Final Report: Surveying Ephemeral Wetlands for Plains Spadefoot Toads, *Spea bombifrons,* and Woodhouse's Toads, Bufo *woodhousei,* in Southwestern Minnesota.

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Abstract

Our objectives were to determine if *Spea bombifrons* and Bufo *woodhousei* occur in southwestern Minnesota. If these species were found we would describe their breeding habitats, characterize the spadefoot tadpoles' ephemeral community and develop a listening protocol. During the summer of 2000 we surveyed for these species using night driving and listening for calling males along preselected routes in Rock and Pipestone counties. However, rainfall was insufficient to provide optimal spadefoot calling conditions during our survey period, and neither species was heard. In 2001 rainfall was abundant during May and June and soils were hydrated. We surveyed our routes, mainly along the western border of Minnesota and South Dakota, in late June under optimal spadefoot calling conditions (warm, rainy nights with water standing in fields, following afternoon thunderstorms). However we heard no spadefoot toads or Woodhouse's toads. A potential Woodhouse's toad call recording sent to us by Carol Hall, Minnesota DNR, from Grant County turned out not to be *Bufo woodhousei.* It is probably either Bufo *hemiophrys* or a hybrid of that species with *Bufo americanus.* We conclude that even though the species of interest have been reported near the Minnesota border in neighboring states, it is unlikely that they occur in the counties that we surveyed.

Objectives

The objectives of our research were:

1. To determine if the Plains Spadefoot Toad, *Spea bombifrons,* and Woodhouse's Toad, *Bufo woodhousei,* are present in southwestern Minnesota.
2. To locate breeding habitats of the Plains Spadefoot Toad.
3. To determine if spadefoot breeding sites contain the typical spadefoot tadpole/fairy shrimp community which contains both carnivore and omnivore tadpole morphological types.
4. To recommend a listening protocol that could be used by individuals wanting to monitor *Spea bornbifrons* elsewhere in the state.

We addressed only objective one because the other objectives depended on locating the species of interest in southwest Minnesota.

Location of Study

We conducted our study in southwestern Minnesota, primarily in Rock and Pipestone counties. Although our proposal included Nobles County, we decided to focus on Rock and Pipestone Counties because they are closest to previously reported spadefoot sites in South Dakota. Had we discovered either species of interest in Rock and/or Pipestone Counties we would have extended the surveys into Nobles County. We checked out potential sites recommended to us by DNR personnel

and others. We focused our search on ephemeral and semi-permanent wetlands, particularly those associated with the stream and river drainages that may have provided migratory paths from existing sites in South Dakota or Iowa.

Methods and Materials (objective 1)

Choosing Survey Times: Spadefoot toads breed mainly from mid-May through July in Iowa. Although Woodhouse's toads typically breed early, they do call after rains later in the season. So our survey strategy was to survey for both species after rains during June and July. Potential and actual rainfall events were tracked on the World Wide Web using sites such as Intellicast.com. We tried to survey when thunderstorms with lots of rain (2-4. inches) were predicted or had just occurred. In Iowa spadefoots call for at most 4 days after a large rain event that has filled the breeding sites with at least 4 inches of water (Farrar and Hey, 1999; Hey and Farrar, 1999).

Selecting Survey Routes: We used a variety of sources to construct driving routes and to find sites to survey. We contacted the following MN DNR nongame specialists and biologists/herpetologists for information on potential sites: Ed Quinn, Julie Cuchna, David Breyfogle, Ed Brekke-Kramer, Bob Beck, Tom Jessen (amateur herptologist), Lisa Gelvin-Innvaer, Carol Hall and John Moriarty.

We hoped to find North American Amphibian Monitoring Program (NAAMP) routes that would inform us of good potential sites. However, as of May 2000, no routes had been surveyed in southwest Minnesota (Moriarty, personal communication).

We used information gleaned from maps and herp records (Fischer, 1998, Fischer et al., 1999; Moriarty, 1984 and 1988, Oldfield and Moriarty;1994). The routes actually driven are included as Figures 1 and 2. Routes colored yellow were driven in 2000, those in green in 2001.

Previewing, the routes. We previewed the routes during the daytime to look for possible breeding sites, ephemeral ponds, cattle tanks, and small wetlands. GPS and county road locations were recorded for potential sites. We returned to the best sites at night to listen for calling males and to look for animals on the road.

Night driving surveys. We identified amphibians by call, estimated relative abundance and recorded data about the site using the Minnesota Frog and Toad Survey Instructions. We stopped to identify and record amphibians found on the road. In 2001 we also surveyed potential sites by dip netting for

tadpoles during the daytime to determine if either species had bred there during previous rainfall events.

Products

This report contains the following products: driving route maps (Figure 1 and 2), species lists of calling anurans, descriptions of sites where calls were heard, and GPS and county road locations of all sites where amphibians were seen or heard (Table 1 and 2). Management recommendations are also made regarding some of the sites.

Schedule of Activities

Year 2000. a. April 15-May 15: We acquired distribution information, maps, and planned routes. May 25-27. We drove potential routes looking for breeding sites. b. June 23-24: We obtained rainfall information, drove routes, did listening surveys and looked for more potential sites. c. July: We turned in a progress report.

Year 2001 a. June 28-July 1: We drove routes after heavy rain, did listening surveys, dip netted for tadpoles, and extended the survey to new sites; b. July 15 - Dec. 30: We wrote and submitted the final report.

Results 2000

On May 25 through May 27 we drove a total of 458 miles from Sioux City through Lyon and Sioux Counties in Iowa, through Minnehaha County in South Dakota looking for potential sites, then drove east to Luverne Mn., and finally north to Pipestone. On day 2 we drove through Lincoln County, down to Split Rock Creek, then south of Jasper to Garretson and to Luverne. That evening during a light rain and cold temperatures (51 °F) we drove west of Luverne to South Dakota looking at the Beaver Creek drainage past Manley and returned to Luverne. We recorded numerous potential ephemeral sites, but it was cold and we heard no amphibians calling (Table 1). On day 3 we explored territory east of Luverne, Rock City, and along the Rock River and then returned to Iowa. We identified and collected GPS readings for 11 potential sites or areas in Minnesota. (See Figures 1 and 2 for actual routes driven marked in yellow and Table 1 for site descriptions and GPS locations).

We monitored the weather throughout June and decided to do a survey on June 23 because of the potential for thunderstorms in the area. Note however, that the area was in a continuing drought and soils were dry.

On June 23 we drove from Flandreau, S.D. to Pipestone along Flandreau Creek. That evening we drove west and North of Pipestone and into Lincoln County. The following day we drove north and

east of Pipestone to investigate potential sites in Pipestone and then drove south into Rock County. We saw some lightning off to the east but it didn't rain along our survey route. The next day we recorded the locations of flooded farm fields east of 65 south of Hy 21, NE of Laverne and continued on to Magnolia on our way back to Iowa. We collected GPS readings for approximately 9 potential sites (Table 1). We drove 392 miles on this trip but did not hear amphibians calling due to unfavorable weather conditions. Because the drought continued we made no more trips during 2000.

RESULTS 2001

Rainfall conditions were much better for amphibians during the spring of 2001. We followed rainfall/storm predictions on the www and chose June 28-July 1 as the best survey time. On June 28 we drove from Sioux City to Split Rock Creek State Park which served as our base camp. Our survey strategy was to look for flooded farm fields and other ephemeral sites during the day and to dipnet for tadpoles, then return to listen at the most likely sites at night, hopefully, during thunderstorms. Luckily we had a thunderstorm at 11:30 A.M. that filled numerous potential spadefoot sites with water. We found 12 potential listening sites on June 29 (Figures 1 and 2; green route). We heard *Pseudacris triseriata* calling in the daytime at one site (Table 2). We also netted tadpoles at two sites, finding *Rana pipiens* and *Bufo americanus* (Table 2).

On the evening of June 29 we conducted a listening survey in western Pipestone and Rock Counties. Our strategy was to survey identified sites, that had experienced rain, and that were close to the South Dakota border (Figures 1 and 2; green route). We heard *Pseudacris triseriata* and *Bufo americanus* calling at 6 sites (Table 2). However, in spite of the presence of numerous ephemeral sites containing water and favorable weather conditions we heard neither *Spea bombifrons* nor *Bufo woodhousei.*

On June 30 we decided to drive to Yellow Medicine and Lac Qui Parle Counties to scout for potential spadefoot habitat for future searches. We thought that southern Lac Qui Parle Counties and northern Yellow Medicine counties seemed most promising because the soils appeared lighter and there were irrigation systems suggesting well drained soils that spadefoots require for burrowing.

The evening of June 30 we decided to check South Dakota within 5 miles of the Minnesota border where spadefoots may have previously been found. Even though we drove from 8 to 11:30 PM and weather conditions were good early, we didn't hear spadefoots. Later in the evening the wind rose as a thunderstorm approached Ihlen in Rock County and no amphibians were heard. While camping at Split Rock Creek State Park we listened for calling anurans nightly. We heard an individual *Bufo hemiophrys* calling from the lake on two evenings.

We recorded another couple of potential sites, but it was windy and cold, so we headed home on July 1 after driving 720 miles.

In July Carol Hall of the Minnesota DNR called us for help with identifying an unknown toad that they thought might be a Woodhouse's toad from Grant County. She sent a taped recording of the calls. However, we identified the call as either a *Bufo hemiophrys* or a hybrid with *Bufo americanus* and not *Bufo woodhousei.*

Discussion

Spadefoot toads and Woodhouse's toads are both species of possible occurrence in the state of Minnesota (Oldfield and Moriarty, 1994). There are several reasons for thinking that spadefoot toads might be found in Minnesota. Known sites exist in bordering states of South Dakota and Iowa, suitable habitat might be present, fairy shrimp that could serve as food for spadefoot tadpoles occur in Minnesota (Belk, 1975).

Spadefoot toads seemed most likely to be found in Rock County because they have been reported within five miles of the county line in Minnehaha County of South Dakota (Fischer et al., 1999; Oldfield and Moriarty, 1994). Spadefoots have also been found in Lincoln and Union Counties of South Dakota (Fischer, 1998; Fischer et al., 1999; Figure 3) but have not been found in the Iowa border counties of Lyon and Sioux. In fact the highest concentration of sites mapped from museum specimens of spadefoot toads is in Lincoln and Union Counties along the Vermillion and James Rivers and Brute Creek which flows into the Big Sioux River (Ballinger et al., 2000; Figure 3). Spadefoot toads are found in the two tiers of counties along Iowa's western border that are associated with the Missouri River floodplain and loess hills topographic regions (Christiansen and Bailey, 1991; Farrar and Hey, 1997).

Prior to our survey we thought that suitable habitat for spadefoots could be found in southwestern Minnesota. This portion of Minnesota is prairie with an integrated network of streams (Prior, 1991.). The topography is like that of neighboring regions of South Dakota (Ojakangas and Matsch, 1982). However after surveying Rock and Pipestone Counties we question whether suitable spadefoot habitat is present. In the eastern part of *Spea bombifrons* distribution in Iowa, Missouri and South Dakota the animals are typically associated with wide floodplains of the Missouri River and its tributaries, such as the Vermillion, James and Big Sioux Rivers. A majority of breeding occurs in ephemeral pools and flooded farm fields associated with alluvial soils, with some breeding also occurring in ephemeral sites in loess soils. Wide flood plains and alluvial soils appear to be lacking in Rock and Pipestone Counties. While spadefoots occur in Iowa's Loess Hills, they may have migrated into this ecoregion from the floodplains that dissect the Hills.

Plains spadefoot toads require well-drained loose soils that are good for burrowing (Conant and Collins, 1991). Soils must be deep enough above bedrock to allow these burrowers to overwinter without freezing. Plains spadefoot habitat has been variously described as sandy loose soil (Fischer et al, 1999), arid sandy grasslands with temporary pools (Oldfield and Moriarty, 1994), soft sandy, gravelly soils along stream floodplains (Hammerson, 1986), prairies and open floodplains with loose soil and sand (Collins and Collins, 1993). These types of habitats appear to be missing from Rock and Pipestone Counties. Where suitable soils, such as loess, are occasionally present, spadefoots have apparently not migrated in from distant population centers perhaps as far away as the Missouri and Big Sioux River floodplains.

We also reasoned that Woodhouse's toads might occur in southwestern Minnesota (Oldfield and Moriarty, 1994) because they are of probable or known occurrence in all the South Dakota counties that border on Minnesota (Fischer et al., 1999 (Figure 3). Maps of museum specimens of Woodhouse's toads show a more restricted, southerly distribution along the Missouri River and its tributaries (Ballinger et al., 2000; Figure 3). Because this species is viewed by some to be a generalist that will breed in a variety of habitats within its range (Conant and Collins, 1991; Fischer et al., 1999), we reasoned that suitable habitat would be found in southwestern Minnesota. After reading numerous other habitat descriptions for the species, we have discovered that the species may have more specialized habitat requirements than we previously recognized. Tom Johnson (2000) describes Woodhouse's toad habitat in Missouri as "sandy lowlands, particularly river bottoms, and open dry areas adjacent to marshes". Collins and Collins (1993) describe the species as "living in lowlands, sandy areas, floodplains of larger streams and breeding in sloughs and sandpit lakes". We have observed similar habitat requirements for Woodhouse's toads in Iowa. Hammerson (1986) describes Woodhouse's toads as requiring deep, friable soils in river valleys and floodplains, irrigated farm land, but breeding in a variety of habitats in Colorado.

We found predominantly *Bufo americanus* occurring in Rock and Pipestone Counties. American toads are often described as more of an upland species while Woodhouse's toads may be more of a lowland species. Perhaps suitable Woodhouse's toad habitat is not present in southwestern counties. This is speculative, however. Additional effort to search for Woodhouse's toads farther north along the Minnesota/South Dakota border where there are larger lakes might pay off.

We also were hoping to find cricket frogs (Acris crepitans) in southwestern Minnesota. Suitable habitat for this species is lacking. Recent studies show that breeding habitat for this species is characterized by open, sunlit, muddy shores forming a buffer zone of about 10 m wide where the frogs feed and bask during the day (O'Neil, 2001). Corridors for migration to neighboring ponds are

probably also required. The two most promising sites that we found with this kind of shoreline were badly degraded. One site north of Manley was being used by the DOT as a dumpsite; the other site was a city park south of Luverne that had lots of geese, fish and turtles. Most other sites had no open shore due to the prevalence of cattails. Cattail control would increase habitat availability and would potentially increase diversity of ephemeral breeding amphibians in southwestern Minnesota.

Conclusions

Spadefoot toads are notoriously difficult to locate and have often been found in "new localities" after intensive surveys under optimal conditions. Recent publications by Fischer (1998), Fisher et al. (1999) and Ballinger et al. (2000) have updated the distribution maps of spadefoot toads in eastern South Dakota. We (Farrar and Hey, 1997 and 99) have added many new calling and breeding localities to distribution maps of spadefoot toads in Iowa (Christiansen and Mabry, 1985). After extensive surveys under good to optimal conditions in 2001 in Rock and Pipestone Counties of southwestern Minnesota, we have failed to find either *Spea bombifrons* or Bufo *woodhousei.* It is impossible to say with 100 per cent certainty that the species are not present, but we feel that the likelihood of finding them in this part of Minnesota is quite small. One possible strategy for future spadefoot searches might be to check known breeding sites of *Bufo cognatus* in Minnesota, since the two often breed in the same sites, at least in Iowa. Woodhouse's toads might still be found further north in Minnesota (such as in Traverse County), because the species is found in the bordering counties in South Dakota and more suitable habitat with larger bodies of water may exist farther north.

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Table 1: Driving Survey 2000

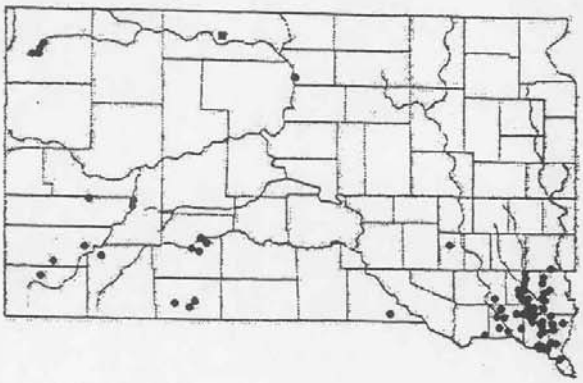
Year and Date	Time	County	Road	GPS	Site description	Weather	Species Heard	Relative Abundance	Species Seen	Comments
5/25 2000	daytime	Rock	75, s of Luverne		Shoeman Park ponds		none		none	possible Woodhouses site
5/25 2000	daytime	Pipestone	eastside of 75 and 2	N43° 47.735	cattle tank in Sioux					geese, turtles, fish
				W96°12.600	Quartzite		none		none	
5/25 2000	daytime	Pipestone	60thAve/171	N44°05.754	gravel pit, irrigation		none		none	several sites in area
				W96°20.873						of N. Pipestone Creek
5/25 2000	daytime	Lincoln	Highway 9 and 75	N44°12.712	marsh		none		none	gravel pits in area
				W9619.127						
5/26 2000	daytime	Pipestone	Split Rock Creek St.Pk		riverine below dam		none			check later for cricketfrogs
										check later for Woodhouse's
5/26 2000	daytime	Rock	BlueMounds State Park		ephemerals in Sioux					not good spadefoot
					Quartzite		none		none	habitat
5/26 2000	daytime	Rock	23, south of Jasper	N43°47.678						
				W96°24.139	flooded farm field		none		none	check for spadefoots
5/26 2000	daytime	Rock	23, south of 20	N43°42.406						
				W96°25.929	flooded farm field		none		none	check for spadefoots
5/26 2000	night	Rock	17, north of Manley	N43°35.608		rain, cold				
				W96°25.931	cattle tanks in pasture		none		none	check again for spadefoots
5/27 2000	daytime	Rock	4, east of Luverne	N43°40.445	Rock River drainage	51°F				
				W96°09.182	pond		none		none	
5/27 2000	daytime	Rock	1 between 9 and 75		Rock River meanders					check later
					gravel pit		none		none	potential listening area
6/23 2000	8:00 PM	Pipestone	30 at S.D. border	N43°59.676	cowpasture semi-permanent		none		none	irrigations systems in area
				W96°24.727	surrounded by cattails					
6/23 2000		Pipestone	13,north of 30	N44°00.919	ephemeral site in pasture					
				W96°25.687	west side of road		none		none	irrigations systems in area
6/23 2000	10:00 PM	Pipestone	75, south of 221	N44°09.745	on road	rain	none		*Rana pipiens*	
				W96°22.111						
6/24 2000	daytime	Pipestone	8, east of 75	N44°05.718	semi-permanent with		none		none	
				W96°05.545	sedges					
6/24 2000	daytime	Pipestone	8, east of 75	further east	Woodstock Wildlife					check later for Woodhouses
					Restoration Area		none		none	
6/24 2000	daytime	Rock	e of 65, south of 21	N43°48.319						
				W96°04.373	flooded farm field		none		none	check for spadefoots
6/24 2000	daytime	Rock	on 65	N43°47.959	marsh east of road					
				W96°04.596	flooded farm field		none		none	check for spadefoots
6/24 2000	daytime	Rock	on 65	N43°46.847	gravel pit and					
				W96°04.370	flooded farm field		none		none	check for spadefoots
6/24 2000	daytime	Rock	3 and 7 intersection	N43°42.495						
				W96°04.384	cattle tanks		none		none	check for spadefoots

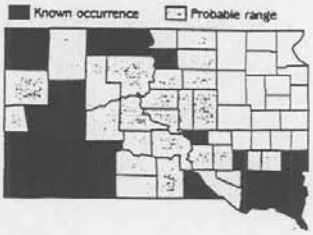
Table 2: Driving Survey 2001

Year and Date	Time	County	Road	GPS	Site description	Weather	Species Heard	Relative Abundance	Species Seen	Comments
6/29 2001	11:05 AM	Rock	51 and 21 intersection	N43°47.680	cattail marsh	thunderstorm	none		*Rana pipiens*	
				W96°25.966	flooded field				tadpoles	
6/29 2001	daytime	Rock	51 and 23 intersection	N43°44.869	flooded field					
				W96°27.015	ag runoff	rain	*Pseudacris*			check for spadefoots
							triseriata	3		
6/29 2001	daytime	Rock	20	N43°43.117						
				W96°26.994	ag runoff					check for spadefoots
6/29 2001	daytime	Rock	s of 23 and 20	N43°22.423	ephemeral pond					check for spadefoots
			mile marker 8	W96°25.928	east of 23					
6/29 2001	daytime	Rock	23	N43°41.563	flooded field		none			check for spadefoots
				W96°25.935	east of 23					
6/29 2001	daytime	Rock	23	N43°41.267	ag runoff		none			check for spadefoots
				W96°25.937	east of 23					
6/29 2001	daytime	Rcok	23	N43°40.871	ag runoff		none			check for spadefoots
				W96°25.938	west of 23					
6/29 2001	daytime	Rock	23	N43°38.655	ag runoff		none			check for spadefoots
				W96°25.955	west of 23					
6/29 2001	daytime	Rock	17, south of I-90	N43°35.999	DOT dump site		none		*Bufo americanus* tadpoles	
			north of Manley	W96°26.011	cattail marsh				*Rana pipiens* metamorphs	
6/29 2001	daytime	Rock	6 north of Beaver Creek	N43°37.370	ag runoff		none			check for spadefoots
				W96°21.136						
6/29 2001	daytime	Rock	59 north of 20	N43°44.037	pond on west		none			
				W96°23.529						
6/29 2001	daytime	Rock	6	N43°45.711	pond on north		none			high ground Sioux
				W96°21.243						Quartzite
6/29 2001	daytime	Rock	1 east of Jasper	N43°50.945	pond		none			
				W96°21.908						
6/29 2001	8:20 PM	Pipestone	15 north of 2	N43°55.503	wetland on each		none			saw a garter snake
				W96°20.841	side of road					
6/29 2001	8:30	Pipestone	15	N43°56.120	wetland on each		none			
				W96°20.856	side of road					
6/29 2001	9:15	Pipestone	1 road south of Jasper	N43°50.082	ag runoff	warm	*Pseudacris*	1		Pipestone had 1 inch
				W96°24.830		humid	*triseriata*			of rain earlier
							Bufo americanus	1		perfect amphib weather
6/29 2001	9:30	Rock	51 and 21 intersection	N43°47.680	cattail marsh		*Pseudacris*	1		
				W96°25.966	flooded field		*triseriata*			
							Bufo americanus	1		
6/29 2001	9:35	Rock	51, 3mi south of 269	N43°46.608	flooded creek		*Pseudacris*	3		
				W96°25.466			*triseriata*			
							Bufo americanus	3		
6/29 2001	9:40	Rock	7 and 51 intersecttion	N43°45.702			*Pseudacris*	1		
				W96°25.956			*triseriata*			
							Bufo americanus	2		
6/29 2001	9:45	Rock	51 and 23 intersection	N43°44.869	flooded field		*Pseudacris*			
				W96°27.015	ag runoff		*triseriata*	2		
6/29 2001	10:00	Rock	s of 23 and 20	N43°22.423	ephemeral pond	storms	*Pseudacris*			
			mile marker 8	W96°25.928	east of 23	wind	*triseriata*	1		
							Bufo americanus	2		
6/30 2001	11:30 P.M.	Rock	6 north of Beaver Creek	N43°37.370	ag runoff	heavy	none			
				W96°21.136		rain				
7/1 2001	daytime	Rock	south on 23	N43°47.665	ag runoff		none			potential spadefoot site
				W96°24.140	west of 23					
6/28-30 2001	night	Rock	Split Rock Creek		lake		*Bufo hemiophrys*	1		
			State Park							

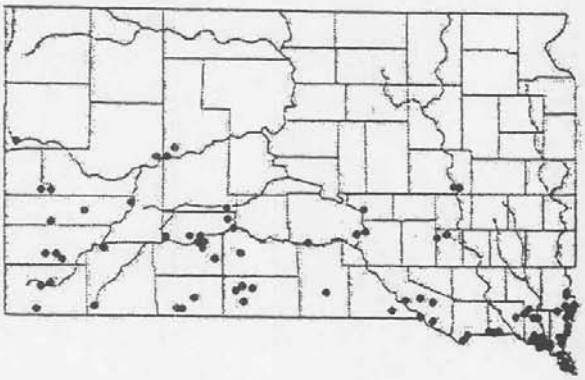
Figure 3. Species distributions in South Dakota from Ballinger et al, 2000 (left) and Fisher et al, 1999 (right)

15. *Spea bombifrons* (Plains Spadefoot Toad)

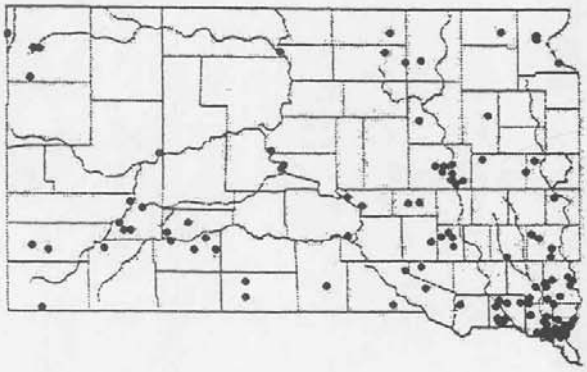


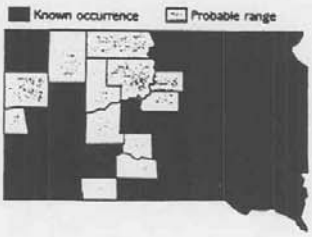


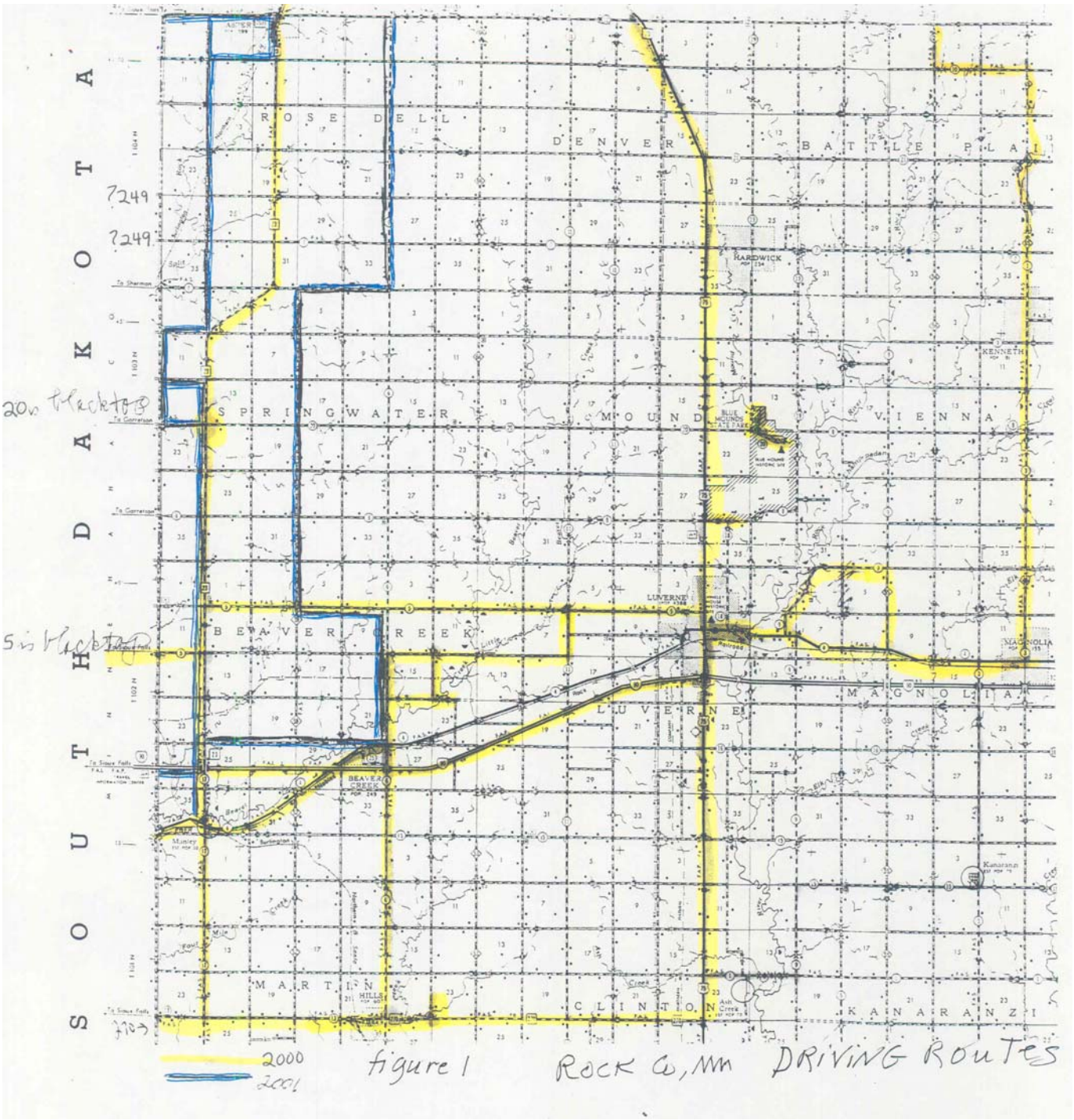
7. *Bufo woodhousii* (Woodhouse's Toad)



5. *Bufo cognatus* (Great Plains Toad)






SOUTH DAKOTA
ROSE DELL
DENVER
BATTLE PLAI
SPRINGWATER
MOUND
VIENNA
BEAVER CREEK
LUVERNE
MAGNOLIA
MARTIN
CLINTON
KANARANZI
HARDWICK
KENNETH
7249
7249
2000
2001
figure 1
ROCK Co, MN DRIVING ROUTES

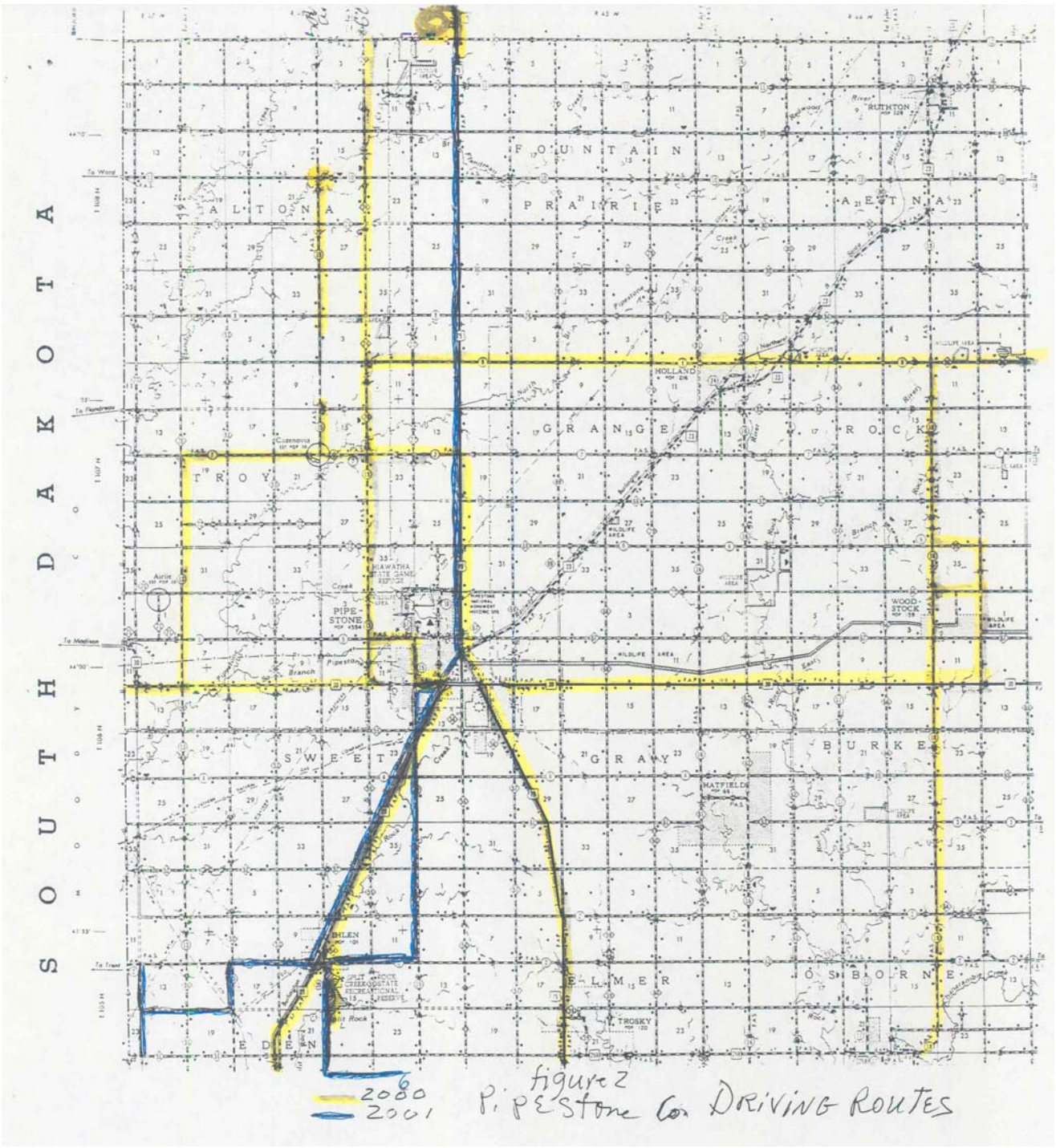


figure 2
Pipestone Co. Driving Routes