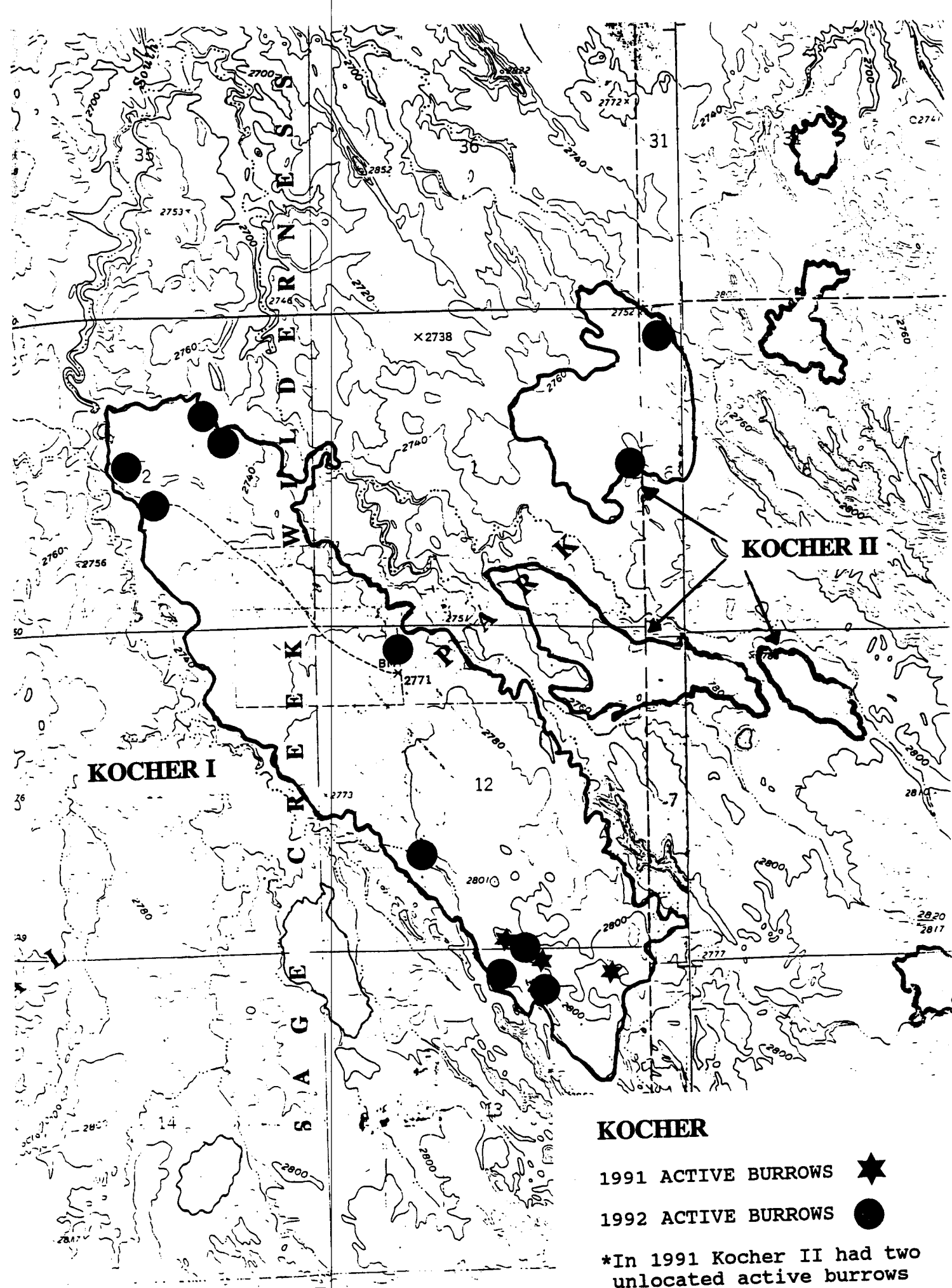
LOCATION OF ACTIVE BURROWS IN PRAIRIE DOG TOWNS
IN BADLANDS NATIONAL PARK



TYREE BASIN

1991 ACTIVE BURROWS ★

1992 ACTIVE BURROWS ●

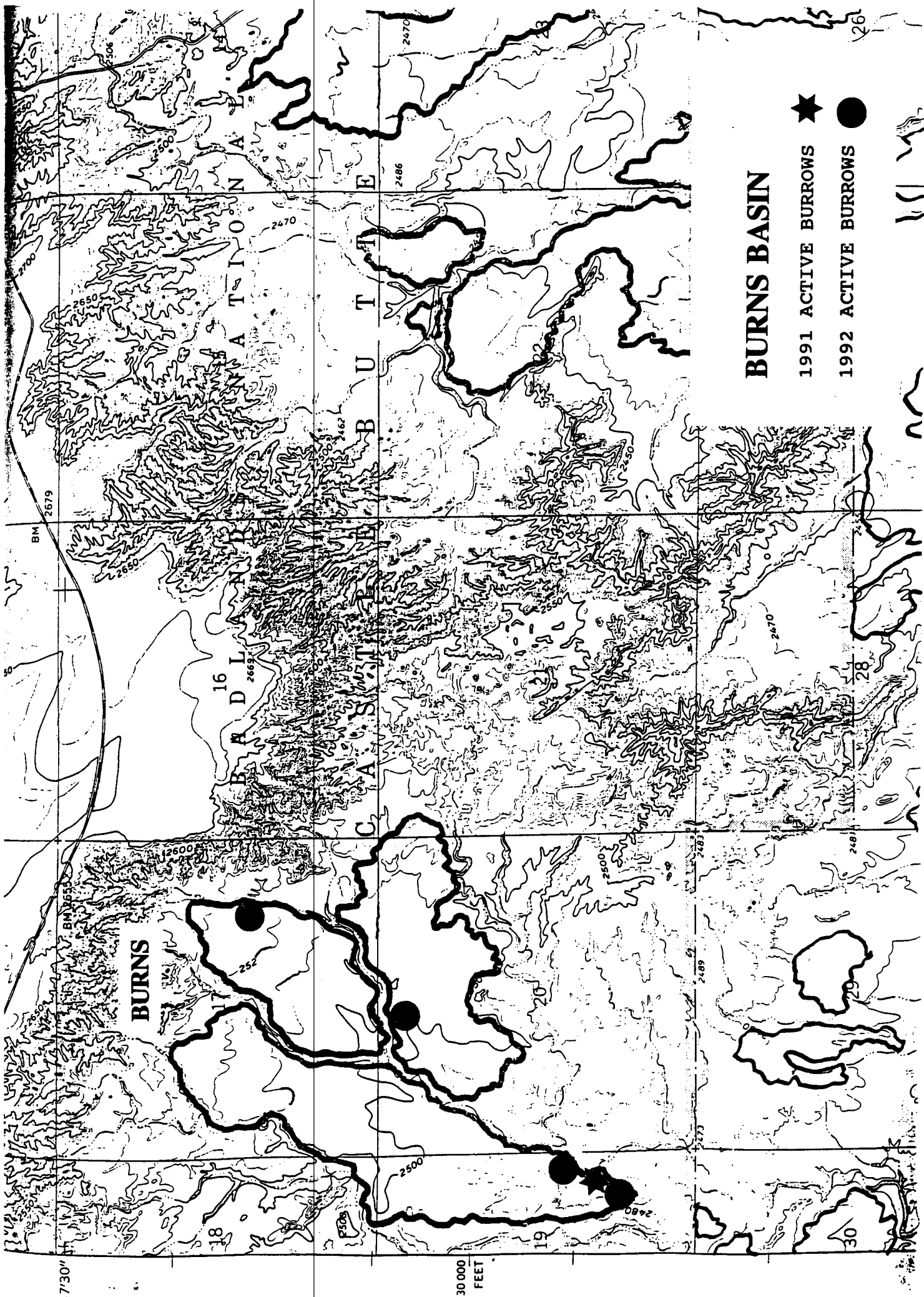


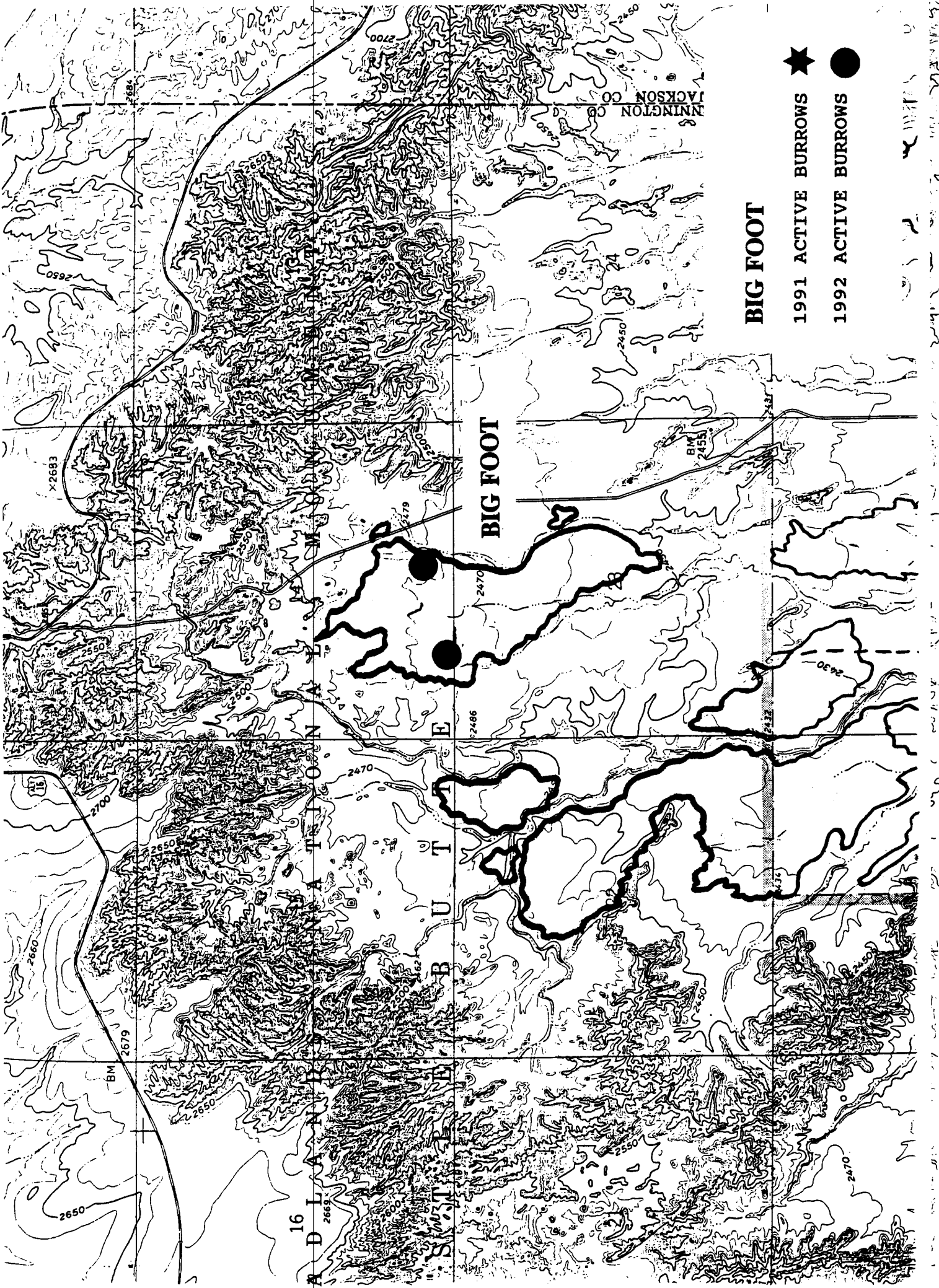
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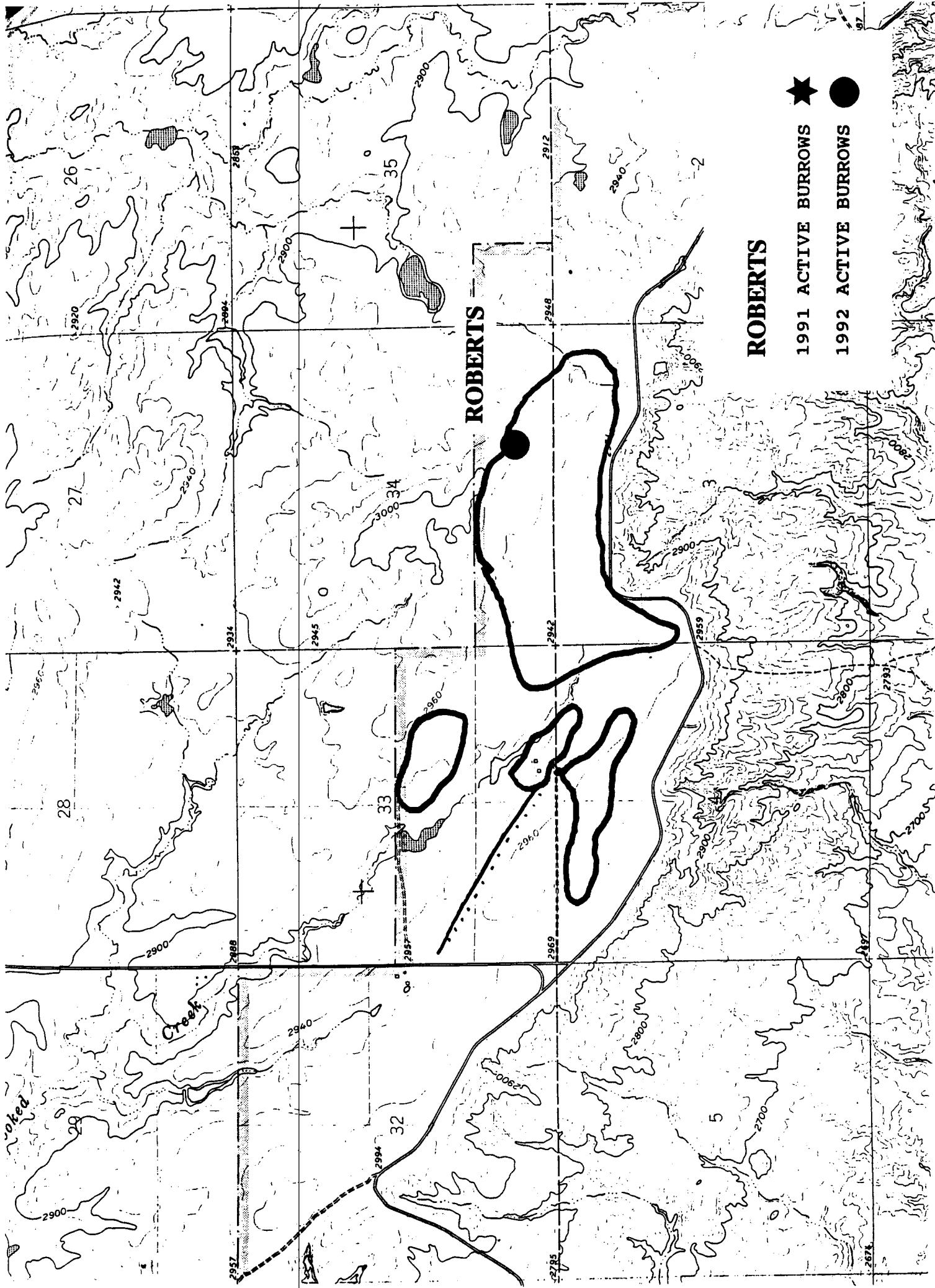
1991 ACTIVE BURROWS ★

1992 ACTIVE BURROWS ●

*In 1991 Kocher II had two unlocated active burrows







ROBERTS

★ 1991 ACTIVE BURROWS

● 1992 ACTIVE BURROWS

Table 6

Probability of detection and area occupied by Burrowing Owls
in Badlands National Park 1991 - 1992

	PROBABILITY OF DETECTION			AREA OCCUPIED		
	MEAN	SE	95% CI	MEAN	SE	95% CI
1991	.448	.097	.274 - .663	.34	.070	.186 - .499
1992	.564	.068	.428 - .700	.57	.072	.439 - .723
2 YR	.486	.056	.376 - .598	--	--	--

Table 7

Numbers of burrowing owls banded in Badlands National Park
and Conata Basin, 1991 - 1992

	BNP		CONATA		TOTAL	
	HY	AHY	HY	AHY	HY	AHY
1991	6	0	24	1	30	1
1992	14	0	34	9	48	9
Total	20	0	58	10	78	<u>10</u>

DISCUSSION

Owl numbers and productivity

We located more owls in BNP in 1992 than in 1991 (Table 3). This is partially due to increasing the area surveyed from 819 ha. in 1991 to 1506 ha. in 1992. However, on towns that were surveyed in both 1991 and 1992 increases in the number of adult pairs (from 14 to 20), number of young (29 to 62), and average brood size (2.07/pr. to 3.10/pr.) occurred.

Brood sizes in both years are below those reported in the literature from other parts of the country. Average brood size has been reported to be between 3.9 - 5.2 , and the average number of young fledged per nest attempt ranged from 4.9 (Martin 1973) to 2.1 young (Thomsen 1971). Grant (1965) reported brood sizes in his Minnesota study ranged from 2 - 6.

Breeding owl density also increased between years from one per 68 ha. in 1991 to one per 48.5 ha. in 1992. The best indication that burrowing owl numbers were higher in 1992 than in 1991 was the increase in the AO from 0.34 to 0.57.

A possible explanation for the increased number of owls in 1992 is that we had improved our ability to locate owls on the

surveys. While this may be a factor, both of the primary field personnel had experience in locating burrowing owls before the 1991 field season and were confident that most if not all of the owls were detected on each town surveyed. Also, there was little difference in the PD between years (Table 6). By all indications there seemed to be a real increase in owl numbers from 1991 to 1992.

The reasons for, as well as the implications of, this increase remain unclear. The factors regulating burrowing populations are not known. The two most likely factors affecting nesting populations are the availability of nesting burrows and prey abundance. We did not collect data on either of these factors. However we do not think that the number of burrows available to the owls changed between years.

Prey availability could have varied between years. Studies have found that invertebrates account for the majority of food items (88% - 93%) but little of the biomass (5 - 22%) (Haug 1985, Green 1983, Thompson and Anderson 1988 and Marti 1974) taken by burrowing owls. In the Conata Basin small mammal remains were most frequently found in pellets between May and July by MacCracken et al. (1985b). During August and September mammal remains decreased and arthropod remains became more frequent. The remains of lark buntings (Calamospiza melanocorys), great plains toads (Bufo cognatus), and northern chorus frogs

(Pseudacris triseriata) were found at active burrows (MacCracken et al. 1985b)

Both small mammal and invertebrate populations can vary greatly from year to year. Fluctuations in prey populations may affect burrowing owl population numbers between years. More studies are needed to determine if this is in fact the case, and what effect this would have on future survey and management plans.

Survey technique

The probability of detecting a burrowing owl on our study area was relatively good at 0.49. This compares with an average PD of 0.34 for red-shouldered hawks (Buteo linneatus) in Indiana (Iverson and Fuller 1989). The PD on individual towns was fairly consistent ranging from 0.33 on Roberts in 1992 (only one stop having a sighting) to 0.709 on Tyree in 1992. Some variation in PD is to be expected due to variations in habitat and owl behavior.

Factors affecting owl visibility, and thus survey accuracy, include prickly pear cactus (Opuntia spp.) and other low lying vegetation which, combined with the owls cryptic coloration, can present problems in identifying owls.

We believe that counting burrowing owls on a walking point-transect survey is an appropriate census technique for Badlands National Park. It is a relatively simple, inexpensive method which can be carried out in the future by Park biologists with a minimum of training. We suggest, based upon our probability of detection of 0.486, that 2 surveys would detect almost all of the nesting burrowing owls on a town.

Doing the surveys between 15 June and 15 July would maximize the chances of detecting all of the nesting pairs. We did not test this method before this time period and thus cannot guarantee its efficacy. Doing surveys after July 15 would be innacurate due to the fledging of youngsters. Young burrowing owls leave their natal burrow before they can fly. Broods will split up and individuals will temporarily join other broods. At this stage of the breeding cycle it becomes extremely difficult to determine the number of pairs as well as obtain accurate productivity data.

Using the Area Occupied method of analysis will allow Park managers to monitor the long term stability of their owl population, and form a framework for future management. Park biologists will also be able to assess the effects of management actions taken in the Park, such as black-footed ferret (Mustela nigripes) reintroduction, or changes in prairie dog control programs.

This technique can be applied to other areas of the country where burrowing owls nest in semi-colonial situations. This is especially true where the species is not considered endangered but monitoring is desired. It must be remembered that this technique provides an index not an actual count of owls (Iverson and Fuller 1989). Thus for areas where there are serious concerns about an endangered owl population, more intensive surveys combined with population data are certainly needed.

ACKNOWLEDGEMENTS

Funding for this study was provided by the National Park Service and the members of The Raptor Center at the University of Minnesota. Mark Fuller provided assistance with statistical analysis. We would like to thank Bruce Bessken and the staff of Badlands National Park for their assistance during this study. Field assistance provided by Gail Buhl, Ted Dick, Charlene Gieck, Jane Goggin, Diane Snyder, and Tim Sulser is sincerely appreciated.

APPENDIX I

BURROWING OWLS BANDED IN BADLANDS NATIONAL PARK AND THE SURROUNDING CONATA BASIN 1991

FEDBAND #	AGE	BANDING LOCATION	BANDING DATE
1204-06731	HY	BGG-35	06/29/91
1204-06732	HY	BGG-35	06/29/91
1204-06733	HY	BGG-35	06/29/91
1204-06734	HY	BGG-35	06/29/91
1204-06735	HY	BGG-35	06/29/91
1204-06736	HY	BGG-33	06/30/91
1204-06737	HY	BGG-05	07/06/91
1204-06738	HY	BGG-05	07/06/91
1204-06739	HY	BGG-18	07/06/91
1204-06740	HY	BGG-18	07/06/91
1204-06741	HY	TYREE I	07/08/91
1204-06742	HY	TYREE I	07/08/91
1204-06743	HY	BGG-11	07/09/91
1204-06744	HY	BGG-32	07/21/91
1204-06745	HY	BGG-03	07/12/91
1204-06746	HY	BGG-05	07/12/91
1204-06747	HY	BGG-03	07/12/91
1204-06748	HY	TYREE I	07/13/91
1204-06749	HY	BGG-05	07/15/91
1204-06750	HY	BGG-05	07/15/91
1204-06751	HY	BGG-05	07/15/91
1204-06752	HY	BGG-05	07/15/91
1204-06753	HY	BGG-05	07/15/91
1204-06754	HY	BGG-05	07/15/91
1204-06755	HY	BGG-19	07/15/91
1204-06756	HY	BGG-19	07/15/91
1204-06757	HY	BGG-19	07/15/91
1204-06758	HY	TYREE I	07/17/91
1204-06759	HY	TYREE I	07/17/91
1204-06760	HY	TYREE I	07/17/91
1204-06761	AHY	BGG-37	07/20/91

APPENDIX II

BURROWING OWLS BANDED IN BADLANDS NATIONAL PARK AND THE SURROUNDING CONATA BASIN 1992

FEDBAND #	AGE	BANDING LOCATION	BANDING DATE
1204-06650	AHY	BGG-05	06/19/92
1204-06651	HY	BGG-35	06/22/92
1204-06652	AHY	BGG-35	06/22/92
1204-06653	HY	BGG-35	06/22/92
1204-06654	HY	BGG-35	06/22/92
1204-06655	HY	BGG-35	06/22/92
1204-06656	HY	BGG-35	06/22/92
1204-06657	HY	BGG-33	06/22/92
1204-06658	HY	BGG-35	06/22/92
1204-06659	HY	BGG-35	06/23/92
1204-06660	HY	BGG-33	06/23/92
1204-06661	HY	BGG-33	06/23/92
1204-06662	HY	BGG-33	06/23/92
1204-06663	HY	BGG-33	06/23/92
1204-06664	HY	BGG-33	06/23/92
1204-06665	HY	BGG-35	06/23/92
1204-06666	HY	BGG-35	06/23/92
1204-06667	HY	BGG-35	06/23/92
1204-06668	HY	BGG-35	06/23/92
1204-06669	HY	BGG-35	06/23/92
1204-06670	HY	BGG-35	06/23/92
1204-06671	HY	BGG-35	06/23/92
1204-06672	HY	BGG-35	06/23/92
1204-06673	HY	BGG-35	06/23/92
1204-06674	HY	BGG-33	06/23/92
1204-06675	HY	BGG-33	06/24/92
1204-06676	HY	BURNS	06/24/92
1204-06677	HY	BURNS	06/24/92
1204-06678	HY	BURNS	06/24/92
1204-06679	HY	BURNS	06/24/92

APPENDIX II (cont)

BURROWING OWLS BANDED IN BADLANDS NATIONAL PARK AND THE SURROUNDING CONATA BASIN 1992

FEDBAND #	AGE	BANDING LOCATION	BANDING DATE
1204-06763	HY	BURNS	06/24/92
1204-06764	HY	BURNS	06/24/92
1204-06765	HY	BURNS	06/24/92
1204-06766	HY	BURNS	06/24/92
1204-06767	HY	BURNS	06/24/92
1204-06768	HY	BURNS	06/24/92
1204-06769	AHY	BGG-35	06/24/92
1204-06770	AHY	BGG-03	06/24/92
1204-06771	AHY	BGG-35	06/25/92
1204-06772	AHY	BGG-35	06/25/92
1204-06773	HY	TYREE I	06/30/92
1204-06774	HY	TYREE I	06/30/92
1204-06775	HY	TYREE I	06/30/92
1204-06776	HY	BGG-05	07/02/92
1204-06777	AHY	BGG-32	07/02/92
1204-06778	AHY	BGG-35	07/03/92
1204-06779	HY	BGG-05	07/04/92
1204-06780	AHY	BGG-37	07/07/92
1204-06781	HY	BGG-35	07/09/92
1204-06782	HY	BGG-35	07/09/92
1204-06783	HY	BGG-35	07/09/92
1204-06784	HY	BGG-35	07/09/92
1204-06785	HY	BGG-03	07/09/92
1204-06786	HY	BGG-03	07/09/92
1204-06787	HY	BGG-35	07/09/92
1204-06788	HY	BGG-35	07/09/92
1204-06789	HY	BGG-35	07/09/92

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