

All location information has been removed from
this document to protect Minnesota's Timber
Rattlesnake populations

Conservation Biology Research Grants Program
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Division of Ecological Services
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**Timber Rattlesnake Reproduction at XXX
(2000 - 2002)
Minnesota**

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BACKGROUND AND SUMMARY

XXX ecosystem appeared to support the largest timber rattlesnake population on state land in Minnesota a decade ago. Comprehensive field surveys conducted in southeastern state parks in Goodhue, Wabasha, Filmore, Winona, and Houston Counties during 1990-1991, and later surveys in 1998 in Olmsted County, yielded data, which supported this proclamation. Timber rattlesnake reproduction in XXX, from 1992 –1997, had been previously confirmed by sporadic observation of neonates with maternal females, primarily at two sites; A1 and A2. Visual observation and recording the location of litters, number of litters, and the number of neonates per litter is an effective, noninvasive, method of monitoring timber rattlesnake reproduction. Timber rattlesnakes reproduce at approximately a 3-year cycle in northern latitudes, and formal monitoring of these XXX sites, over a time period which encompassed this 3-year female Timber Rattlesnake reproductive cycle, had not been previously attempted. Reproduction monitoring at A1 and A2 has now been completed for the consecutive three-year (2000 – 2002) period with rookery and hibernacula at each site having been surveyed 2-3 times during the active seasons. Since neonates remain with their maternal females for 10 – 14 days following birth and, given the three-year time-window study period, the number of surveys per site, specific timing of seasonal surveys, the confirmation of reproduction during the study period was probable. It was anticipated that optimal reproduction at the two study sites would have yielded annual observations of reproduction, while minimal reproduction would have resulted in only a single observation of reproduction at each site over the three active seasons. It was hoped that the overall viability of each den complex could be assessed. However, surveys made during favorable conditions resulted in no observations of Timber Rattlesnakes at A1 during any of the 2000-02 seasons. Concurrent surveys of A2 resulted in the observation of only four adult *Crotalus horridus* with the finding of only a single gravid female in August/September, 2002. Collectively, the results of the current survey support the conclusion that there has been a substantial decline in the Timber Rattlesnake population at A1 and A2 in XXX. Furthermore, recruitment of newborn snakes into the remaining population is minimal if not nil. Insults to Timber Rattlesnake habitat were observed at A1 each season during surveys, and they were the direct result of malicious human behavior. There is no doubt that this behavior has impacted the Timber Rattlesnake population. The negative findings of the current study demonstrate a profound loss that should serve as a driving force to increase conservation efforts for the Timber Rattlesnake in Minnesota. Protection of habitat, prevention of human intrusion and collecting, increased vigilance and surveillance, and appropriate land management should be of highest priority if the Timber Rattlesnake is to survive in the state of Minnesota.

OBJECTIVES

Monitor Timber Rattlesnake reproduction at two sites in XXX 2000 -2002

- 1) To determine and define the calendar time-window during which Timber Rattlesnake birthing occurs at A1 and A2.
- 2) To determine the frequency of Timber Rattlesnake reproduction at A1 and A2 over three consecutive active seasons (spring-summer-fall 2000-02).
- 3) To determine the number of Timber Rattlesnake litters birthed, and number of newborns per litter during each of three consecutive active Timber Rattlesnake seasons (spring-summer-fall).

METHODS

Survey Sites – Two sites in XXX, Minnesota where Timber Rattlesnake reproduction had been previously documented were monitored: A1 and A2 (*please note that exact location data has been removed from this document*).

Survey Times & Frequency – Three to five separate surveys of Timber Rattlesnake habitat on A1 and A2 were made during each spring (1 May through 15 June) and each of 3 consecutive birthing seasons from 12 August through 15 September (birthing period in Minnesota; Oldfield and Moriarity, 1995) in the years 2000, 2001, and 2002.

Spring and early summer surveys were made to increase the possibility of finding potentially gravid females and possibly yearlings (young born the previous season). Surveys were thorough and exhaustive, with detailed attention given to specific habitat such as small rock outcrops, crevices, and superficial rock structure in basking areas. Peripheral wooded borders to the bluff prairies were also carefully surveyed. Late-summer surveys were made to determine evidence of birthing.

Survey Method - surveys were made on foot by traversing the bluff prairie areas from their crown working downward to their base. Hibernacula and rookery areas were thoroughly monitored without disruption of habitat features. Snakes were only disturbed for documentation of gravid status. The following data were recorded.

- I. Location
- II. Weather conditions and temperature
- III. Date
- IV. Habitat (condition)
- V. Timber Rattlesnakes observed
- VI. Gravid status
- VII. Number of neonates
- VIII. Other species of snakes observed

RESULTS

Survey/Summary – Tables I – III

A1 and A2, were surveyed on seven separate occasions (A2 4 and A1 3) during the early part of the active seasons, 2000-2002 (May 15 – June 8). During the reproductive interval of the same years (August 12 – September 14), A1 and A2 were surveyed nine and eight separate times respectively. A total of 6300 miles was traveled and 108 field man-hours (actual time spent surveying for snakes) were logged over the three-year study period, resulting in the observation of no Timber Rattlesnakes at A1 and four adult *Crotalus horridus* at A2. Three other species of snakes were also observed during field surveys: *Pituophis catenifer*, *Thamnophis sirtalis*, and *Lampropeltis triangulum*. Observations of *Pituophis catenifer* were only at A2, and the snakes were all large adults, 5.5-6.0 ft. in length.

During a survey of A1, May 30, 2001 evidence of habitat destruction was noted. Large rocks had been levered out of the hillside with the use of a 6-ft. x 4-inch diameter log with several areas on the slope damaged. Further signs of human disruption to rookery sites at the base of A1 were noted by trampled and broken vegetation, specifically around the den crevice areas and rookery/basking rocks. Discarded empty water bottles were also found at these same sites. Later, on June 28, 2001 a comprehensive survey of the damage was made by representatives from SNA, Nongame Wildlife, and State Parks divisions. In addition, to surveying damage, there were also no observations of timber rattlesnakes, at rookery or den sites, despite favorable weather conditions at the time.

Of the four adult *C. horridus* observed during surveys, one was a gravid female found during the 2002 season. This female was seen on two separate occasions (August 25 and Sept. 13) at A2 and confirmed to be gravid by palpation (see Table III). Unfortunately, confirmation of the snake actually having given birth was not observed. There were no signs of timber rattlesnake reproduction seen at A1 during any of the three active seasons (no gravid or postpartum females were observed, adult shed skins, no newborns observed, or first sheds of newborns).

Climatic Conditions at Time of Surveys

Weather conditions at the time of May surveys were excellent with warm (20 - 25°C) and partially sunny to overcast skies, which followed previously cool rainy conditions. This usually results in snakes coming out to bask where they are readily observed. Late August and early September surveys were also done under optimal weather conditions for thermoregulation by gestating females with moderate humidity, no rain, low wind velocity < 10 mph, optimal air temperatures ranging from 25 – 30°C, and basking area substrate temperatures ranging from 26 – 31° C.

Habitat Conditions at Time of Surveys

Native Big Blue Stem was substantially evident on all slopes, with bittersweet and wild grape present around rocky crevices. At both sites ninebark and sumac were in abundance, if not in excess. Sumac has encroached on many of the crevice-rock and rookery rock areas used for basking. There was also extensive sumac and ninebark growth in general on the mid and lower portions A1. A2 had more growth on the periphery of the prairie area with thick growth about 1/3 of the way down from the crown. Despite these encroachments suitable habitat is still present at both sites, especially at A2.

CONCLUSIONS

- 1) Timber rattlesnake reproduction is minimal at A2, and appears to be nonexistent at A1.
- 2) Repeated intrusion and disruption of habitat by snake hunters/collectors may be the single most significant factor responsible for the decline in Timber Rattlesnakes at A1 and A2.
- 3) Off-cycle reproductive years, use of different basking/birthing sites, and alteration of habitat by management practices, either singly or collectively, have contributed to the reduction in Timber Rattlesnakes and their reproduction at the two XXX survey sites during the three-year study period.
- 4) Timing of surveys and random chances of Timber Rattlesnakes coincidentally, not being out in visually observable areas, or snakes utilizing other desirable habitat in the XXX may be possible reasons for the lack of sightings. However, given the repeated absence of snakes over the three-year period, and the limited findings during recent comprehensive spring surveys, these possibilities seem highly improbable.
- 5) Protection and surveillance of A1 and A2 is absolutely essential if the timber rattlesnake population at these sites (and probably in the entire XXX) is to recover.
- 6) Management practices (i.e. burning, cutting/clearing, herbicides) should be cautiously approached with respect to management of both the Timber Rattlesnake and its home range habitat.

DISCUSSION

The 2002 field season was the third consecutive survey season of the 3-year study (2000-2002). This final year yielded only a single case of observable evidence for potential timber rattlesnake reproduction at XXX. This was the finding of single gravid female at A2 in August/September. Thus, there remains great cause for concern about the remaining reproductive potential at A1 and A2. In addition, there were only three other Timber Rattlesnakes observed over the entire three-year period, and none was gravid. To put this into perspective one only has to compare the data from 1990 - 91 surveys (Keyler and Oldfield, 1992) at A1 and A2 with the 2000 - 02 survey data gathered from these sites. Data obtained at A1 and A2 during two active seasons in 1990 - 91 (May 12 - June 15) showed that a total of 72 field survey hours yielded 70 *Crotalus horridus* (A2 55 hrs/34 snakes; A1 17 hrs/36 snakes). The more recent data obtained during the three active seasons in 2000 - 02 showed that a total of 108 field survey hours yielded 4 *Crotalus horridus* (A2 52 hrs/4 snakes; A1 56 hrs/0 snakes). Based on these comparisons, the data suggest a decline of > 90% in the populations at these sites over the past 10 years. Furthermore, there were the random observations at A1 and A2 of six Timber Rattlesnake litters from 1990-97 when surveys were not specifically focused on reproduction efforts at these two sites (see Table IV). In stark contrast, the specifically focused efforts to confirm reproduction during the current three-year study yielded the finding of only a single gravid female compared to the finding of twelve gravid females during two-year 1990-91 surveys. Thus, the results of the current three-year study, at these two previously prime Timber Rattlesnake sites in XXX, are devastating. Explanations for this drastic decline must be carefully evaluated and appropriate actions considered.

Intrusion by humans in general, as well as snake collectors/hunters, is a major concern. A1 is a site with a reputation, and historically is known as a site where rattlesnakes were taken from for bounty. Today, this knowledge still lives on in the minds of local people. However, since A1 is a protected area today, it was

surprising that the selective disturbance of habitat by snake hunters was evident at the time of each visitation to the Bluff. Rocks had been dislodged from the slope, and vegetation trampled around crevices. Water bottles were found discarded around den areas as well as remains of recent campfires indicating repeated visitation to the sites and probable attempts to remove Timber Rattlesnakes. In the past, one individual is known to have taken four timber rattlesnakes off A1. Although this individual was requested to return the snakes to the site, it is unknown if the snakes were actually released back to A1. This individual was caught purely by chance during field surveys in August of 1991, and it is likely there had been, or have been, repeat forages into the site since that time. Two outside opinions concerning the potential impact of these findings, were solicited from well-known timber rattlesnake researchers; W.H. Martin (Harpers Ferry, WV) and Dr. Howard Reinert (Trenton, NJ). Martin believes that, with a moderate amount of effort to collect snakes (3-4 site visits/yr), that possibly all the adult females could be taken in a 3-4 yr period, and about 2/3 adult males could be taken. In colder climates den colonies tend to be further spaced apart (3 miles or more), which makes a given site an easy target with limited potential for repopulation (personal communication, W.H. Martin, 2001). He further states that the site possibly may recover over an 8-10 year period if left alone. Dr.Reinert suggests that it is difficult to eradicate timber rattlesnakes from an area in 2-3 yrs (the decline reported herein was observed over 10 years) because the bulk of the adult population forages in areas where they are extremely difficult to find with only a small number using the basking areas at any given time, and these are the ones likely to be collected (personal communication, Howard Reinert, 2001). Either, or both, of these scenarios may be possible, and both imply a serious problem given the repeated evidence of snake hunters working the areas. Given the relatively restricted geographic confines of XXX, due to major highway or road boundaries on three sides, XXX is a fairly small area that can easily be accessed by snake hunters. This is in contrast to much larger geographic areas in the eastern United States, such as the Appalachians and the Shenandoah Valley, which are not as tightly restricted in space. The Timber Rattlesnakes inhabiting these regions are remotely distributed, and their habitat is not easily accessed by humans. Thus, the local problem with the “human factor” is important, and makes the possibility of Timber Rattlesnake eradication in XXX a legitimate concern.

Utilization of other “XXX sites” for basking and birthing is a possibility that has been considered as a reason for the lack of Timber Rattlesnake observations at the two study sites. Gravid females, and all other Timber Rattlesnakes, which were originally utilizing habitat at the two sites may possibly be using other basking areas, which may have become more desirable. Reinert states; “ a clear-cut gets made and a formerly good basking area gets quickly forsaken in a matter of 1-2 years for the clear-cut, even though it may be a greater distance from the overwintering hibernaculum” (personal communication, Howard Reinert, 2002). However, results of comprehensive daily field surveys (May 23 – June 7, 2002) of twelve separate sites in XXX, which involved 112 field survey hours, resulted in the finding of only three *C. horridus* (Keyler and Oldfield, 2002). Again, this does not support the likelihood of snakes having left A1 or A2 for other sites at XXX. Surveying of other areas in XXX and its periphery will continue in 2003 to further confirm or rule out the possibility of snakes having shifted to other sites. The likelihood of snakes having moved to more remote or distant favorable sites is also improbable as highways bound the XXX on three sides, which serve as major barriers to any significant movement.

Habitat disruption of rattlesnake travel corridors and associated bluff prairies can occur due to conservation management practices. XXX management practices over the past decade, which have involved controlled burns of bluff prairies and timber cutting in travel corridors, may also be factors affecting the Timber Rattlesnake population? However, as Reinert pointed out these activities may enhance habitat in some instances. These measures may have unintentionally disrupted the utilization of rookery habitat at the study sites, the breeding and reproductive cycle at the survey sites, or disrupted movement patterns through regularly used travel

corridors between the two sites forcing snakes to use other sites for basking and birthing. Again, the results of recent comprehensive surveys during the spring 2002 suggest that snakes are not utilizing other habitat areas in the XXX.

The primary focus of the study was to determine the timing and frequency of the Timber Rattlesnake reproduction cycle at A1 and A2 and to quantitate reproductive efforts at these sites. To maintain a viable population sexually mature females are essential. The observation of only a single gravid female at A2 and A1 together sites during the current three-year study, pales in comparison to the thirteen documented in the 1990-91 surveys at the same sites. The thrust of this comparison is that the number of adult reproductive age female Timber Rattlesnakes at these sites has declined significantly over the past ten years. From a biological perspective, since there had been no reproduction observed the first two study seasons (2000-01), and it is believed that timber rattlesnakes reproduce on a triennial cycle in this northern latitude, the observation of a gravid female at A2 during the third study season (2002) supports the possibility of a triennial reproductive cycle. However, in view of the fact that it was only a single gravid female, observed at a single site, makes this possibility of great uncertainty. Data from previous surveys of the two sites, made between August 1 and September 15 (the optimal time-window of birthing), during the years 1990 – 1997, when compared to the 2000-02 seasons (Table IV), suggests a lack of reproduction in recent years, and that Timber Rattlesnakes may no longer be present at A1, and that a very limited number of snakes remain at A2. Annual seasonal comparisons over the past decade for A2 show reduced observations of snakes and reproduction in recent years, but do reveal a three-year reproduction cycle as litters were observed in 1990, 1993, and 1996. No surveys were made in 1998-9 and it is unknown if birthing occurred during these years? However, given the finding of a gravid female during the 2002 season (the third year of surveying and the end of a three-year cycle of surveying), the possibility of triennial reproduction cannot be completely excluded at A2. (See Tables III and IV). The birthing of litters, previously observed at A2, 1990 -96, had occurred in late August and early September. This timing in conjunction with the finding of the gravid female at A2 in August/September 2002 is consistent with the birthing period reported by other Timber Rattlesnake researchers in the United States.

In conclusion, of all the possible reasons discussed, which may provide some explanation for the observed decline in Timber Rattlesnake numbers and reproduction at XXX, the only one for which there has been repeated objective documentation, is that of human interference at the two study sites.

RELEVANT LITERATURE:

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TIMBER RATTLESNAKE REPRODUCTION STUDY - XXX – 2000 - 2002
FIELD DATA

Table I Field Data 2000

Date	#Pers	Fld hrs	Mileage	Site	Cty	Twshp-R-Sec-1/4sec	Species	Sex
5/15	1	2	450	A2			C. horridus	0.0 A
							C. horridus	2 yo
8/12	1	3	450	A2			0	0
8/13	1	4		A1			shed T. sirtalis	0.0
8/19	1	3	450	A2			0	0
8/20	1	4		A1			0	0
9/10	1	3	450	A2			C horridus	0.0
							shed P. catenifer	0.0
9/10	1	4		A1			shed L triangulum	0.0
Totals		23 Fld hrs	1800 miles					

Total C. horridus 2000: A2, 2000 = 3 A1, 2000 = 0

Table II Field Data 2001

Date	#Pers	Fld hrs	Mileage	Site	Cty	Twshp-R-Sec-1/4sec	Species	Sex
5/27	3	6	450	A2			0	
5/29	3	6	450	A2			0	
5/30	2	7		A1			0	
6/28	7	2	450	A1			0	
8/20	1	3	450	A2			0	
8/20	1	3		A1			0	
8/28	2	6	450	A2			0	
	2	6		A1			L. triangulum	0.0
9/4	1	4	450	A1			T. sirtalis	0.0
							L. triangulum	0.0
	1	3		A2			0	
Totals		46 hrs	2700 miles					

Total C. horridus 2001: A2, 2001 = 0 A1, 2001 = 0

Table III Field Data 2002

Date	#Pers	Fld hrs	Mileage	Site	Cty	Twshp-R-Sec-1/4sec	Species	Sex
6/8	2	6	450	A2			0	
6/8	2	7		A1			0	
8/25	2	5		A2			C. horridus	F(grav)
8/25	2	6	450	A1			0	
9/1	2	7	450	A1			T. sirtalis	0.0
9/13	2	6	450	A2			C. horridus*	F*(8/25)
							P. catinefer x 3	0.0
9/14	2	6		A1			0	
Totals		43 hrs	1800 miles				F* same as found on 8/25	

A2 = A2, A1 = A1

Total C. horridus 2002: A2, 2002= 1 A1, 2002 = 0

Table IV.**Chronology of Timber Rattlesnake & Litter Observations at A1 and A2 During the Reproductive Period 1 August to 15 September 1990 - 2002**

Year	Site	Fld Hrs	# TR adults	Hrs /TR	# litters	Hrs /litter
1990	A2	19	9	2.1	1	19
1991		14	3	4.6	0	
1993		4	2	2.0	1	4.0
1996		6	1	6.0	1	6.0
2000		9	1	9.0	0	
2001		9	0	0	0	
2002		13	1	13	gravid F*	NC
1991	A1	9	11	0.8	2	4.5
1995		5	1	5.0	1	5.0
1997		8	1	8.0	0	
2000		12	0	0	0	
2001		13	0	0	0	
2002		19	0	0	0	

A2 = A2 A1 = A1 *gravid female observed but birthing not confirmed (NC)