Timber Rattlesnake (*Crotalus horridus*) Biology and Conservation in the Upper Mississippi River Valley[1]

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Photographs by Barney Oldfield, www.lizardsandlandscapes.com

Excerpts from Abstracts.[2]

Why a Symposium About Timber Rattlesnakes?

Why the concern about a venomous species of snake that shares home-space with humans in states along the Upper Mississippi River? … [S]tudies reveal and confirm that the species is losing its foothold along the Upper Mississippi and its collateral river-bluffland corridors.

Timber Rattlesnakes once ranged from southern Maine to Florida and westward to Minnesota and Oklahoma, down to Texas.…

Timber Rattlesnakes were probably the first venomous snake encountered by early settlers during their forays into the forests and mountains of eastern North America. One of the earliest explorers to our region, Father Louis Hennepin, noted rattlesnakes as "*serpens sonnettes*" in his travel log during his Upper Mississippi voyage in 1680. Shortly thereafter, in 1700, Leseur mentioned the potential "danger" of rattlesnakes in the caves around Lake Pepin. Two centuries later, the impact of increased human settlement along the Mississippi on Timber Rattlesnakes could be read about in local newspapers. One such article reported the killing of hundreds of "rattlers" in a single day at Minnesota's Cedar Creek Bluffs (*The Winona Daily Republican-Herald*; August 16, 1913). Similar events occurred at other sites along the Upper Mississippi Valley, and human fear regarding this abundance of dangerous rattlesnakes led to the implementation of a bounty system that served as an economic incentive for the killing of Timber Rattlesnakes. The bounty system provided a viable source of income for some individuals during years of hard economic times, and thousands of Timber Rattlesnakes were killed. Their heads and rattles were turned in for a fee. Bounty systems were eventually repealed in Wisconsin and Minnesota, but not until 1975 and 1989, respectively.

Amazingly, for three centuries following the arrival of settlers, the Timber Rattlesnake has managed to persevere despite the continuous loss of its habitat to agriculture, the dissecting of its habitat with roads, encroaching housing developments in recent decades, and depredation by man. One cannot deny that

[1] Limited quantities of the complete program with extensive "abstracts" and color photographs are available from Zoo Book Sales (zoobooks@acegroup.cc) or visit their website: www.zoobooksales.com.

[2] Daniel Keyler's introduction is presented verbatim, with excluded sections indicated by "…" Abstracts are summarized and occasionally paraphrased for brevity.

An old adult male Timber Rattlesnake (*Crotalus horridus*) from Houston County, Minnesota.

An adult male Timber Rattlesnake (*Crotalus horridus*) from Houston County, Minnesota, showing classic sulphur coloring, black chevrons, velvet black tail, and tan rattle.

the Mississippi's bluffs and valleys, which have been the Timber Rattlesnake's home for thousands of years, represent some of the most beautiful landscapes in the country. However, the constantly increasing interface between Timber Rattlesnake habitat and humans has gradually taken its toll on the rattlesnakes over time, and loss of Timber Rattlesnake habitat is accelerating.

Mutual coexistence between humans and rattlesnakes is complex, but is essential if the Timber Rattlesnake is to retain its place in the Upper Mississippi River Valley ecosystem…. If true conservation of this species is not achieved in the near future, the Timber Rattlesnake will fade from the Upper Mississippi River Valley, becoming a legend of the past.

Daniel E. Keyler

Some Notes on Phenology, Reproduction, and Winter Biology of Timber Rattlesnakes in Wisconsin

Since 1999, Timber Rattlesnakes at several Wisconsin den sites have been monitored with radio transmitters [see *Iguana* 12:90–97]. Three records of snakes emerging in early April may have involved animals that were ill. The latest recorded den ingress was 19 October.

Snakes moved within winter dens, reaching their deepest penetrations during December and January. Lowest body temperatures occurred from late March to early April. Movement toward the den entrance began at about that same time.

Seven females monitored over five years produced 15 clutches. Mean interval between clutches was 3.14 years (range 2–5 years). The earliest recorded birth was 30 August, the latest occurred in early October.

Craig Berg

Reproduction at a Northwestern Illinois Timber Rattlesnake Rookery

Since 1991, monitoring a Timber Rattlesnake rookery in northwestern Illinois has generated the following data: (1) Gravid females arrived between 29 April and 21 July. (2) Postpartum female departure ranged from 22 August to 30 September. (3) Earliest neonate appearance ranged from 19 August to 15 September. (4) Latest dates for neonate emergence ranged from 28 August to 12 October. (5) Litter sizes ranged from 5–11 (total of 106 births observed to date). (6) Of 18 reproductive cycles, 13 (72.2%) were 2 years and 5 (27.8%) were 3 years (mean = 2.28 years). Two females had both 2-year and 3-year cycles. (7) For 22 females, 10 (46%) gave single births during the monitoring period, 8 (36%) gave birth twice, 2 (9%) gave birth 3 times, and 2 (9%) 4 times. (8) Many gravid females depart from the rookery prior to parturition and give birth at undetermined locations. One such location was about 30 m upslope from the rookery den. Additional observations included: One mating event on 22 August 2001 in the vicinity of the rookery; interactions between neonates and mothers, including cloacal posturing with scent ejection; interactions between gravid females, non-gravid females, and males; rain-drinking by gravid females; and molting.

Habitat modification by burning and cutting around the rookery resulted in the creation of an additional rookery that was utilized by females from the original rookery. Such practices might be used to restore historical basking/gestating/birthing sites in blufflands that have become overgrown and shaded and are no longer used.

Brian Bielema

Long-term Field Studies of the Timber Rattlesnake: What Has Been Learned?

A series of dens in the southeastern Adirondack Mountains of New York have been under continuous study since 1978. Resultant data and on-going conservation efforts allow this system to serve as a microcosm of approaches taken to protect and manage Timber Rattlesnakes anywhere in their range.

Den populations vary from 42–558 new individuals captured over a 25-year period. Although not population size esti-

mates, the data suggest a wide variation in numbers of snakes using dens. Shifts between dens are rare. Estimated survival rate in field-born snakes was about 65% in the first year, whereas adults (5+ years old) survived at about 90% per year. Recapture intervals of 22 and 23 years for snakes released initially as adults (at least 10 years old when marked) suggest a natural lifespan that approaches 35 years.

Five major range segments correspond to ecoregions. These divisions may deserve targeted conservation attention based on particular biological features associated with each region and its subdivisions. Varying parameters of snake biology can guide efforts within a management unit. For example, in the New England Upland management unit (where the current study is taking place), the snake is characterized by high adult survival rates, low rates of reproductive performance brought on the decadal span necessary for female maturity, and exceptional longevity in some individuals. In contrast, snakes in the Southeast Atlantic-Gulf Coastal Plains management unit would require different strategies because adult survival rates may be lower, reproductive performance higher or shifted to younger age classes, and shorter longevity. Some management plans should therefore stress steps to enhance survival, others to enhance reproduction. Enhancing longevity might be achieved by legal protection coupled with vigilance. To reflect such regional variations, a national Timber Rattlesnake Conservation Action Plan (TRCAP) was developed ten years ago. The chief goal of the plan has been to produce a major synopsis of the historical and current distribution, threats, and management options authored at the state level by recognized authorities. Those involved in TRCAP are hopeful that this plan will become an exemplary model of a comprehensive conservation strategy for the Timber Rattlesnake. Certainly, it is one of the first for any reptile in North America.

William S. Brown

A History of Timber Rattlesnakes in Winona County, Minnesota

Detailed petroglyphs of rattlesnakes were traced by Theodore Lewis in the 1880s from a cave in La Moille and artifacts from a nearby rock shelter were attributed to the Woodland Tradition (~2500–1000 years before present). Unfortunately, the petroglyphs are no longer extant. Tales from the 1800s tend to emphasize the size of individual snakes and the sheer number of snakes that were destroyed at certain localities. The most celebrated characters in the history of human interactions with rattlesnakes were the bounty hunters of the 1900s. "Black Bill" Venzol of Elba would bring rattlesnakes to the old schoolhouse for the children to see, Raymond Carter of Pickwick caught 86 rattlesnakes from one spot in a single afternoon during the Great Depression, and, across the border in Fillmore County, Arnold Rank killed over 2000 rattlers during his long career. Fortunately, times have changed. The bounty has been eliminated, and bounty hunters have been replaced by rattlesnake responders who remove nuisance snakes from yards and relocate them to more natural habitats within their home ranges.

Philip A. Cochran

A Timber Rattlesnake raising its head in response to the approach of the photographer (Winona County, Minnesota).

An adult female Timber Rattlesnake in a rock cranny with neonates, which will stay with her up to two weeks. Note the opaque eyes of the neonates prior to their first shed (Houston County, Minnesota).

Timber Rattlesnake Work with Private Landowners in Minnesota

Triggered by increased frequencies of human-rattlesnake encounters, the Minnesota Department of Natural Resources (MN DNR) has been working with private landowners in southeastern Minnesota on bluff prairie management and Timber Rattlesnake management. The main reasons for increased encounter rates are degrading habitat, habitat fragmentation, and encroaching land development.

The Timber Rattlesnake was listed as a threatened species in Minnesota in 1996. Its range once covered all of the bluff counties along the Mississippi River. Today, the active range is reduced to remnant populations in Goodhue, Olmsted, Wabasha, and Winona counties, with larger populations in Fillmore and Houston counties — with most on private lands. Many once active den sites are extirpated, and many currently active dens are in jeopardy of extirpation.

Restoration of habitats involved clearing cedar-infested bluff prairies in critical snake habitats. Initially, efforts were successful, but slow, affecting only a few acres at a time. A new federal program created by Congress in 2002, the Landowner Incentive

Program (LIP), administered by the U.S. Fish & Wildlife Service, allocates funds to assist states in working with private landowners on "at risk species." LIP funds help landowners implement management practices that maintain, enhance, or restore habitats that benefit bluff prairie "at risk" species. Practices include cedar removal, invasive species control, and prescribed burning.

Jaime Edwards and Dave Spiering

Status of Timber Rattlesnakes in Wisconsin

Wisconsin Timber Rattlesnake populations appear to be significantly reduced from historic levels. Human persecution, including a county-administered bounty system, has been a major contributing factor. Records indicate that hunters targeted gravid females, accelerating the population declines by restricting recruitment. Other factors include den destruction and habitat loss to agriculture. In recent years, natural succession has resulted in overgrowth of prairies, specifically contributing to degradation or loss of overwintering or rookery sites.

The state has outlined a four-tiered approach to conservation that will be implemented as funding allows. One element is an educational program for rural landowners called "Rare Snake Workshops." These help promote conservation of four prairie- or bluffland-dwelling snakes, including the Timber Rattlesnake. As of summer 2005, 58 workshops have been conducted. Each addresses how to safely handle and move venomous snakes, why habitat management is necessary, and the Department of Natural Resource's nuisance control program.

Additional conservation efforts include surveys to identify and protect hibernation sites and support of research to better understand this snake in Wisconsin.

Robert Hay

Timber Rattlesnake Bites in the Upper Mississippi River Valley

Two species of rattlesnakes, the Timber Rattlesnake (*Crotalus horridus*) and Massassauga (*Sistrurus catenatus*) are native to the Upper Mississippi Valley. Bites, albeit rare, do occur. Prior to 1880, 70 cases of venomous snakebite were reported in Wisconsin. Twelve were fatal, five victims were men, four were children, and three were women. Literature records indicate that 15 bites occurred in Wisconsin from 1958–59, but only four in Minnesota.

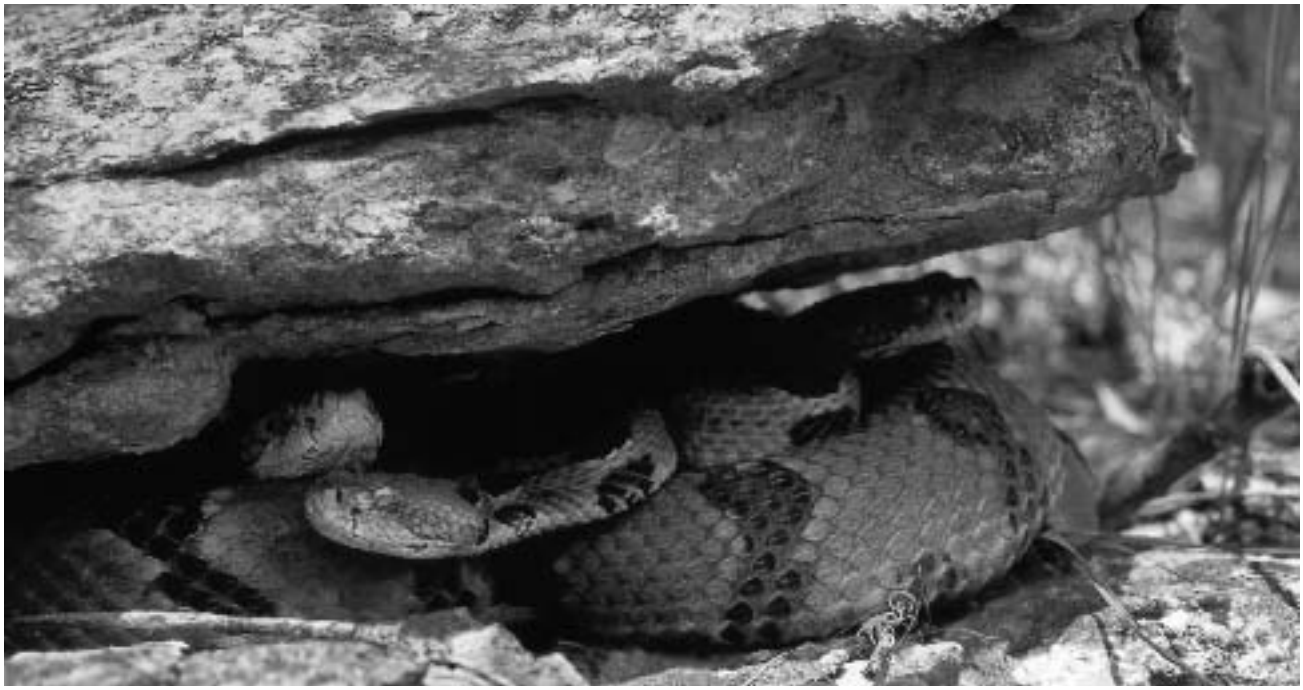
More recent records show 36 cases of rattlesnake bite, involving eight different species, in Minnesota, western Wisconsin, and northeastern Iowa from 1982–2002 (1–2 bites per year). Timber Rattlesnakes were responsible for 27 bites, with 15 in Minnesota, seven in Wisconsin, and five in Iowa. All bites occurred between April and October. Fewer than half (44%) were naturally occurring bites; the rest resulted from deliberate human manipulation of snakes. Most victims were males (81%) and the average age was 33 ± 12 years. All victims were evaluated in a medical facility, only 12 were hospitalized. Fang punctures were evident in all patients, but symptoms of envenomation were absent or minimal in 52% of victims. One instance of intravenous envenomation was fatal. Venom-induced effects were profound and occurred rapidly. Antivenin was administered to 11 patients, two had surgery, and average hospital stay was 3.5 days.

Daniel E. Keyler

Timber Rattlesnakes in Northeastern Iowa

Timber Rattlesnakes occur in northeastern, southeastern, and small areas of central Iowa. Little information exists in the liter-

A very large adult male Timber Rattlesnake with a complete (tan) rattle and a black basal segment (Fillmore County, Minnesota).



A trio of male Timber Rattlesnakes at spring emergence. This site was destroyed by snake hunters later in the same season. Den rocks were dislodged from the bluff, and several crushed Ringneck Snakes (*Diadophis punctatus*) were all that remained. The den has not been used since (Pierce County, Wisconsin).

ature regarding the species in the state and unpublished surveys provide insubstantial baseline data. Consequently, trends are difficult to quantify.

Variations in morphology encompass the full range of what is expected in the Upper Mississippi Valley. Ground color ranges from golden yellow to tan or brown. A rust-red middorsal stripe is almost always present, but may vary in intensity, especially posteriorly. "Bow-tie" markings are common and often become full bands toward the tail. Entirely gray specimens are known, but are uncommon.

Emergence begins in late April to early May. Autumn staging is initiated in late September; ingress occurs by mid-October. Individuals have been observed basking in mid-April, but those animals usually show signs of dermatitis. Most adult males and non-gravid females appear to migrate to summer feeding sites 7–15 days after first emergence. Gravid females select den sites, rock crevices with significant depth or large loose rocks, as rookeries. Neonates to two-year olds seem to prefer loose rock in small forest patches in or at the edge of prairies.

Reproductive data are scant. Nothing is known of courtship or mating. Females produce litters at least biennially or triennially. Parturition usually occurs in late August or early September, peaking during the first week in September. Litter sizes range from 5–12, average of 8. Neonates range from 257–348 mm in total length; average is 344 mm.

Bounty records from 1925–1952 show an obvious decline in numbers, and conversations with bounty hunters indicate a decline in snakes rather than a reduction in efforts to catch them. Timber Rattlesnakes were unprotected in Iowa until 2001 (the only other reptile unprotected in the state was the Garter Snake. Recent revisions of rules now protect Timber Rattlesnakes in 12 counties of eastern and southern Iowa.

Jeff LeClere

Velvet Tails of the Blufflands: Field Observations and Anecdotal Information

Over 22 years, I have searched and searched, found timbers, not found timbers, photographed more than several, molested many gathering biological information, answered a few intriguing questions, and pondered numerous riddles of Timber Rattlesnake biology. Den areas are found in limestone and dolomite outcrops, rookery sites in limestone and sandstone, and summer pastures in hardwood forests and bluff prairies. With others, I have documented egress and ingress dates, average and maximum sizes of males and females, color variation, reproductive dynamics, maturity, longevity, frequency of shedding, and behavior. Also during this time, the battle to remove the Minnesota bounty was won, and the Timber Rattlesnake was subsequently given legal protection in both Wisconsin and Minnesota. However, in Minnesota, with this revived emphasis, poaching and anti-rattlesnake sentiment have grown.

Seldom are rattlesnake bites to large animals such as cattle and horses likely to be fatal, although facial and throat swelling that restrict airways may be a concern. Dogs and rarely cats may be bitten, most frequently in the head or front legs. Venomous snakebite that produces rapid swelling and pain should be considered serious, and the animal should be taken immediately to a veterinarian. The use of antivenin may be limited due to cost factors, but aggressive medical therapy including antibiotics, analgesics, and supportive therapy may be indicated.

A rust-colored middorsal stripe characterizes many Timber Rattlesnakes from the Upper Mississippi River Valley (Pierce County, Wisconsin).

The ultimate survival of "Velvet Tails" in the Upper Mississippi River Valley must be about habitat protection, public education, and a strictly enforced protective policy. Since reestablishing dens is not a reliable option, attention should be focused on known viable populations by providing relatively large expanses of minimally managed habitat.

Barney Oldfield

The Ecology and Conservation of the Timber Rattlesnake in the Agricultural Landscape of Central Iowa

Since 2002, we have focused attention on a den site in Madison County that appears to be healthy despite being adjacent to a busy highway. Data are based on over 100 snakes plus litters born in captivity from wild-caught females.

Monitoring about nine snakes implanted with radio transmitters per year, we found that, in 2001, 42% of snake locations were in edge/scrub habitats, 24% in woodland habitats, and 34% in grassy/open habitats. Average canopy cover was 60%. Madison County animals tended to have smaller home ranges and move shorter distances than rattlesnakes in eastern populations.

An effort to document time spent in agricultural fields and in natural versus disturbed habitats indicated that efforts aimed only at protecting rock outcrops used as hibernacula are doomed to failure if the entire range of the animals is not considered. One individual, for example, spent nearly an entire season in a field or along a fence line bordering a cow pasture. Much of the remaining habitat in Iowa is extremely fragmented and degraded, calling for conservation efforts on a landscape scale.

Jeffrey R. Parmelee and Paul W. Frese

Minnesota State Parks: Protecting Timber Rattlesnakes within an Ecosystem Management Framework

The Minnesota Department of Natural Resource's Division of Parks and Recreation is legislatively mandated to preserve presettlement natural features and communities as well as other natural, scenic, scientific, and historic features of significance. Given this mandate, the Division has the responsibility to preserve and perpetuate populations of Timber Rattlesnakes along with other rare species.

The historic range of the Timber Rattlesnake in Minnesota included eight southeastern counties that encompassed ten state parks. The current range has decreased to six counties with seven state parks. At least 37 historic den sites are known from those seven parks. Assuming a minimum viable population size of 25–45 snakes per den suggests that these parks once supported populations totaling about 1000–1600 individuals.

The bounty system in effect from 1909–1989 resulted in these parks being heavily hunted. The impact of wanton killing combined with vandalism of den sites and habitat degradation due to disturbances have caused significant declines in populations (>90% in one park). Rattlesnakes have been extirpated in three of the seven parks and populations in the other four have declined dramatically. Only about one-third of historically active den sites remain extant.

The Division's objectives for these parks are: (1) To restore or maintain native plant communities, and (2) to preserve or restore animal populations so that all native species for which reintroductions and maintenance are possible are present. Specifically, for Timber Rattlesnakes, the objectives are: (1) To restore sustainable populations to the three parks where the species has been extirpated, and (2) To restore and maintain existing populations at levels that are sustainable.

Since 2001, increased efforts to protect the species have been funded through the State Wildlife Grant program, with current work grouped into four main categories: Surveys and monitoring, protection, habitat management, and education.

Ed Quinn and Shawn Fritcher

Habitat Selection and Home Ranges of Wisconsin Timber Rattlesnakes in the Mississippi River Valley

Data collected from nine radiolocated Timber Rattlesnakes (4 males, 3 females, 2 juveniles) and 353 subsequent observations (132 male, 129 female, 92 juvenile) reveal that all three groups were found in secondary woodland more than expected by chance (19% female, 24% male, and 39% juvenile versus 13% expected). The greatest disparity was for use of prairie habitat (28% female, 2% male, 15% juvenile versus <2% expected). Sumac/dogwood/blackberry shrub also was over-utilized (13% female, 5% male, 11% juvenile versus <2% expected). Males were found most frequently in mature oak woods (39%), but less frequently than expected (43%). Males also utilized swamp woodlands (24%) at about the expected rate (25%). Marsh (3% female, 4% male, 0% juvenile versus 13% expected) and agricultural habitats (0% female, 1% male, 0% juvenile versus 13% expected) were under-utilized.

Richard A. Sajdak