

**A Reptile and Amphibian Survey**

**of**

**The Roaring Brook Wildlife Management Area  
in Vernon and Guilford, Vermont**

**2003**

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## Introduction

The purpose of this effort was to perform a herpetological survey of four parcels of Vermont state lands. The Roaring Brook Wildlife Management Area (WMA) in Vernon, the Narrows WMA in West Haven, Tinmouth Channel WMA in Tinmouth, and the Kulig-Spiegel addition to Bomoseen State Park in Hubbardton. The goals of the survey were to locate any rare, threatened, or endangered reptiles or amphibians that were using the parcels or might be using the parcels based on their location, habitat, and reports from adjacent areas. In addition, to determine and discuss any issues pertaining to the sustainability of their populations at those sites and recommend management strategies or additional survey work if warranted. Funding and hence effort were limited, so parcels and specific regions within some of the parcels were prioritized. Approximately 50% of the time was to be spent at Roaring Brook WMA with the remaining time divided between the other three parcels. I will here report on all reptiles and amphibians (herptiles) located or suspected at **Roaring Brook WMA** (Tables 1-3) paying particular attention to those with a Vermont State Heritage rank of S3 or lower. In addition, significant habitats and locations are noted and management suggestions given.

## Methods

No one method will inventory the complete range of reptiles and amphibians occurring in an area. A combination of methods must be employed over a variety of seasons. I used variations on six basic herp-survey methods over 15 days, starting fieldwork with salamander trapping on March 26 and 27, continuing with visits on April 29, 30, & May 1; June 4 & 5, June 30, July 1 & 2; July 22-24; September 18, and finishing in the field with a brief site check on October 9, 2003. I was always assisted by at least one field assistant, occasionally two interns, and during the June 30-July 2 visit, I had the help of a team of students and counselors from Vermont Audubon. The help of all these additional eyes, ears, and hands was significant and largely paid for out of other sources. As much as possible, visits were timed to be during the optimal window of opportunity to locate the widest variety of reptile and amphibian species in the area. It should be noted that not all priority areas were surveyed (Figures 1 & 2). In addition, reptile and amphibian species usually require multiple visits to the same site to locate them. Consequently the species lists for each community type are not necessarily complete. The species list for the entire WMA, however, should contain all widespread species and should be missing only a very few isolated and/or very rare species.

The six **herp-survey** methods used in this inventory are described below.

An active search is a concentrated effort in a predetermined area to locate reptiles and amphibians by raking leaf litter, looking under rocks and logs, looking within rotten logs or under any items, natural or unnatural, that provide moist and shady retreats during the day. This method was used on eight different days at a wide variety of sites. In addition some older searches in the area are also in the database.

A site check is a less localized form of active search that includes time spent searching for and traveling between the best microhabitats. This method was used on five different days at a wide variety of sites

A night-time road search consists of driving roads at a speed of 10-15 mph with the vehicle window open to hear calling anurans (frogs), and with eyes on the road and road margins to see herptiles crossing the route. Road searches were performed when the surface of the road was wet or the night was relatively warm and humid. When herptiles were heard or spotted, the car was stopped, the organisms identified and counted, and their locations noted. The small roads in and around the area made this a very useful survey method, and many amphibians were located during the night-time road searches. This method was used three times.



Salamander trapping involves the use of a series of unbaited minnow traps placed at selected locations in shallow water around the margin of potential breeding pools and swamps. It was used to locate frogs and salamanders that bred in pools in the spring. It is a very effective method for locating amphibians but is only useful during a narrow window of time (March-May). This method was used on one evening at three sites.

Turtle trapping was performed on a total of three nights at the two sites that seemed most likely to contain Spotted Turtles (*Clemmys guttata*). This was a very limited effort. Up to six 30-inch hoop traps with 1-inch mesh were baited with sardines and left for approximately 24 hours.

Interviews are useful in gathering important leads on areas where unusual or rare herptiles may be located now or were historically. We used data from seventeen interviews of residents who lived in the area.

In addition to the above methods I used records from the Vermont Reptile and Amphibian Database. As coordinator of the Vermont Reptile and Amphibian Atlas Project, all known records of Vermont herptiles current or historic are on a database on my computer. These records were accessed to check for all other records from the region and surrounding towns.

## Results

### Reptiles and amphibians located within the WMA

Nineteen species of herptile were located in the WMA: six species of salamander, seven species of frog (including toads), two species of turtle, and four species of snake. Sixteen of the nineteen species located are the most common of the S4 & S5 species. Three are S1-S3 species. All the species I located at the priority sites that were visited, along with the upland Beaver Pond and the Old Welcome Center, are shown in Tables 1 & 2. In addition, some reliable reports from Fish and Wildlife and Nature Conservancy staff are indicated in these two tables.

Also shown are other species we found outside the WMA and species that were reliably reported from Guilford or Vernon by others that may use the Roaring Brook WMA (Table 3). The communities and locations within the WMA that they are most likely to use (if at all) are also marked.

### Unusual species located within the priority sites

**Northern Watersnakes** (*Nerodia sipedon*) were found consistently at Vernon Pond. This is an S3 species that has a very spotty distribution in Vermont. This is one of only three sites where this species has been found in eastern Vermont. All of the sightings have come from Vernon. Most populations of this species are found in the Lake Champlain Basin.

### Unusual species located outside of the priority sites but within the WMA

The most unusual species was located outside of the priority areas at the Old Welcome Center along I-91. Using this site was a small group of **Eastern Racers** (*Coluber constrictor*). We located two live snakes, one dead one, and two shed skins of this species. This is the only vouchered report of this species anywhere in the state since 1985. There are a string of historic unvouchered reports from Vernon and Guilford either on or near the WMA. This is an **S1 species** that, largely as a result of this find, is now **proposed for listing as a threatened** species. I strongly suspect that it also uses other areas of the WMA. In particular the oak-hickory woods, the powerline, the floodplain south of the Old Welcome Center and the old septic field area north of the Old Welcome Center. Due to unverified



records from residents in the area, I suspect that it may use the Newton Road Marsh area on occasion. Residents at the Gaines Farm, due west of Old Welcome Center, used to see this species regularly in their fields and crossing roads but have not seen them for many years.

**Jefferson Salamander** (*Ambystoma jeffersonianum*) was also found outside of the priority areas. An adult was found crossing the road to the north of the WMA (Tyler Hill Road) and two egg masses were found in a vernal pool partly in the WMA (see Figure 3). This is an **S2 special concern** species with fewer than 10 reported locations in Windham and Windsor Counties. Biologists reported probable egg-masses of this species from the Gravel Pit Pond in 1988. I did not see any egg-masses of this species at this site myself. Others have also reported Jefferson Salamander from the Huckle Hill Road, Miller Swamp, and Tyler Hill areas east and north of the WMA. It seems to prefer rocky and pH neutral areas with semipermanent ponds and mature oak-hickory hardwoods. I did not see any ideal habitat for this species in the WMA, but I did not survey very many of the vernal pools.

#### Species found during this survey outside the WMA

**Fowler's Toad** (*Bufo fowleri*) was found during a night-time road search outside of the WMA. This is an **S1 species of special concern**. Its only current vouchered site in Vermont is the Stebbin's Road site (near the old Smead Lumber Company) in Vernon. This is about 1.5 miles north of the Fox Hill portion of the WMA. I don't believe this species strays far from the floodplain bottoms, so I think it is unlikely to use current WMA lands.

We located **Ring-necked Snakes** (*Diadophis punctatus*) outside the survey area west of the interstate along the powerline. This is a secretive S4 species. I strongly suspect that it uses the oak-hickory woods and the powerline right of way within the WMA as well.

#### Other species reliably reported from Guilford and Vernon but not located during our survey

Reliable reports of eight additional species were found from Guilford and Vernon in the Vermont Reptile and Amphibian Database. I did not locate any of these species within the WMA but they should be considered possibilities.

Dr. Ross Bell from UVM remembers a **Four-toed Salamander** (*Hemidactylium scutatum*) being collected in Vernon somewhere around 1970. The specimen could not be relocated. This is a small, **S2, special concern** species that has only been reported from approximately a dozen locations in the state. No other reports of this species come from the Connecticut River Drainage. It can be a difficult species to locate. If it uses the WMA, the most likely habitat would be the Black Gum Swamps, Large Pond and Marsh, or the Newton Road Marshes.

An **Eastern Ribbonsnake** (*Thamnophis sauritus*) from Vernon is in the UVM collection. George Shippee collected it in 1958. This is an **S2, special concern** species that has been located at approximately one dozen sites in the state. This species could be associated with emergent marshes, swamps, and vernal pools, at warm sites in the WMA. If it uses the WMA, the most likely locations that I visited were the Large Pond and Marsh area, the Beaver Pond area, the Fox Hill vernal pool, the Newton Road Marsh, or the Gravel Pit Pond area. We did not find any.

We did not find any **Spotted Turtles** (*Clemmys guttata*) on or near the WMA. These turtles are an **S1** species that is listed as **endangered** in Vermont. They have been well documented from Lily Pond and in the drainage that connects to the Newton Rd. Marsh to the north and east. At some point in the past they must have at least traveled through this portion of the WMA. We trapped this site and visited it specifically looking for them but they can be very difficult to find and may require a more sustained effort. They may also feed on egg-masses in the Fox Hill vernal pool during the early spring.



A **Wood Turtle** (*Glyptemys insculpta* formerly *Clemmys*) was reported from near the recreation center along Pond Road by a volunteer in 1998. It is a believable report but was not accompanied by a photo. The Wood Turtle is an **S3, special concern** species that is too wide spread to get protection under the current Endangered Species Criteria. However its habit of feeding on land and its attractiveness as a pet, put populations at risk. It may be using the low slope sections of stream draining east out of the WMA as wintering and mating habitat.

A **Spring Salamander** (*Gyrinophilus porphyriticus*) was collected from Guilford. This species likes cold, clear, well oxygenated, permanent streams. It usually is associated with high-gradient streams in large watersheds. We did not locate any along Roaring Brook but it could possibly be found in some of the streams flowing east off the WMA. It is an S4 species.

Jackie Gaines of the Gaines Farm in the valley just west of the WMA remembers seeing **Smooth Greensnakes** (*Opheodrys vernalis*) several years ago. Although this is an S4 species, I rarely find it and fear that it is declining. This species prefers dense annual vegetation such as pastures, sedge marshes, and early successional habitat. It seems to be found in areas that are not regularly cut and often in uplands. If it exists on the WMA, I would suspect that it would use the powerline right of way, or the open sedge and cattail portion of Newton Road Marsh.

Snakes in general are less numerous and more secretive than most amphibians and hence are easier to miss during a limited survey. Other snake species reported from the county, that could possibly be found in the Roaring Brook WMA are **Dekay's Brownsnake** (*Storeria dekayi* - S4), and the **Red-bellied Snake** (*Storeria occipitomaculata* - S2). Dekay's Brownsnake has been reported from seven towns in the county and Red-bellied Snake from four. We did sample what seemed like appropriate habitat for these two species but did not find them.

The other species reported from the county, that I might have expected to locate was the **Blue-spotted Salamander** (*Ambystoma laterale*). It has been reported only once from the county but appropriate habitat seems to exist. If it uses the WMA, I would expect it to breed in the Large Marsh and Pond, the Newton Road marsh, or perhaps the Black Gum Swamps.

It is not possible to prove the absence of small, secretive, seasonal, or rare species. It is still possible that species other than those mentioned above exist in low numbers in the area during certain seasons. However, given the distribution and amount of field effort combined with interviews of individuals who have spent a great deal of time in the area, it is unlikely that species not already discussed have significant populations within the region. A list of all known Vermont species of reptiles and amphibians along with their protective status and state ranks is contained in Appendix A.

#### Sites visited

The many sites that were selected as priority areas represented a wide variety of community types from oak-hickory forest to black gum swamps. Due to budget restrictions, it was not possible to do thorough surveys of any of the selected priority areas, however with the help of outside funding, along with student and volunteer labor, all but two of the priority areas were visited at least once. The river valley above the Gravel Pit Pond Area and the wetland uphill and east of the large Beaver Pond shown in Figure 1 were not surveyed. I suspect that the river valley above the Gravel Pit Pond holds the same species as the Roaring Brook Gorge. The wetland above the Beaver Pond probably holds many of the same species as the Beaver Pond but I am unaware if it is currently flooded, filled, or vernal.



While traveling to some of the selected priority areas, we kept alert for additional sites that might be significant habitat for reptiles and amphibians. Four additional significant habitat types were located and have been mentioned: temporary pools, the powerline, the Beaver Pond at the head of Roaring Brook, and the Old Welcome Center along I-91. The Beaver Pond and the Old Welcome Center are included in the tables. Part of the powerline is included in what I refer to as the Powerline and NW Priority site (Figure 1). Other portions of the powerline were surveyed on other dates while traveling to and from other sites. The powerline provides a pocket of early successional habitat within forestland that many of the snake species will use. Management of the Old Welcome Center, breeding wetlands, and the powerline are discussed individually.

## Discussion

### Conservation of Eastern Racers

The most significant species found in (or very near) the WMA was the **Eastern Racer** (see Appendix B). The site that this species is using is the Abandoned Welcome Center along I-91. I suspect that the overgrown lawns mimic the early successional habitat that this species prefers. The walkways, foundations, and pavement mimic ledge and generate heat. The yews, roses, and other shrubs provide protected off-the-ground basking and refuge sites. The abandoned buildings provide an abundant supply of rodents. The downed hollow aluminum light poles provide heat and cover and the underground system of pipes and cisterns may provide winter denning areas. Unfortunately, this site is slated to become a truck weighing station. Since it is an artificial habitat, I am in hopes that the WMA land immediately adjacent to it can be manipulated to recreate many of these factors in a more natural way. I have met with local biologist Forrest Hammond, Vermont Department of Transportation (VTRANS) Environmental Officer Chris Slesar, Nongame and Natural Heritage Chief Steve Parren, and local VTRANS Maintenance Chief Brian Thompson discussing management of this site and adjacent terrain. In addition, I had discussions with Nina Huffer who is a forester for the private landowners (Weinsteins) that own approximately 400 acres of adjacent land. They plan to work through the Wildlife Habitat Improvement Program (WHIP) to improve habitat for this species. A representative of WHIP contacted me for ideas on how to manage for this species.

### Prior to the redevelopment of the Old Welcome Center

I recommend that the state land immediately adjacent to it be made as attractive as possible for this species. To do that I recommend:

- Expanding the cleared area to the north and east of the old leach field site.
- Expanding the cleared area to the south and west of the wetland. (Leaving the wetland and the east side of it forested).
- Expanding the cleared area to the east of the Old Welcome Center.
- Logging during winter to minimize the chances of causing snake mortality.
- All the open areas existing or created would need to be kept in early succession. Cutting in cold weather when the ground is frozen would assure that the snakes would already be in their dens but portions of the areas should be cut more often. Portions of it should be mowed a few times a year to maintain exposed basking areas. This needs to be done in a way that would not chop or bale the snakes. Hence it should be cut carefully and slowly with the blades set high and it should not be raked or baled. It should be cut using a pattern that would not herd all wildlife into the middle of the uncut area. The cutting pattern should drive animals out of the cutting path instead of into the middle of



the uncut area. When cut during the active season, I recommend late afternoon when the snakes are warmed up and active.

- Creating rock piles of large rock (12-inch diameter or more) that provide basking and refuge areas for the snake. These piles should get southern and western exposure and be large enough so as not to be overgrown easily.
- Creating an artificial den that would provide winter refuge for the snakes. This would have to extend below frostline, be located to receive maximum sunlight, and be designed so that the access points did not fill with water. The size would not have to be large. A square meter of space should be plenty. I could envision using an old septic tank, spring casing, or some such precast concrete item that could be adapted for the purpose. The rock alone could provide the denning site if it were deep enough.
- I believe that bringing in a few truckloads of sawdust from a mill would provide a good substrate for egg laying. This could be replenished during the winter as needed.
- Dropping or bringing in a few large downed logs for cover. In addition the racer needs and uses refuge sites. Leaving or planting a few patches of dense shrubs would provide refuges for the snakes.
- This should be in place before the Old Welcome Center is disturbed. The old structures above and below ground should be deconstructed carefully with biologists on hand and working cooperatively with VTRANS personnel to move any snakes discovered.

#### Managing the surrounding lands for Eastern Racers

- Create small early successional openings (1/4 acre) with southern or western exposure. Locate these sites away from the roads, close to other openings, or near water (leave a buffer) that might attract food. Leave large down logs or shrubby patches for basking or refuge within or along the north and east edges of the patches.
- Release rocky areas (ledge, talus, and stone walls). Open them up with patch cuts to create basking and feeding sites.
- Prohibit ATV use of trails and actively work to stop illegal use. They run over basking snakes.
- Provide food and cover for small mammals in woods. Encourage oak, hickory, and berries. Maximize coarse woody debris.
- Work closely with surrounding land owners (including VTRANS), community members, and environmental organizations (Bonnyvale Environmental Education Center) to generate understanding, support, and private management for this species. This is just a small piece of the habitat that will be needed to maintain this wide-ranging species.
- Encourage reporting and, if possible, photo documentation of all sightings.
- The powerline right-of-way may be useful habitat for this species, although we did not locate them along it. I recommend working with the folks who maintain the powerline to expose rocky areas or create new ones, maximize coarse woody debris, maintain refuge sites (occasional bushes, logs, or brush piles, minimize herbicide use, and to minimize ATV and other 4-wheel use of the powerline.



### Monitoring and further study of Eastern Racers

- It would be very useful to learn more about the size, movements, and needs of this population through further survey work. At the very least we should see if they use the habitat that has been created for them and explore ways to maximize its effectiveness. This species has never been managed in Vermont. It should be assumed that our efforts will need to evolve as we learn more about the species habits and needs.

### **Conservation of the other significant reptiles and amphibians**

The second most significant find were the **Jefferson Salamanders**. They were not found on any of the priority sites. One probable breeding location is noted in Figure 3. I have found this species in rocky hardwoods with permanent or semipermanent breeding pools. There also seems to be a correlation with close to neutral pH (6-7). **Vernal pools** are the result of a fine balance between the amount of water received and the rate at which it is lost. If they are exposed to more sunlight than they normally receive, they may evaporate too fast to provide habitat through metamorphosis in June or July. Hence it is important that these pools remain shaded (if shaded at present) and that the drainage is not altered in such a way as to prevent them from receiving and/or holding as much run-off. A minimum 30-m buffer (100 ft.) of uncut trees should be left to conserve shade. Pools are essential for maintaining herptile diversity and population viability. As Semlitsch and Bodie (1998, 1129) concluded, "small, isolated wetlands are extremely valuable for maintaining biodiversity, [and] the loss of small wetlands will cause a direct reduction in the connectance among remaining species populations".

The need to maintain such buffer strips around pools is clear but sometimes obscures the equally important concept of protecting foraging and overwintering habitat for the species that breed in those protected water bodies. Semlitsch (1998) reviewed travel distances of many amphibian species and determined that a protected distance of 164.3 m would include 95% of the salamander population using a given pond. This is clearly short, however, of the total distance traveled by Wood Frogs and Eastern Newt, and does not consider recolonization distances. Amphibians breeding in the pools may be coming from as far away as 400 meters. deMaynadier and Hunter (1995) recommend that no more than 25% of the basal area should be cut in a 100 m 2nd-tier buffer that extends beyond the no-cut zone around a pool. I recommend carefully managing a 600-ft. terrestrial-habitat zone, starting at the pool edge.

Heavy equipment should be kept out of the pools and they should not be filled with debris. Fish should not be introduced into any pools, beaver ponds, or lakes that have significant breeding populations of spring breeding amphibians. The introduction of salmonids in the western US to high elevation lakes has been shown to be the cause of precipitous declines of both salamanders and frogs (Gillespie and Hero 1999).

As a result of their moist permeable skin, amphibians absorb water, and any substance that is dissolved in it, directly through their skin. Any species that feed upon amphibians, such as herons, raccoons, and snakes, can then be affected by these chemicals as well. Although many **biocides** have been shown to be toxic to amphibians (Power et al. 1989), the short-term toxic effects of most chemicals (herbicides, pesticides, fungicides, etc.) have not been tested on amphibians. The long-term and/or sublethal effects are almost never tested prior to commercial use. Information regarding the effects of different biocides on amphibians and reptiles may be found at [www.on.ec.gc.ca/herptox/](http://www.on.ec.gc.ca/herptox/).

Jefferson Salamanders are not tolerant of habitat acidification. The number of eggs that adults deposit, and egg and larval survival rates are correlated with water acidity (Petranka 1998). Changes to the pH of these pools could potentially affect the population viability of the Jefferson Salamander and other amphibian species.



A few general recommendations for protecting Jefferson Salamander habitat follow.

- Potential breeding pools in or near rocky deciduous woods that are close to or more than 3-ft. deep at high water, should be kept buffered (100 ft. no cut zone) and surrounding terrestrial habitat should be carefully managed.
- I recommend that woodlands within 600 feet of known and potential breeding pools be managed as amphibian terrestrial habitat. In this zone (outside the buffer), woodlands can be managed for hardwoods, maximizing coarse woody debris and dense leaf litter. However, no more than 25% of the 600-foot radius outside the buffer around the pool should be in young or early successional growth. The rest should be 70 years old in moist areas and older in dry areas. This concentrates activity and disturbance in a relatively small area and leaves the majority of habitat undisturbed. This is a slightly different recommendation than that of deMaynadier and Hunter who recommend spreading a smaller impact over a wider area (see above).

The only unusual herptiles found in a priority area were the **Northern Watersnakes** found in Vernon Pond. I suspect that the main threat at this site, to the maintenance of this population, is human persecution as this site becomes more heavily used.

- I recommend signage that informs users of the site that the snake is protected, nonvenomous, and rare in eastern Vermont.
- I also recommend discouraging use of or closing portions of the shoreline, so that the snakes have some refuge areas.
- In those refuge areas, a few downed trees dropped into the water would provide safe basking and refuge sites for them.

The **Spotted Turtle** was not found on any of the priority sites but it seems likely that it would at least occasionally travel through the Newton Marsh Site and perhaps the Fox Hill vernal pool area. It will travel overland to reach feeding, overwintering, or aestivation sites. Risks to the species are habitat loss, degradation, and fragmentation; collection; road mortality; and farm equipment mortality.

Given, that the Spotted Turtle is **endangered** in Vermont, the proximity of this WMA to the only known Spotted Turtle population in Vermont, the variety of unusual plant and animal species in the area, and the scattered nature of the WMA, **I think it would be tremendously valuable to add known or potential pieces of habitat for this species to this WMA as they became available.** Further information on this species is included in Appendix C.

Although the **Fowler's Toad** was found nearby on Stebbin's Road, it was not found on the WMA and it seems unlikely that it would use it. Yet, it is so rare (S1), so localized (only current site), and so close, I think **the state should consider purchasing the critical habitat for this species and adding it to the Roaring Brook WMA.** It appears that the state may have owned some of the land previously, since there is an old Fish and Wildlife Access area along the Connecticut at this site. If not purchase, I would like to see the state work with the landowners in this rural area to manage and protect the existing habitat and develop a sense of local stewardship. Some background information on this species is attached in Appendix G.

The **Four-toed Salamander** was not found on the WMA but it is a secretive species that may use some of the priority sites (Table 3) such as the Black Gum Swamps, Large Pond and Marsh, and Newton Road Marsh as egg-laying sites. In addition it may use the margins of some vernal and semipermanent pools. It lays eggs under moss or in tussocks near the wetlands and migrates from nearby uplands where it feeds and overwinters. It is not known how far they migrate, but I recommend the same management suggestions for this



species as I do for any of the migratory salamanders, except applied to some other breeding sites: protection of wetlands and buffers, and protection of terrestrial habitat. They appear to have a far greater tolerance for low pH (acidic) breeding sites.

If the **Smooth Greensnake** uses the WMA, it would benefit from the same types of upland openings that have been suggested for the Eastern Racer as well as the powerline right-of-way.

The **Eastern Ribbonsnake** feeds primarily on amphibians and hence is primarily a watersnake. I have found it using both vernal pool edges and the edges of open permanent ponds. Staff should be on the lookout for this species anywhere near water on this WMA. My primary concerns would be draining of wetlands, heavy traffic (even ATVs) near wetlands, or low and frequent mowing and bailing in open areas.

Another species of special concern found in the area but not on the WMA is the **Wood Turtle**. Mike Klemens (2000) points out that among the many threats worldwide to turtles, the primary threats to this species are habitat destruction, fragmentation, and illegal collection. Along the eastern side of the WMA, development, increased traffic, and number of roads are potential threats to this species. Populations of this species center on a low-gradient home river. Usually this stream is large enough to have some undercut banks, log jams, or deeper pools where the turtles can successfully overwinter. Since this species feeds almost entirely on land, it survives best where floodplains and surrounding uplands are scarcely developed. It wanders up to 1000 ft. from the river to feed and further to lay its eggs. It will travel and feed in both forests and in pastures where it occasionally gets hit with equipment. We do not yet know if there is a population based on any of the streams within the WMA. The most likely streams to harbor a population drain east out of the WMA. The Wood Turtle is a long-lived, low-reproductive-capacity species (it lives up to 40 years in wild populations, Lovich et al. 1990, and does not breed until it reaches an age of ~14 years, Ernst et al. 1994). The removal of one or two breeding adults per year would be enough to eventually eliminate a population.

### **Conservation of all reptiles and amphibians**

The remaining S4 and S5 species found at most of the priority areas will not be mentioned here individually (see Tables 1-3), but they are still worthy of wise management in an effort to continue to keep their populations healthy and sustained.

#### General amphibian microhabitat requirements.

- breeding locations that hold water at least through July,
- coarse woody debris in adjacent forested areas,
- foliage height diversity in adjacent forested areas,
- canopy cover over breeding and foraging areas,
- deep deciduous leaf litter for moisture retention and feeding,
- cool and moist conditions.

General reptile microhabitat requirements include;

- coarse woody debris (standing and down),
- small open patches for basking, mixed with well shaded refugia for warm weather and feeding,



- undisturbed areas in and around wetlands for feeding and breeding,
- access to safe denning areas.

Many studies have examined the relationships between different timber management practices and amphibian richness and abundance (see review by deMaynadier and Hunter 1995). Most work supports the finding that amphibian richness and abundance decrease with clearcuts and similar shelter wood cuts (Ash 1988, Howard and Caschetta 1999, Petranks et al. 1993) but gradually return to pre-cut levels with time (60 to 120 years) **as long as source populations and travel corridors are maintained intact**. deMaynadier and Hunter (1998) also showed that these declines extend 25-35 m beyond the edges of the affected area cut. General recommendations for the maintenance of reptile and amphibian habitat relative to timber harvesting practices are listed below. They will benefit the common amphibian and reptile species found at most of the priority sites and throughout this WMA.

#### General forest management recommendations for reptiles and amphibians

- Maintain large down trees (>2 per acre, 7 per hectare), dead standing trees (> 4 per acre), and a future supply consisting of older standing trees.
- Maintain standing trees with knotholes and dead branches.
- Within areas that are heavily cut, patches of older trees should be left in addition to the scattered mature trees.
- Maintain a thick layer of deciduous litter.
- Softwood plantations limit the number and diversity of amphibians (decreased coarse woody debris, decreased structural diversity, decreased hardwood leaf litter, increased acidity). In these situations maintaining pockets of hardwoods and leaving large debris on the ground would help to minimize the impact.
- Long rotations provide the old mature growth and dense forest cover amphibians prefer. As forests age they show increasing amphibian abundance up to an age of 60 to 70 years old in wet cool habitats and up to 120 years in warm, dry, lowland habitats (deMaynadier and Hunter 1995).
- Minimize compaction of the soil and direct mortality by keeping heavy equipment off the site when the ground is saturated. Winter logging or logging in late summer and early fall should help minimize this effect.
- Protect and maintain shrub cover in the forest and on forest edges (vertical complexity).
- Do not create ditches and ruts that will hold water only briefly. Amphibians often lay their eggs in these small patches of water, which dry too soon to permit the larvae to transform and leave. They should either be prevented or they should be deep and shaded enough to hold water through July.

The recommendations above are also included in the handout Forest Management Practices to Minimize the Negative Impacts on Vermont Reptiles and Amphibians. I have included a copy (Appendix D).

Rarely is there a species of amphibian that benefits from large openings. One exception is the Northern Leopard Frog, which is not known from this region. A few species such as Spring Peepers, Pickerel Frogs, and American Toads will use small openings for at least part of the season. Most of our snakes will benefit from small openings. In this case,



because of the presence of the Eastern Racer, which is a large snake with a relatively large range, there is a reason to mix mature timberland with a larger percentage of openings and edge habitat than would normally be the case for other herptiles.

Almost all herptiles will benefit from the protection and maintenance of **buffers for all streams and wetlands**. These buffers minimize siltation, absorb nutrients, maintain shade, maintain undisturbed soil and deep leaf litter, provide patches of older growth as sources for recolonization, and provide movement corridors. Buffer strips should be widest where wetlands and streams are larger, where the intensity of harvest is greatest, where the surrounding terrain is steepest, or where rare, threatened, or endangered species are found.

### Seepage areas

The management of seepage areas is sometimes overlooked but important to amphibians. They need to be kept shaded so that the moisture content will remain high and the mosses will continue to grow (Northern Dusky Salamanders lay their eggs under the moss). They don't need to be large to be significant; they may be only a few feet across as long as they stay moist. During periods of drought, seepage areas (along with stream beds and other wetland edges) become a very important refuge as a wide variety of other more terrestrial amphibian species will join the saturated soil salamanders (in this case Northern Dusky and Northern Two-lined Salamanders) in their moist hideouts. My recommendations for seepage areas in general are listed below.

- Maintain a 100 ft. wooded buffer (50 foot minimum) to keep the seeps well shaded and moist. The 100-ft. buffer will be most effective at preventing light penetration, intercepting sediment and nutrients, and providing future coarse woody debris.
- Minimize erosion and keep sediments and chemicals from draining into seepage areas and small streams.
- Nearby logging should be during dry or frozen ground conditions when erosion is minimized.
- Locate roads out of the buffer areas.
- Don't allow septic overflow, fertilizers, pesticides, herbicides, or equipment fluids to drain into the sites.
- Don't channelize, ditch or drain the area.
- Leave existing coarse woody debris but don't smother the sites with tops or branches.
- Leave rocks in place, don't remove them.
- Don't flood the areas by damming up the drainage.
- Remove invasive exotic vegetation (I did not see any at these sites).
- Keep livestock out.
- Keep logging equipment, ATVS, and other vehicles out of the buffer area.
- Locate trails so that foot traffic, bicycles, and sunlight are kept off the seepage areas.



## Connectivity, fragmentation, roads, and development

In the Roaring Brook WMA there is a high diversity of amphibians and reptiles. One of the reasons for this diversity is the current connectivity of habitat types; herptiles can easily move between overwintering, breeding, and foraging grounds. They can move relatively freely through or around private lands, and the amount of direct road mortality is relatively low. As mentioned earlier, as **development** increases on the private parcels within and adjacent to the WMA, so does the fragmentation of the habitat, making it more and more difficult for these species to move to and from their required habitats. Not only does increased development affect an individual herptile moving from one habitat type to another, it can also affect an entire population. As patches of suitable habitat are destroyed or broken into smaller and smaller pieces, local diminished populations die off, and recolonization and immigration (the ability of an existing population to "rescue" the declining or extinct population) decreases. As cited in Sjogren 1991, "the fragmentation process poses a twofold extinction threat at local and regional levels. In addition to the increased risk of extinction following the reduction in population size, increased isolation of the remaining populations beyond a critical degree is likely to increase the risks of local and regional extinction further" (Sjogren 1991, 144). Therefore, "reserves should include sets of interconnected local populations and vacant suitable habitats, or be located in groups so that connectivity is achieved" (Sjogren 1991, 144). The state should work to maintain connections within and allow for movement in and out of this WMA.

**Road mortality** is a serious threat to a wide variety of wildlife through direct mortality, migrational barriers, hydrologic disruption, pollution, construction impacts, spread of exotics, and increased human usage (Trombulak and Frissell, 2000). Much of the February 2000 issue of Conservation Biology is dedicated to the ecological effects of roads and a variety of websites have sprung up with useful bibliographies (see End of the Road: [www.nrdc.org/publications](http://www.nrdc.org/publications)). As traffic increases, so do the negative effects on local amphibian densities (Fahrig et al, 1995). Heine (1987) calculated that 26 cars per hour could reduce the survival rate of toads crossing roads to zero.

Direct **road mortality** is a problem for almost all herptiles, including Eastern Racers and Jefferson Salamanders. Many species were found both dead and alive on the roads in and next to this WMA. With increased road traffic and numbers of roads, the chances of road mortality are much greater. When road mortality pushes the total mortality beyond the production capability of the herptile populations, they disappear. Ideally, traffic on all roads within the WMA will be limited and no new roads would be built. The greatest concentration of mortality takes place on wet, warm, and humid nights (all herptiles) and on sunny mornings after the first frosts of fall in late September and October (snakes). Direct road mortality is a large problem for Wood Turtles because they spend much of their time foraging on land. Although less terrestrial, Spotted Turtles often move overland between different wetlands and between wetlands and aestivation or egg-laying sites and hence they are also at risk from increased road traffic.

Although, I did not identify any specific locations of concentrated crossing activity in or immediately adjacent to the WMA, I have included information on designs that could be useful in the future. Properly designed **tunnels and underpasses** built under roads can guide young and adult herptiles under roads. This involves the combined use of fencing or walls and underpasses for reptiles, amphibians, (Langton 1989) and some small to medium sized mammals. Underpasses have been very effective when carefully designed and strategically placed. They are expensive. The design that makes the most sense based on my experience and observations would be that used in Payne's Prairie in Florida (reptile wall and culverts). The continuous wall is a valuable addition to the design and it is aesthetically more pleasing than a fence.



For more information on the Payne's Prairie design, visit the website below and open the chapters on Tortoise Underpasses, Salamander tunnels, and Amphibian-Reptile wall and culverts.

Critter Crossings (Federal Highway Administration)  
[www.fhwa.dot.gov/environment/wildlifecrossings/index.htm](http://www.fhwa.dot.gov/environment/wildlifecrossings/index.htm)

There is a large and growing body of literature on the impacts of roads on herptiles. I have attached a bibliography in Appendix E.

**Other construction-related threats are amphibian-breeding traps.** These can result when pools are created in gravel pits, construction sites, or road beds that hold water long enough to entice amphibians to breed but not long enough for the young to metamorphose. Even if these pools hold water through the time of metamorphosis, some of them are too frequently disturbed by vehicles to produce metamorphs. The drainage of man-made pools that are frequently disturbed (road beds) should be altered so that they do not gather any water in the spring. **Pools could also be created in areas that are not disturbed.** I don't suggest this as a method to replace significant pools but as a way to enhance amphibian breeding at disturbed sites such as old logging headers. If so, care should be taken to make sure they are deep enough to hold water through July of most years (>70 cm). I did see attempted amphibian breeding in road ruts along the many small roads within the WMA. These should be filled with gravel, or drained.

**Sedimentation** of streams from road construction also diminishes the abundance and diversity of salamanders present (Bury and Corn, 1988 and Corn and Bury, 1989) and the effects may last for many years. Among other effects, silt fills the spaces in stream beds where larval amphibians hide and feed.

Other options to minimize road impacts on herptiles in critical areas include signage to alert traffic to wildlife of all types and to ask drivers to avoid or assist wildlife crossing roads, lowered speed limits, speed control bumps, narrowing of roads, removal of blacktop, closing of roads after dark or on rainy evenings after dark, limiting the amount or type of vehicles (bicycles instead of cars), and hiring or training volunteers to act as conservation officers. Clearly, the impact on wildlife of building, improving, or relocating roads should be taken into consideration and the effects of increased traffic flow should also be taken into account.

### Chemical use

Amphibians absorb any chemicals which are in the water (dew, ground water, streams etc.) around them. Minimize use of herbicides, pesticides, and other biocides. Almost none of these chemicals have been tested on our native herptiles. In some cases even the inactive ingredients (e.g., surfactants in Roundup) have been found to be deadly to amphibians. Indirect, long-term, and sublethal effects have almost never been tested before marketing.

### General thoughts on conservation design for reptiles and amphibians

Most mobile species use a variety of community types over the course of the year and over the course of their lives. In addition, they need to be able to recolonize areas where populations have been eliminated due to drought, winterkill, disease, or anthropogenic forces. They need to be able to find alternative cover, food sources, breeding, or overwintering sites when natural disasters occur. Genetic diversity also needs to be maintained by allowing different populations to interact. Permeability is a term that I think should be used when thinking of the ability of a species to move comfortably across the landscape. Does the intended use leave the landscape permeable to the wide variety of species you wish to maintain? When details about the permeability of landscape uses are not known for many species, I believe that the safest and most logical way to proceed to



maintain natural biodiversity is to maintain a network of interconnected sites where natural processes are allowed to occur. This network currently exists within and between most of the parcels that make up Roaring Brook WMA. I suspect that I-91 on the west of the WMA acts as a barrier for some herptile species now and may keep Spotted Turtles from surviving in that valley despite what appears to be appropriate habitat. Pond Road and Rte. 142 will become more significant barriers as traffic on them increases. Further development in the area (the building of new roads and structures, the increase of traffic, and clearing) could potentially impact a wide variety of herptile species, by direct road mortality, loss of habitat, and habitat fragmentation and alteration. Human uses don't need to be curtailed in the region but they should allow the regular movement of species. Efforts to maintain permeability and connectivity on surrounding lands should be considered necessary to maintain the biodiversity of this WMA over the long term. Working with land trusts and conservation organizations to obtain development rights on surrounding lands and lands between the many scattered parcels of this WMA, will help conserve its wildlife.

### **Summary**

This site has a high diversity of reptile and amphibian species including some rare and listed species, in particular the Eastern Racer. Management and monitoring of herptiles on this WMA are recommended. Expansion to include important habitat nearby is also recommended. Some additional survey would also be valuable.

### **Appendices**

Attached are: a printout of the current status and accepted names for reptiles and amphibians in Vermont (Appendix A), documentation for the proposed listing of the Eastern Racer (Appendix B), listing documentation for the Spotted Turtle (Appendix C), Forest management recommendations for reptiles and amphibians (Appendix D), a bibliography of road impact literature (Appendix E), suggested resources for herptile identification, natural history, and management (Appendix F), and background information on the Fowler's Toad (Appendix G).

### **Recommended management guides that include reptiles and amphibians**

Management guides are just beginning to be available. All of the following include reptile and amphibian related information.

- Biebighauser, T. 2002. A guide to creating vernal ponds. USDA Forest Service in cooperation with the Izaak Walton League of America. Morehead, Kentucky. 33 pp. (Call 606-784-6428 to order or find it on the web.)
- Calhoun, A.J.K. and M. W. Klemens. 2002. Best Development Practices: Conserving pool-breeding amphibians in residential and commercial developments in the Northeastern United States. MCA Technical Paper No. 5, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York. 57 pp. (Call 924-925-9175 to order.)
- deMaynadier, P. and M. Hunter. 1995. The relationship between forest management and amphibian ecology: a review of the North American literature. *Environmental Reviews* 3: 230-261.
- Evink, G. 2002. National Cooperative Highway Research Program Synthesis 305, Interaction between roadways and wildlife ecology, A synthesis of highway practice. Transportation Research Board, Washington D.C. 78 pp. (Impacts of roads on herptiles and some conservation strategies. A big problem, good information. Order at 202-334-3213 or on the web.)



Flatebo, G., C. Foss, and S. Pelletier. 1999. Biodiversity in the forests of Maine: Guidelines for land management. University of Maine Cooperative Extension Bulletin #7147. C. Elliot editor, University of Maine Cooperative Extension, Orono, Maine. 168 pp. (Contact UME Extension Office at 207-581-3188.)

Kingsbury, B. and J. Gibson. 2002. Habitat management guidelines for amphibians and reptiles of the Midwest. Midwest Partners in Amphibian and Reptile Conservation (Midwest PARC). 57 pp. (Visit the PARC website for more information: [www.parcplace.org](http://www.parcplace.org).)

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**Table 1.** Amphibians found at selected locations within the Roaring Brook Wildlife Management area.

<b>Amphibians found in Roaring Brook WMA</b>	Black Gum Swamps (High Priority Area)	Oak Hickory (Low Priority Area)	Power Line & NW (High Priority Area)	Beaver Pond (Non-priority Area)	Fox Hill (Low Priority Area)	Large Pond & Marsh (Low Priority)	Vernon Pond (Low Priority Area)	Newton Rd. Marsh (Low Priority Area)	Gravel Pit Pond Area (Low Priority Area)	Old Welcome Center (Non-priority Area)	Welcome Center Floodplain (Low Priority Area)	Roaring Brook Gorge (High Priority Area)	Other Non-priority Sites on WMA
<b>Species and State Status</b>													
<b>Frogs (including toads)</b>													
American Toad (S5) ( <i>Bufo americanus</i> )	X	X	X	X	X			X		X	X	X	X
Gray Treefrog (S5) ( <i>Hyla versicolor</i> )	X				X	X	X	O	O				X
Spring Peeper (S5) ( <i>Pseudacris crucifer</i> )	X		X		X	X		X	O		X		X
American Bullfrog (S5) ( <i>Rana catesbeiana</i> )				X	X		X						X
Green Frog (S5) ( <i>Rana clamitans</i> )			X	X	X	X	X	X			X	X	X
Pickerel Frog (S5) ( <i>Rana palustris</i> )										X		X	
Wood Frog (S5) ( <i>Rana sylvatica</i> )	X		X	X	X	X		X	X	X	X	X	X
<b>Salamanders</b>													
Jefferson Salamander (S2,SC) ( <i>Ambystoma jeffersonianum</i> )									O				e
Spotted Salamander (S5) ( <i>Ambystoma maculatum</i> )	X	X	X		X	X		X	X		X		X
N. Dusky Salamander (S4) ( <i>Desmognathus fuscus</i> )			X						X			X	
N. Two-lined Salamander (S5) ( <i>Eurycea bislineata</i> )			X									X	
Eastern Newt (S5) ( <i>Notophthalmus viridescens</i> )	X	X	X	X	X	X		X	X	X	X	X	X
Eastern Red-backed Salamander (S5) ( <i>Plethodon cinereus</i> )	X	X	X		X	X					X	X	X

SC = Special Concern, PT = Proposed for state-threatened, SE = State Endangered.

X = Species located during this survey.

O = Other reports from the Vermont Reptile and Amphibian Database.

E = Probable based on egg-masses.



**Table 2.** Reptiles found at selected locations within the Roaring Brook Wildlife Management area.

Reptiles found in the Roaring Brook WMA	Black Gum Swamps (High Priority Area)	Oak Hickory (Low Priority Area)	Power Line & NW (High Priority Area)	Beaver Pond (Non-priority Area)	Fox Hill (Low Priority Area)	Large Pond & Marsh (Low Priority)	Vernon Pond (Low Priority Area)	Newton Rd. Marsh (Low Priority Area)	Gravel Pit Pond Area (Low Priority Area)	Old Welcome Center (Non-priority Area)	Welcome Center Floodplain (Low Priority Area)	Roaring Brook Gorge (High Priority Area)	Other Non-priority Sites on WMA
Species and State Status													
<b>Snakes</b>													
Eastern Racer (S1,SC,PT) ( <i>Coluber constrictor</i> )		<b>p</b>	<b>p</b>					<b>p</b>		<b>x</b>	<b>p</b>		<b>o</b>
Milksnake (S5) ( <i>Lampropeltis triangulum</i> )			<b>x</b>							<b>x</b>			
Northern Watersnake (S3) ( <i>Nerodia sipedon</i> )							<b>x</b>						
Common Gartersnake (S5) ( <i>Thamnophis sirtalis</i> )	<b>x</b>	<b>x</b>			<b>x</b>	<b>x</b>		<b>x</b>		<b>x</b>			<b>x</b>
<b>Turtles</b>													
Snapping Turtle (S5) ( <i>Chelydra serpentina</i> )							<b>x</b>						
Painted Turtle (S5) ( <i>Chrysemys picta</i> )						<b>x</b>	<b>x</b>	<b>x</b>					

SC = Special Concern, PT = Proposed for state-threatened, SE = State Endangered.

X = Species located during this survey.

O = Other reports from the Vermont Reptile and Amphibian Database.

P = Other sites that the Eastern Racer may use based on habitat type and/or proximity to known site.



**Table 3.** Amphibians and Reptiles found near the Roaring Brook Wildlife Management area but not within it. Sites within the WMA that would be the most likely to be used by the species are marked.

Reptiles and Amphibians found near Roaring Brook WMA with indications for where in the WMA they might be found.	Black Gum Swamps (High Priority Area)	Oak Hickory (Low Priority Area)	Power Line & NW (High Priority Area)	Beaver Pond (Non-priority Area)	Fox Hill (Low Priority Area)	Large Pond & Marsh (Low Priority)	Vernon Pond (Low Priority Area)	Newton Rd. Marsh (Low Priority Area)	Gravel Pit Pond Area (Low Priority Area)	Old Welcome Center (Non-priority Area)	Welcome Center Floodplain (Low Priority Area)	Roaring Brook Gorge (High Priority Area)	Reported from outside the WMA
<b>Species and State Status</b>													
<b>Frogs (including toads)</b>													
Fowler's Toad (S1,SC) ( <i>Bufo fowleri</i> )													X
<b>Salamanders</b>													
Spring Salamander (S4) ( <i>Gyrinophilus porphyriticus</i> )													O
Four-toed Salamander (S2,SC) ( <i>Hemidactylium scutatum</i> )	P					P		P					O? ?
<b>Snakes</b>													
Ring-necked Snake (S4) ( <i>Diadophis punctatus</i> )		P	P										X
Smooth Greensnake S4 ( <i>Opheodrys vernalis</i> )			P					P					O
Eastern Ribbonsnake (S2,SC) ( <i>Thamnophis sauritus</i> )				P	P	P		P	P				O
<b>Turtles</b>													
Spotted Turtle (S1,SE) ( <i>Clemmys guttata</i> )					P			P					O
Wood Turtle (S3,SC) ( <i>Glyptemys insculpta</i> )													O

SC = Special Concern, PT = Proposed for state-threatened, SE = State Endangered.

X = Species located during this survey.

P = Sites within the WMA that would be the most likely to be used by the species based on habitat type and/or proximity to known sites.

O = Other reports from the Vermont Reptile and Amphibian Database.

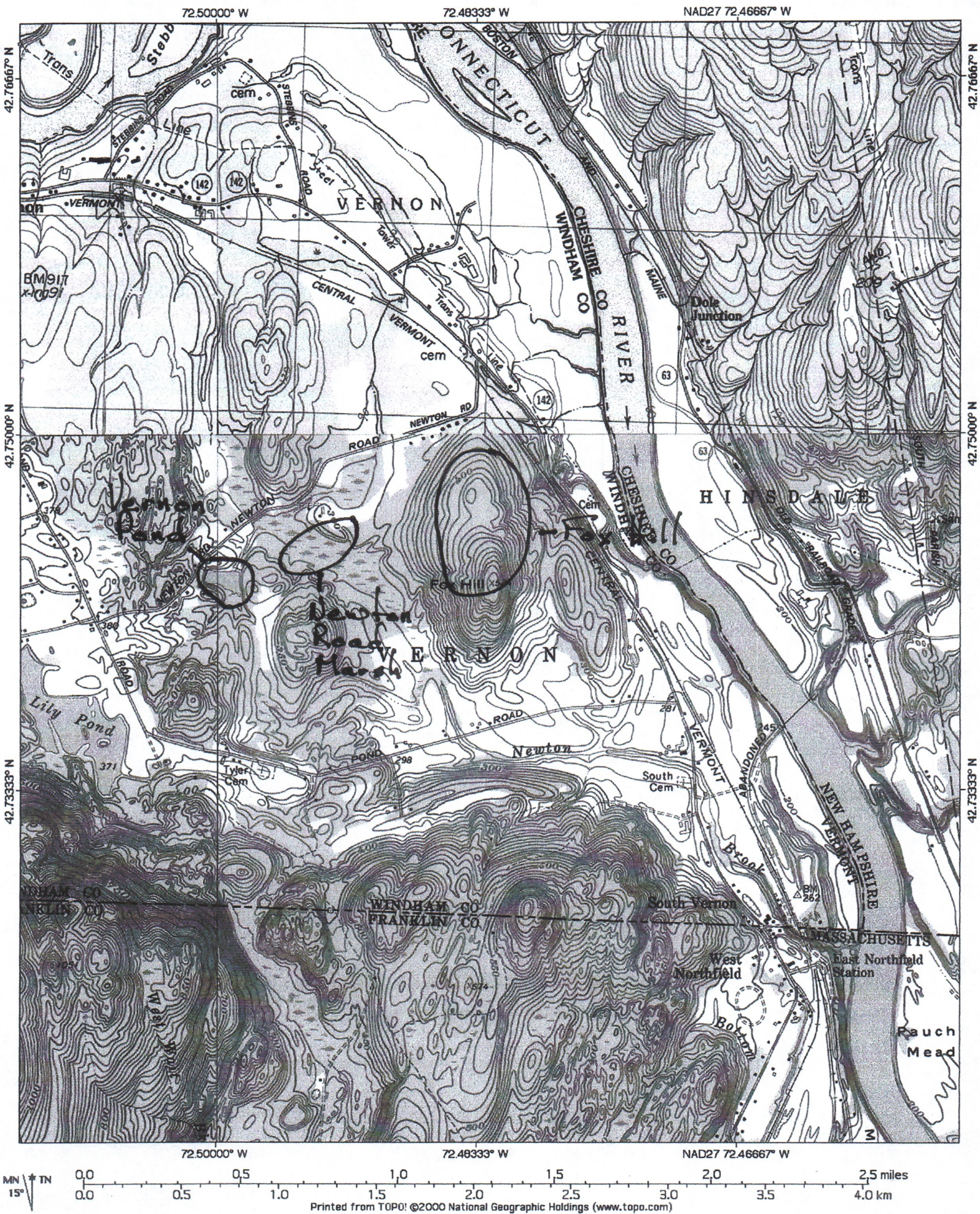
O? = Dr. Ross Bell from UVM believes a specimen of this species was brought in to his class from Vernon. I could not find it in the UVM collection.





**Figure 1.** Selected priority sites and other significant areas within the western parcels of the Roaring Brook WMA.





**Figure 2.** Selected priority sites and other significant areas within the eastern parcels of the Roaring Brook WMA.



**Figure 3.** Notes on selected sites within the Roaring Brook WMA.

Beaver Pond \_\_\_\_\_ Heard 4/10/2002 Vernon \_\_\_\_\_ 18

Geodetic Datum

Found on private property just north of the WMA

RBWMA

Found by Forrest Hammond on private property just north of the WMA. He was there conducting a site visit to a proposed communication tower.

Information was in a letter by Forrest to Jim Andrews dated 1/16/03

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Black Gum Swamp Pools \_\_\_\_\_ sight 4/30/2003 Vernon \_\_\_\_\_ 18T 0700762 4739029

Geodetic Datum WGS 84

Series of wet areas, East of the Rd.

RBWMA

Black Gum Swamps

Weather history: dry, warm yesterday ( 20-23 C) cloudy morning

Habitat type: Mountain Laurel, Red Maple, series of wet areas. More like vernal pools than swamps.

---

Black Gum Swamp Pools \_\_\_\_\_ sight 4/30/2003 Vernon \_\_\_\_\_ 18T 0700703 4739038

Geodetic Datum WGS 84

Series of wet areas, East of the Rd.

RBWMA

Black Gum Swamps

Weather history: dry, warm yesterday ( 20-23 C) cloudy morning

Habitat type: Mountain Laurel, Red Maple, series of wet areas. More like vernal pools than swamps.

---

Black Gum Swamp Pools \_\_\_\_\_ sight 4/30/2003 Vernon \_\_\_\_\_ 18T 0700691 4739257

Geodetic Datum WGS 84

Series of wet areas, East of the Rd.

RBWMA

Black Gum Swamps

Weather history: dry, warm yesterday ( 20-23 C) cloudy morning

Habitat type: Mountain Laurel, Red Maple, series of wet areas. More like vernal pools than swamps.

---



Vernal pool \_\_\_\_\_ Sight 5/1/2003 Vernon \_\_\_\_\_ 18T 0699594 4737486

Geodetic Datum WGS 84

Walking back to Lili's pasture road from man-made pool east of I-91 and south of big marsh. Took forest roads to get back, this pool was on the edge of the road. The state property line runs right through the pool. This pool appears to have some breeding Jefferson Salamanders based on two egg masses.

RBWMA

Outside of priority blocks.

Weather history: dry and warm last 2 days, some sprinkles after midnight.

Vernal pool \_\_\_\_\_ Sight 4/30/2003 Vernon \_\_\_\_\_ 18T 0700392 4739412

Geodetic Datum WGS 84

Series of wet areas, East of the Rd., VP430-1

RBWMA

Black Gum Swamps

Weather history: dry, warm yesterday ( 20-23 C) cloudy morning

Habitat type: Mountain Laurel, Red Maple, series of wet areas. More like vernal pools than swamps.

Vernal pool \_\_\_\_\_ Sight 7/24/2003 Vernon \_\_\_\_\_

Geodetic Datum

NW of power line at end of West Rd.

On boundary of state land and cleared area in front of a private camp.

RBWMA

Priority site (NW of Powerline)

Cut on private land exposes vernal pool.

Weather history: hot with rain over last two days

Vernal pool \_\_\_\_\_ Sight 4/10/2002 Vernon \_\_\_\_\_ 18 0699922E 4736732N

Geodetic Datum

Found on private property just north of the WMA.

RBWMA

Found by Forrest Hammond on private property just north of the WMA. He was there conducting a site visit to a proposed communication tower.

Information was in a letter by Forrest to Jim Andrews dated 1/16/03



# **Appendix A**

## **Current Status and Accepted Names of Vermont Reptiles and Amphibians**



# Reptiles and Amphibians of Vermont

## Accepted Name, State Rank, and State Status, as of November 2003

Common Name	Scientific Name	State Rank	State Status
<b>Amphibians</b>			
<b>Amphibia (Class)</b>			
<b>Salamanders</b>			
<b>Caudata (Order)</b>			
Jefferson Salamander	<i>Ambystoma jeffersonianum</i>	S 2	SC
Blue-spotted Salamander	<i>Ambystoma laterale</i>	S 3	SC
Spotted Salamander	<i>Ambystoma maculatum</i>	S 5	
Northern Dusky Salamander	<i>Desmognathus fuscus</i>	S 4	
Northern Two-lined Salamander	<i>Eurycea bislineata</i>	S 5	
Spring Salamander	<i>Gyrinophilus porphyriticus</i>	S 4	
Four-toed Salamander	<i>Hemidactylium scutatum</i>	S 2	SC
Mudpuppy	<i>Necturus maculosus</i>	S 2	SC
Eastern Newt	<i>Notophthalmus viridescens</i>	S 5	
Eastern Red-backed Salamander	<i>Plethodon cinereus</i>	S 5	
<b>Frogs (including toads)</b>			
<b>Anura (Order)</b>			
American Toad	<i>Bufo americanus</i>	S 5	
Fowler's Toad	<i>Bufo fowleri</i>	S 1	SC
Gray Treefrog	<i>Hyla versicolor</i>	S 5	
Spring Peeper	<i>Pseudacris crucifer</i>	S 5	
Western Chorus Frog	<i>Pseudacris triseriata</i>	S 1	E
American Bullfrog	<i>Rana catesbeiana</i>	S 5	
Green Frog	<i>Rana clamitans</i>	S 5	
Pickerel Frog	<i>Rana palustris</i>	S 4	
Northern Leopard Frog	<i>Rana pipiens</i>	S 4	
Mink Frog	<i>Rana septentrionalis</i>	S 4	
Wood Frog	<i>Rana sylvatica</i>	S 5	
<b>Reptiles</b>			
<b>Reptilia (Class)</b>			
<b>Turtles</b>			
<b>Testudines (Order)</b>			
Spiny Softshell	<i>Apalone spinifera</i>	S 1	T
Snapping Turtle	<i>Chelydra serpentina</i>	S 5	
Painted Turtle	<i>Chrysemys picta</i>	S 5	
Spotted Turtle	<i>Clemmys guttata</i>	S 1	E
Wood Turtle	<i>Glyptemys insculpta</i>	S 3	SC
Northern Map Turtle	<i>Graptemys geographica</i>	S 3	SC
Stinkpot	<i>Sternotherus odoratus</i>	S 2	SC
<b>Lizards and Snakes</b>			
<b>Squamata (Order)</b>			
<b>Lizards</b>			
<b>Lacertilia (Suborder)</b>			
Common Five-lined Skink	<i>Eumeces fasciatus</i>	S 1	E
<b>Snakes</b>			
<b>Serpentes (Suborder)</b>			
Eastern Racer	<i>Coluber constrictor</i>	S 1	SC, PT
Timber Rattlesnake	<i>Crotalus horridus</i>	S 1	E
Ring-necked Snake	<i>Diadophis punctatus</i>	S 4	
Eastern Ratsnake	<i>Elaphe alleghaniensis</i>	S 2	SC, PT
Milksnake	<i>Lampropeltis triangulum</i>	S 5	
Northern Watersnake	<i>Nerodia sipedon</i>	S 3	
Smooth Greensnake	<i>Opheodrys vernalis</i>	S 4	
DeKay's Brownsnake	<i>Storeria dekayi</i>	S 4	
Red-bellied Snake	<i>Storeria occipitomaculata</i>	S 5	
Eastern Ribbonsnake	<i>Thamnophis sauritus</i>	S 2	SC
Common Gartersnake	<i>Thamnophis sirtalis</i>	S 5	



## Hypothetical Species

### Salamanders

Allegheny Mountain Dusky Salamander

*Desmognathus ochrophaeus*

One specimen of a juvenile from central Vermont may be of this species. Otherwise, the distribution of this species is believed to have an eastern boundary of the Hudson River and Lake Champlain. No populations have been located.

Northern Slimy Salamander

*Plethodon glutinosus*

Specimens labeled from Caledonia County in Vermont at the Carnegie Museum in Pittsburgh have long been questioned. They are believed to be mislabeled. No populations have been located.

Marbled Salamander

*Ambystoma opacum*

One historic photo of this species is labeled Vermont and an historic field record from Fair Haven is from a credible source. A population of this species may eventually be located in southern Vermont, most likely along the Connecticut River drainage. No populations have been located.

### Turtles

Eastern Box Turtle

*Terrapene carolina*

The occasional reports of single adult animals are assumed to be released pets. Reports near the southern Connecticut River Valley could possibly be native turtles. No populations have been located.

Blanding's Turtle

*Emydoidea blandingii*

Widely disjunct populations of this species suggest that populations could potentially exist in Vermont. One well-documented record could be a released pet. No populations have been located.

## Explanation of Legal Status & Information Ranks

**State Status:** As per the Vermont Endangered Species Law

- E: Endangered--In immediate danger of becoming extirpated in the state.  
T: Threatened--High possibility of becoming endangered in the near future.

**Information Categories:** Not established by law

- PE: Proposed for endangered.  
PT: Proposed for threatened.  
SC: Special Concern--rare; status should be watched.

### State Ranks of Plants, Animals, and Natural Communities

State ranks are assigned by the Nongame & Natural Heritage Program based on the best available information. They are not established by law. Ranks are reviewed annually.

- S1: Very rare, generally only 1 to 5 populations believed to occur in the state and/or some factor(s) making it especially vulnerable to extirpation.  
S2: Rare, generally 6 to 20 populations believed to occur in the state and/or some factor(s) making it vulnerable to extirpation.  
S3: Uncommon, but believed to be more than 20 populations in the state and/or there is some threat to it.  
S4: Apparently secure in the state, often with more than 100 populations.  
S5: Demonstrably secure in the state.



## **Appendix B**

### **Documentation for the Proposed Listing of the Eastern Racer**



## Eastern Racer (*Coluber constrictor*) Background, September, 2003

Eastern Racer (*Coluber constrictor*) is an active, easily agitated, relatively large (up to 6 ft.) snake that has sometimes been lumped together with Eastern Ratsnake (*Elaphe obsoleta*) as a "Black Snake". The earliest known report of a "Black Snake" in Vermont was an 1829 collection in Brookline. In 1853, Zadock Thompson reported them in his Natural History of Vermont. He described the Eastern Racer well and used the scientific name for that species but was apparently unaware that the Eastern Ratsnake was a separate species which was also found in the state. Even at that time the "Black Snake" was reported as uncommon and limited to southern and southwestern Vermont. Reports of "Black Snakes" have also turned out to be Northern Water Snake (*Nerodia sipedon*) and if very small (~1 ft.) Red-bellied Snake (*Storeria occipitomaculata*).

Eastern Racer is distinguished from other large black snakes by its smooth unkeeled scales, solid gray venter, round cross-section, tan-colored nose and face, large head scales, long slender form, and its fast and nervous behavior. Young Eastern Racers are not black but instead are distinctly patterned, so any small snakes that appear solid black belong to another species.

The species is listed as endangered in Ontario and Maine, absent from Quebec, and has no protective status in Massachusetts, Connecticut, New Hampshire or New York. Al Breisch of NYDEC reports historic records from the Champlain Basin of NY but no current records in New York north of the Albany area. Scott Jackson reports no current records of this species from the northern tier of quadrats in Massachusetts and Mike Klemens (1993) reports this species as widespread in Connecticut and common in the central Connecticut River lowlands of Massachusetts. In New Hampshire, Taylor (1993) shows the species missing from the entire northern and central portion of the state with records clustered along the coastal plain and a few records along the southern Connecticut River Valley.

At the time of publication of the 1995 Preliminary Reptile and Amphibian Atlas only two reliable reports from Vermont were mapped: a road-kill in 1983 (Charles Johnson) from Danby and a road-killed specimen from Putney in 1985 (Mark DesMeules). Additional unverified leads pointed to the southern Connecticut River Valley Region as the area with the highest potential of generating a photo or a specimen. In addition to the ongoing atlas efforts, Jim Andrews has been working with the Bonnyvale Environmental Education Center (BEEC) in Brattleboro over the last ten years to educate and inform the residents of that area about this species and encourage them to report sightings. These efforts have intensified over the last two years (with funding from VT Fish and Wildlife). Slide shows, posters, newspaper articles, field surveys, and many personal conversations have since then generated many new reports (almost entirely from Windham County). About half of the more believable reports (25/57) are historic (greater than 25 years old) and 45 of the 57 are ten years old or older. We very often hear that "Black Snakes" used to be seen regularly twenty or more years ago and are only rarely seen anymore. Until July of 2003, none of these new reports were accompanied by the detail needed to differentiate an Eastern Racer from an Eastern Ratsnake. In July of 2003, we found two skins, and captured and photographed an adult Eastern Racer in Guilford. This also allowed us to confirm the identification of a skin collected in the 1940's in Grafton. Some of the remaining reports are quite likely of other species. One series of reports led to a melanistic Common Gartersnake and some may well be Northern Watersnakes. We have no evidence yet of Eastern Ratsnakes in the southern Connecticut River Valley. In addition, all "Black Snake" reports from the northern Taconics and the Lake Champlain Basin that we have investigated have turned out to be the Eastern Ratsnakes. Over the last 25 years, there have been multiple reports of large



"Black Snakes" from six towns along the Connecticut River in Windham County: Brattleboro, Dummerston, Guilford, Putney, Rockingham, and Vernon. Given the emerging picture of distribution of these two species, I suspect that over the next ten years; small, localized, populations of Eastern Racers will be documented as still present in more of these towns.

The one site where we located this species in Guilford is owned by the state and managed by the Vermont Department of Transportation (VTRANS). They have plans to build a truck-weighing station on the site when funds allow. An environmental spokesperson for VTRANS is anxious to work with the VT Department of Fish and Wildlife to manage this area and/or adjacent lands for this species. Other adjacent landowners in the region both public and private have expressed an interest in managing for this species.

The Reptile and Amphibian Scientific advisory group had been hesitant to recommend this species for listing until dedicated efforts were made to locate populations and proof of its continued existence in the state was available. It is a species that we have been concerned about for some time and information on its status and our concern has been forwarded to the Endangered Species Committee previously. Given the information gathered over the last few years, we now feel we should recommend it for listing as a threatened species. Formal documentation is attached.

### **Habitat**

This species requires large dry open fields, open woods, shrubbery, or ecotones and avoids dense woodlands. Klemens (1993) reports that it "thrives in areas that are periodically cleared or mowed" and is most often found at low elevations or along low ridges near denning sites (rocky areas with deep fissures). Harding (1997) reports that this species "may make lengthy migrations" to denning sites.

### **Threats to this species in Vermont**

According to Harding (1997) "populations decline quickly in the face of intensive agriculture or suburban/urban sprawl and development"

As a result of their need to bask, warm and/or sunlit road surfaces are very attractive and deadly artificial ledges. Consequently increased traffic and road building are even larger threats to snakes than any of the other herptiles.

The large territories of this species and migrations to denning sites require that they cross roads.

The larger size of this species requires that it bask more often to maintain optimal temperatures.

Many snakes are feared and killed by humans. Large and visible snakes are at an even greater risk.

Limited and sometimes communal denning sites put them more at risk from anthropogenic disturbance.

Efforts to eliminate Timber Rattlesnake dens may have had an impact on the historic distribution of this species that often shares denning sites.

Loss of small farms and regrowth of open pasture may have removed traditional habitat.



Increased mechanization of farming and in particular cutting, raking, and bailing are a direct threat to many snakes. Many of our more common snakes are killed during bailing. Eastern Racers may also suffer similar mortality.

Species whose habitat needs are more restrictive and whose numbers are limited are at a heightened risk from anthropogenic and natural events (winterkill of denning snakes has been mentioned as a threat).

Species at the edge of their ranges are less able to recolonize after natural or anthropogenic events that reduce or eliminate populations.

#### Literature Cited

- Harding, J.H. 1997. Amphibians and reptiles of the Great Lakes Region. The University of Michigan Press, Ann Arbor, Michigan 378 pp.
- Klemens, M.K. 1993. Amphibians and reptiles of Connecticut and adjacent regions. State Geological and Natural History Survey of Connecticut, Bulletin No. 112 318 pp.
- Taylor, J. 1993. The amphibians and reptiles of New Hampshire with keys to larval, immature and adult forms. Nongame and Endangered Wildlife Program, New Hampshire Fish and Game Department, Concord, New Hampshire 71 pp.



## SPECIES STATUS REVIEW

### STATE OF VERMONT

### ENDANGERED SPECIES COMMITTEE

Common Name: <b>Eastern Racer</b>	Current Status: <b>None</b> (Special Concern by SAG - Reptiles & Amphibians)
Scientific Name: <b><i>Coluber constrictor</i></b>	Recommended Status: <b>Threatened</b>
Scientific Advisory Group Chair:	Endangered Species Committee Chair:
Date:	Date:

*Wildlife and plant species are added to or removed from the list of endangered and threatened species by action of the Secretary of the Agency of Natural Resources, upon recommendation of the Vermont Endangered Species Committee, according to 10 V.S.A., Chapter 123. The Vermont Endangered Species Committee is advised by scientific advisory groups on vascular plants, non-vascular plants, invertebrates, fish, reptiles and amphibians, birds, and mammals.*

## DEFINITIONS

**ENDANGERED:** A species that normally occurs in the State and whose continued existence as a viable component of the State's wild fauna or flora is in jeopardy, or a species determined to be an endangered species under the Federal Endangered Species Act. [V.S.A. Title 10, Chapter 123, Sections 5401(6) & 5402(b).]

**THREATENED:** A species whose numbers are significantly declining because of loss of habitat or human disturbance and unless protected will become an endangered species, or a species determined to be a threatened species under the Federal Endangered Species Act. [V.S.A. Title 10, Chapter 123, Section 5401(7) & 5402(c).]

## GUIDELINES FOR LISTING AS ENDANGERED OR THREATENED

1. Species (including subspecies and varieties) which may be listed include all wild and free-ranging or naturally-occurring mammals, birds, amphibians, reptiles, fish, invertebrates, vascular and non-vascular plants.
2. Species which may be listed include those native to the State or known to exist as viable, naturalized populations in Vermont.
3. Species which may be listed must have spent at least some portion of their life cycle in Vermont on a sustained basis, breeding or otherwise.
4. Species listed by the Secretary of the Interior as endangered or threatened in the U.S., if occurring as historical or current residents or transients in Vermont, shall be listed in their respective categories.
5. Attached to this review shall be a SPECIES DOCUMENTATION including the best scientific information available with sources cited.
6. The Endangered Species Committee and its scientific advisory groups shall consider the CATEGORIES and CRITERIA FOR LISTING when recommending species for listing or delisting, using the best scientific information available and their best expert judgments.
7. Specific numbers cited in the Primary Criteria of the CRITERIA FOR LISTING are guidelines only, and are to be interpreted with respect to the biology of the species. Definitions of terms such as *population* and *reproductive potential* for each species shall be provided by the appropriate scientific advisory groups according to accepted practices in their field of biology.



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## CRITERIA FOR LISTING AS ENDANGERED OR THREATENED

### 1.0 ENDANGERED

- ☐ 1.1 The species is known to have occurred historically in Vermont but has not been documented in the last 25 years; OR
- ☐ 1.2 The species meets at least one of the following primary criteria of rarity:
- ☐ 1.2.1 There are estimated to be three or fewer viable, reproducing populations separated by unfavorable habitat in Vermont; OR
  - ☐ 1.2.2 There are estimated to be fewer than 100 reproducing individuals in Vermont; OR
  - ☐ 1.2.3 The species is known in the last 25 years from 20 or fewer sites throughout its global range;
- AND one of the following secondary criteria:
- ☐ 1.2.4 The species has declined overall or noncyclically throughout a significant portion of its global range; OR
  - ☐ 1.2.5 The species is restricted to localities within or immediately adjacent to Vermont; OR
  - ☐ 1.2.6 One or more special factors cause the species to be vulnerable to extirpation:
    - ☐ 1.2.6.1 The species is in danger of exploitation or is threatened with disturbance; OR
    - ☐ 1.2.6.2 The species occurs in rare or specialized habitat that is vulnerable to loss, modification, or variations in quality; OR
    - ☐ 1.2.6.3 The species has low reproductive potential or is experiencing reduced reproductive success; OR
    - ☐ 1.2.6.4 The species has other factors that render it vulnerable to extirpation (*list*).

### 2.0 THREATENED

- ☒ 2.1 The species meets at least one of the following primary criteria of rarity:
- ☒ 2.1.1 There are estimated to be ten or fewer viable, reproducing populations separated by unfavorable habitat in Vermont; OR
  - ☒ 2.1.2 There are estimated to be fewer than 300 reproducing individuals in Vermont; OR
  - ☐ 2.1.3 The species is known in the last 25 years from 60 or fewer sites throughout its global range;
- AND one of the following secondary criteria:
- ☒ 2.1.4 The species has declined overall or noncyclically in Vermont or the Northeast region of the United States; OR
  - ☐ 2.1.5 The species is restricted to localities within or immediately adjacent to Vermont; OR
  - ☒ 2.1.6 One or more special factors cause the species to be vulnerable to decline:
    - ☒ 2.1.6.1 The species is in danger of exploitation or is threatened with disturbance; OR
    - ☐ 2.1.6.2 The species occurs in specialized habitat that is vulnerable to loss, modification, or variations in quality; OR
    - ☐ 2.1.6.3 The species has low reproductive potential or is experiencing reduced reproductive success; OR
    - ☐ 2.1.6.4 The species has other factors that render it vulnerable to extirpation (*list*).

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## Other Lists

The Endangered Species Committee, for the purposes of maintaining the most up-to-date information possible, shall obtain for reference lists of species which are of special concern, missing from the state, extirpated, known only from unsubstantiated reports, and/or are imported or transplanted.



# I. Species Documentation

## A. STATE OF VERMONT

### 1. ENDANGERED SPECIES COMMITTEE

1. Scientific Name:	<i>Coluber constrictor</i>	7. Surrounding State & Provincial Status:
2. Common Name:	Eastern Racer	Maine: Endangered (S2, declining)
3. Species Code ( <i>Department use only</i> ):		New Hampshire: S5 (Missing from northern & central NH)
4. Current Vermont Status:	S1	Massachusetts: S5 (Missing from northern MA)
5. Recommended Vermont Status:	Threatened	New York: S5 (Southern, extirpated from Champlain Basin)
6. Federal Status:	None	Quebec: (Not within range of species, endangered in Ontario)

## POPULATION STATUS

### 8. Global, North American, and Vermont Ranges:

One known population in southeastern Vermont and others suspected from the same region. May occur in small, localized, populations in the Lake Champlain Basin and Taconic Region. Currently in southeastern and south central New York, but historically in the Lake Champlain Basin of NY. Currently in southern NH and coastal Maine (endangered). Ranges south to Florida with scattered populations in Mexico and west to the Pacific Ocean but missing from most of the interior southwest.

### 9. Vermont's Position within Global Ranges: ☐ Central ☒ Peripheral ☐ Disjunct

### 10. Historic Occurrences in Vermont More Than 25 Years Ago (Type, Number, General Location, Regularity of Use, Confidence in Records, etc.):

Since the three skins and two specimens of "Black Snakes" from Windham County are Eastern Racers (*Coluber constrictor*) and there is no documentation of Eastern Ratsnakes (*Elaphe obsoleta*) from the Connecticut River Valley of Vermont, reports of large Black Snakes from this region are likely to be Eastern Racers.

The oldest probable record that has been located is 1829 in Brookline ("Black Snake"). It was reported as an unusual sighting at that time and location and was collected.

The species *Coluber constrictor* was reported by Zadock Thompson in his Natural History of Vermont (1853) but he apparently lumped it together with the Eastern Ratsnake (*Elaphe obsoleta*). Thompson listed the(se) species as uncommon in southern and southwestern Vermont.

In 1855 the Brattleboro Republican (The Daily Free Press, 1855) reported that 27 "Black Snakes" had been killed on one ledge in Guilford.

In June of 1901 John W. Titcomb reported that "Black Snakes" (*Bascanium constrictor*) were found in southern Vermont in The Vermonter: A State Magazine", 'Twentieth Century History of Vermont: Animal Life of Vermont'.

In 1910 G. H. Perkins reported *Zamenis constrictor* from southern Vermont in the "History and Condition of the State Cabinet." Report of the State Geologist, 1909-1910, Bellows Falls, VT

An historic specimen exists in the Smithsonian Museum (by way of France) but it has no date or locality record with it other than Vermont.

The first vouchered record (skin) came from Grafton in 1940. Between 1940 and 1978 there are 18 records from Windham County currently classified as sight records (reliable but no vouchers). Dr. Gordon Nielsen (retired entomologist at UVM) remembers a letter referring to a population in Western Rutland County but no further details are known.

During interviews of long-time residents of Windham County we were frequently told that "large black snakes" were once quite



common in the area but are very rare now. Two reports are from Chester, just across the border, in Windsor County.

Very few older historical records (1800's) make comparison with current distribution and abundance difficult.

11. Historic Abundance More Than 25 Years Ago (number of Breeding Individuals or Size of Area Occupied, Confidence in Records, etc.):

There are no historical abundance data for this species but anecdotal and literature records suggest they were locally abundant in a limited region. The one report of 27 snakes killed at one den in 1855 suggests a healthy population at that location. However, the 1829 record from Brookline states that this species was unusual at that site and Thompson (1853) states that the species was uncommon in southern and southwestern Vermont. However, Thompson was from Burlington and was dependent on reports from others. This species was probably always limited in range to pockets of appropriate habitat in southern Vermont. Interviews of many long-time residents in Windham County regularly prompt the statement that these snakes were often seen in the past (>20 years ago) but are very rarely seen now. The species is closely tied to open fields, ecotones, and open rocky woods and ridges below 1300 feet in elevation (Klemens, 1993).

12. Current Occurrences in Vermont (Type, Number, General Location, Regularity of Use, Confidences in Records, Extent to which the Species has been Inventoried, etc.):

At present we can be sure of only two snakes at one location in Guilford. One of the two skins located at that site could have been the shed of the adult snake we found. The other skin was a different size and showed slightly different scalation.

At the time of publication of the 1995 Preliminary Reptile and Amphibian Atlas only two reliable reports from Vermont were mapped: a road-kill in 1983 (Charles Johnson) from Danby and a road-killed specimen from Putney in 1985 (Mark DesMeules). Additional unverified leads pointed to the southern Connecticut River Valley Region as the area with the highest potential of generating a photo or a specimen. In addition to the ongoing atlas efforts, Jim Andrews has been working with the Bonnyvale Environmental Education Center (BEEC) in Brattleboro over the last ten years to educate and inform the residents of that area about this species and encourage them to report sightings. These efforts have intensified over the last two years (with funding from VT Fish and Wildlife). Slide shows, posters, newspaper articles, field surveys, and many personal conversations have since then generated many new reports (almost entirely from Windham County). The majority of the reports are historic (greater than 25 years old) and we very often hear that "Black Snakes" used to be seen regularly twenty or more years ago and are only rarely seen anymore. Until July of 2003 however, none of the new reports were accompanied by the detail needed to differentiate an Eastern Racer from an Eastern Ratsnake. In July of 2003, we found two skins, and captured and photographed an adult Eastern Racer in Guilford. This also allowed us to confirm the identification of a skin collected in the 1940's in Grafton. Some of the remaining reports may be of other species. One series of reports led to a melanistic Common Gartersnake and some may well be Northern Watersnakes. We have no evidence yet of Eastern Ratsnakes in the southern Connecticut River Valley. Three leads suggest there may have been (and may still be) populations of Eastern Racer in western Vermont. A report of a partial skin from Poultney has not been verified. Dr. Gordon Nielsen (retired UVM entomologist) remembers a letter referring to a population in Western Rutland County but no further details are known and Al Breisch (NY State Herpetologist) reports historic records from the New York portion of the Lake Champlain Basin. All "Black Snake" reports from the northern Taconics and the Lake Champlain Basin that we have investigated have turned out to be the Eastern Ratsnakes.

Over the last 25 years, there have been multiple reports of large "Black Snakes" from six towns along the Connecticut River in Windham County: Brattleboro, Dummerston, Guilford, Putney, Rockingham, and Vernon. Given the emerging picture of distribution of these two species, I suspect that over the next ten years small, localized, populations of Eastern Racers will be documented as still present in more of these towns.

Klemens (1993) "strongly suspects" that the distribution of this species in northern New England is "discontinuous and confined to small pockets of optimal habitat".

13. Current Abundance (Number of Breeding Individuals or Size of Area Occupied, Confidence in Records, Problems in Estimating Abundance, etc.):

This species is the rarest snake in Vermont. By the time of the 2001 Atlas of the Reptiles and Amphibians of Vermont (Andrews), we had only three reliable current reports (< 25 years old) from three sites in southern VT (Mt. Tabor, Putney, and Newfane). This compares to 71 reports of Timber Rattlesnake from 18 sites (*Crotalus horridus*, endangered), 46 of Eastern Ratsnake from 18 sites (*Elaphe obsoleta*, proposed for threatened), and 15 reports of Eastern Ribbonsnake (*Thamnophis sauritus*, special concern) from nine sites. A site is defined here as a location at least 0.5 km from the nearest reported location and does not necessarily indicate a population.

Recent efforts led to the addition of one more current town (Guilford) and one historic town (Grafton) from which we had proof (photos and skins) of this species. Numerous newly gathered, unvouchered reports of "Black Snakes" from the southern Connecticut River Valley strongly suggest that small populations exist in the border towns of Guilford and Vernon and run north along the river to Rockingham. All the recent (last 25 years) records are confined to the towns of Windham County that border New Hampshire



with the addition of Guilford. The records of the last 10 years are confined to four general areas: the border of Guilford and Vernon near the Roaring Brook Wildlife Management area, the Black Mountain area in Dummerston, central and northeastern Rockingham, and southeastern Putney. Most long-time residents interviewed report that large "Black Snakes" were much more common twenty or more years ago.

The large adult size of "Black Snakes" would be expected to result in its being easily observed, and therefore, over-reported compared with smaller, less conspicuous species. Despite this, the "Black Snakes" are encountered less often than even small, cryptic species such as the brown snake (*Storeria dekayi*; 90 reports from 43 towns), indicating that the Eastern Racer is a rare species even within its restricted habitat. Although exact numbers and range are not known, current distribution and occurrence information indicate the Eastern Racer is a highly restricted species with low abundance that has declined over the last fifty years.

- |   |  |
|---|--|
| 14. Population Trend:                         | Estimate Based On:   |
| <input checked="" type="checkbox"/> Declining | <input checked="" type="checkbox"/> Surveys                              |
| <input type="checkbox"/> Stable               | <input type="checkbox"/> Counts  |
| <input type="checkbox"/> Increasing           | <input checked="" type="checkbox"/> Observations                         |
| <input type="checkbox"/> Unknown              | <input checked="" type="checkbox"/> Other ( <i>explain</i> ) (see below) |

#### Documentation & Comments:

Evidence of decline is based primarily on anecdotal evidence supported by the observed loss of early successional habitat and the increased mortality risks of increased traffic and mechanized farming. Almost everyone, who has seen this snake in Vermont, reports that it was much more frequently seen 20 or more years ago. No one reported it as stable or increasing. Most of these people have not seen the snake at all in recent years. Despite recent efforts, we have not been able to find the snake or even obtain recent reports of sightings from most of the area from which it was once reported. We are at the northern extreme of its range and Eastern Racer may have always been quite localized. Some of the historic reports mention that it was rare or unusual even in the 1800's. In DeKay's Natural History of New York (1842) he quotes a Dr. Kirtland in Ohio who states "it is evidently on the increase as the state becomes cleared and cultivated". That may have been the case in Vermont as well. In the days when farms were more common, pastures were kept open by grazing, and fields and orchards were cut by hand or horse, this species may have increased in number and range in Vermont. As the fields turned to woodlands, mechanized cropland, or mowed lawns, and additional roads were built and others expanded, habitat was lost at the same time as mortality risks were increasing. One road in particular (Interstate 91) was built right through some of the valley farms that generated our historical records. Since roads attract snakes due to their exposure to sun and their ability to retain heat, they are a death trap for many snake species.

## HABITAT IN VERMONT

### 15. General Description:

This species requires large dry open fields, open woods, shrubbery, or ecotones and avoids dense woodlands. Klemens (1993) reports that it "thrives in areas that are periodically cleared or mowed" and is most often found at low elevations or along low ridges near denning sites (rocky areas with deep fissures). It is often found in meadows and along power cuts below 1,300 feet (Klemens, 1993) and associated with ledges, talus, or exposed rock. It is not necessarily associated with water. Harding (1997) reports that this species "may make lengthy migrations" to denning sites. It may den singly or in large groups and has been known to den while partially submerged in water.

They are primarily a diurnal species with activity peaks in the late spring and early fall. Their diet includes invertebrates, amphibians, other snakes, birds, bird's eggs, and small mammals. Juveniles resemble Milksnakes (*Lampropeltis triangulum*) and eat primarily invertebrates.

In the northern part of their range, which includes Vermont, they emerge from hibernation in late March or April and remain active until late October (Ernst and Barbour, 1989). In Kansas, home ranges averaged 10 hectares although for periods of time they often frequented the same feeding or resting areas.

### 16. Habitat Losses in Past (*Amount and Location*):

Loss of pasture, old fields, and ecotones to mature forest or development. Change of remaining open land to intensively managed cropland, or to fields and lawns kept open by equipment rather than by hand or horse. Increasing fragmentation of habitat and direct mortality due to increased number of roads, increased size of roads, and increased traffic on roads.

### 17. Probable Habitat Losses in Future (*Amount, Location, and Type*):

Same as above. Small farms continue to be lost or increasingly mechanized. As Vermont's human population continues to rise, the



demand for more residences, driveways, and roads will increase further, reducing and fragmenting habitat. Increased traffic volume will result in greater numbers of Eastern Racers killed on roads, with impacts on populations resulting.

18. Current Protected Status of Habitat:
- ☐ Unknown Whether Any Protected
  - ☒ Believed To Be None Protected
  - ☐ At Least One Protected Occurrence
  - ☐ Several Protected Occurrences
  - ☐ Many Protected Occurrences
  - ☐ Other (*explain*)

*Comments:*

The only site where this species has been documented in the last 18 years is owned by the state and managed by the Vermont Department of Transportation (VTRANS). They have plans to build a truck-weighing station on the site when funds allow. Immediately adjacent is a small open field that is on top of a large leach field. The leach field area could be expanded (adjacent lands are owned by Vermont Fish and Wildlife) and managed for this species. Other adjacent landowners in the region (both public and private) have expressed an interest in managing for this species. It seems likely that portions of the adjacent Roaring Brook Wildlife Management Area are used by this species.

**POPULATION BIOLOGY**

19. Population Threats (Contaminants, Predation, Competition, Disease, Human Disturbance from Recreation, Collection, Harvest, etc.):

Degree of Threat:

- ☒ Very Threatened, Species Directly Exploited or Threatened by Natural or Man-caused Forces
- ☐ Moderately Threatened, Habitat Lends Itself to Alternate Use but is not Currently in Jeopardy
- ☐ Little Threat, Self-protecting by Unsuitability for Other Uses
- ☐ Unknown

*Documentation & Comments:*

Habitat loss (pasture, fields, early successional habitat), road mortality (more roads, increased traffic), mortality resulting from the increased mechanization of farming (cutting and baling) and lawn mowing, increasing ATV use (snakes bask in the open sunlit trails), and direct persecution due to fear, are continuing. Habitat fragmentation due to roads and development has exposed Eastern Racers to increased mortality. Migration to and from denning sites, during feeding or while dispersing may require road crossings. Snakes are attracted to roads as basking sites and will linger on roads to obtain optimal body temperatures for hunting, feeding, digesting, or other necessary activities. Larger snake species require more basking time to bring up body temperatures. Increasing road traffic increases the risk of road mortality. Regular use of poison to control small mammals in orchards may also be a factor. These are all in addition to the concern that species at the edge of their ranges are often less able to recolonize after natural or anthropogenic events that reduce or eliminate populations.

This species is known to share denning sites with other species such as Timber Rattlesnakes. In the past Eastern Racers may have been eliminated from portions of their range during efforts to kill Rattlesnakes in or near their dens.

20. Tolerance To Human Activity:

- ☒ Fragile
- ☐ Fairly Resistant
- ☐ Tough
- ☐ Unknown

*Documentation & Comments:*

Agricultural lands (fields, pastures, and orchards) are attractive to Eastern Racers due to the abundant food supply (insects, rodents, birds) stone walls, basking areas, and cover associated with small farms. The pitfall of this is that many snake species are killed during hay cutting, raking, and baling activities, or just residential mowing of yards. This may also be the case with Eastern Racers. Harding (1997) reports that "populations decline quickly in the face of intensive agriculture or suburban/urban sprawl and development". Exposure of Eastern Racers to predation and intentional killing is also increased. Roads within the species' habitat result in losses from populations. Increased traffic on and off roads results in mortality. Increasing residential conversion of habitat results in loss of animals and permanent increased geographical restrictions. Fear and misunderstanding of snakes is widespread resulting in the death of many snake species, particularly those that are large and conspicuous.



21. Reproduction Parameters (Age to Sexual Maturity, Annual Production of Offspring, Reproductive Life, or Other Factors that Warrant Consideration):

Information from Kansas (Ernst and Barbour, 1989): reports that males and females may reach reproductive age in their second year. Copulation usually occurs in the spring but has been observed in the fall. Egg laying occurs June through early August, hatching in late August to early October. Clutch size is usually 9-12 eggs (up to 36 in large females). Reproduction appears to be annual. Although reproductive information is lacking for Vermont, it is probable that many aspects of the Eastern Racer's life history make it more vulnerable in the Northeast (including Vermont) than in warmer areas of the country. Reproductive characteristics that may make Eastern Racers more vulnerable in the Northeast, where the active season is short with moderate temperatures, include increased age at first reproduction, greater interval length between reproductive events, longer gestation period, lower annual natality, and a longer generation time. Using the Timber Rattlesnake as an example of this, in Kansas (6-month active season), this snake can reach maturity in four years and breed every two years, while in New York (4.5-5.0-month active season) it averages 9-10 years to reach maturity and breeding occurs only every 3-5 years.

22. Reproductive Status: *Documentation & Comments:*  
Reproduces in Vermont

- ☐ Confirmed In Last 2 Years  
☐ Confirmed In Last 10 Years  
☒ Confirmed In Last 25 Years  
☐ Confirmed Prior To 25 Years Ago  
☐ Unconfirmed

Does Not Breed or is Migratory

*Documentation & Comments:*

Life expectancy for this species is about 10 years. If the snakes and skins found in Guilford are assumed to have been born in Vermont then they are confirmed evidence of breeding in the last 25 years. However, since they are very close to the Massachusetts border they may have been born or bred in Massachusetts. Snakes reported from Putney, Rockingham, and Dummerston, are almost certain to have been born within Vermont. However, no young or eggs have been documented. Two unverified reports of young exist: one in Whitingham and one in Rockingham.

23. Additional Study or Documentation Needed:

Follow up visits and surveys at some of the other reported locations including those in the Champlain Valley and Taconics. Determination of areas of critical habitat. (Better understanding of their seasonal and annual habitat use, including denning areas and egg-laying sites).

Information on geographical limitations, both natural and human-caused.

Long-term population studies to document trends.

24. Attachments:

- 24.1 X Narrative Summary.  
 24.2 X Relative Reports or Papers. (map)  
 24.3 X List of Literature Cited or Other References.

25. Scientific Subcommittee Chairman:

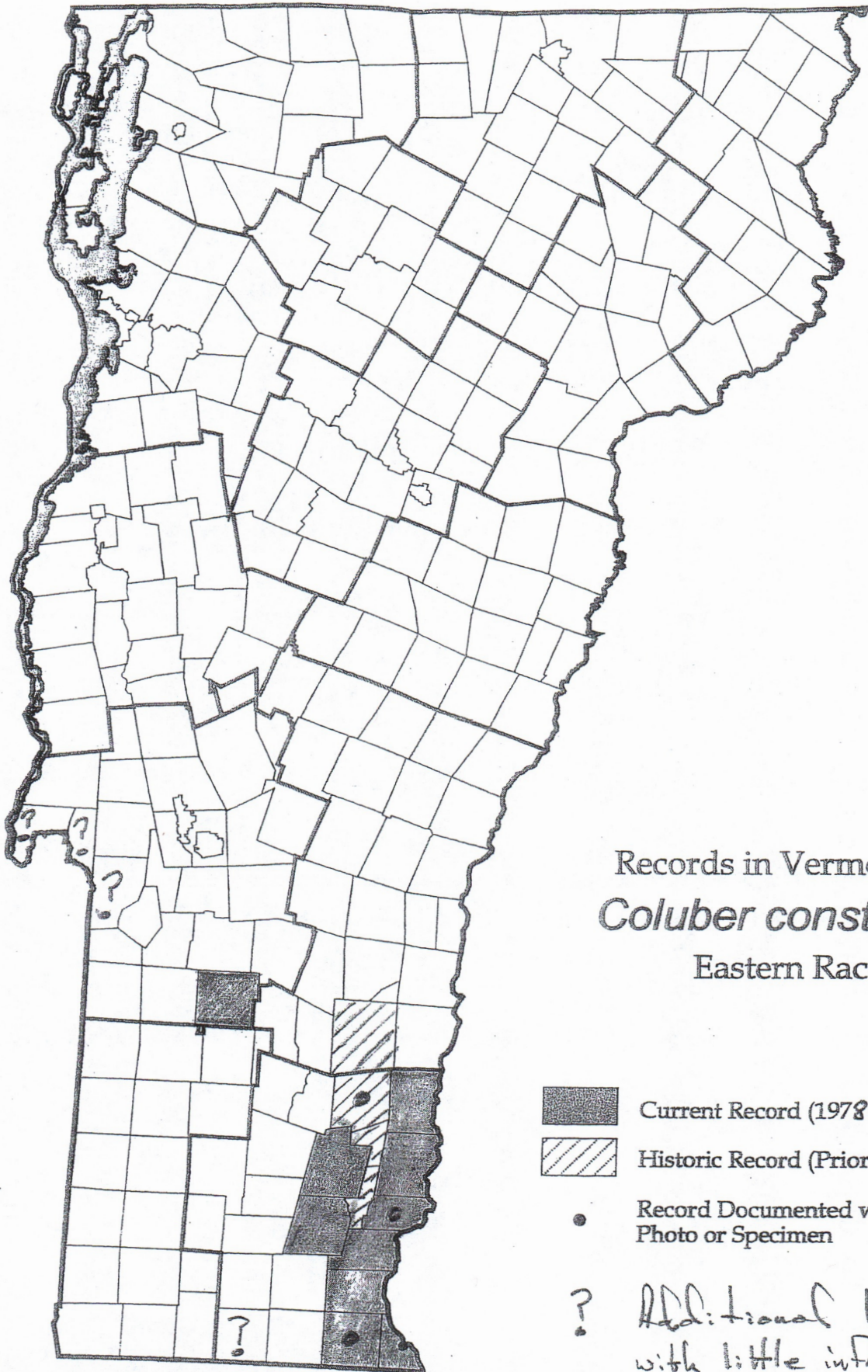
Date:






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Records in Vermont of  
*Coluber constrictor*  
Eastern Racer

-  Current Record (1978 through 2003)
-  Historic Record (Prior to 1978)
-  Record Documented with Photo or Specimen

? Additional leads with little information



# **Appendix C**

## **Documentation for the Listing of the Spotted Turtle**



December, 1996

# Species Documentation

STATE OF VERMONT  
ENDANGERED SPECIES COMMITTEE

1. Scientific Name: Clemmys guttata	7. Surrounding State & Provincial Status:
2. Common Name: Spotted turtle	Maine: Threatened, S3
3. Species Code (Department use only):	New Hampshire: S3, not protected
4. Current Vermont Status: Threatened	Massachusetts: Special concern, S3 or S4
5. Recommended Vermont Status: Endangered	New York: Special concern, S4
6. Federal Status: G5	Quebec: S1, not reported since 1972, extremely rare
<b>POPULATION STATUS</b>	
<p>8. Global, North American, and Vermont Ranges:</p> <p>Global and North American range: Along the Atlantic Coastal Plain of the US from Maine to Florida, with pockets in the lowlands around the Great Lakes including southern Ontario. Historic records in southern Quebec (Cook 1980, Bider and Matte 1994, Ernst, Lovich, and Barbour 1994).</p> <p>Vermont range: Connecticut River Valley, one site in Vernon, Windham County.</p>	
<p>9. Vermont's Position within Global Range:    <input type="checkbox"/> Central    <input checked="" type="checkbox"/> Peripheral    <input type="checkbox"/> Disjunct</p>	
<p>10. Historic Occurrences in Vermont More Than 25 Years Ago (Type, Number, General Location, Regularity of Use, Confidence in Records, etc.):</p> <p>Single specimen located by Ron Rood in 1970 apparently not a part of a currently viable population. Two non-vouchered sightings from Vernon.</p>	



11. Historic Abundance More Than 25 Years Ago (*Number of Breeding Individuals or Size of Area Occupied, Confidence in Records, etc.*):

No data available.

12. Current Occurrences in Vermont (*Type, Number, General Location, Regularity of Use, Confidence in Records, Extent to which the Species has been Inventoried, etc.*):

Please see attached sheet.

13. Current Abundance (*Number of Breeding Individuals or Size of Area Occupied, Confidence in Records, Problems in Estimating Abundance, etc.*):

Please see attached sheet.



14. Population Trend: Estimate Based On:
- |   |   |
|---|---|
| <input type="checkbox"/> Declining          | <input type="checkbox"/> Surveys                  |
| <input type="checkbox"/> Stable             | <input type="checkbox"/> Counts                   |
| <input type="checkbox"/> Increasing         | <input type="checkbox"/> Observations             |
| <input checked="" type="checkbox"/> Unknown | <input type="checkbox"/> Other ( <i>explain</i> ) |

Documentation & Comments:

#### HABITAT IN VERMONT

15. General Description:

Lowlands below 700 ft (Klemens 1993). Wetlands complexes that include vernal pools, woodlands, and permanent swamps, bogs, brooks, or fens. System must be contiguous and without barriers to safe movement between wetlands.

16. Habitat Losses in Past (*Amount and Location*):

Wooded lowland forests and small wetlands contained within them would have been among the earliest to be cleared and drained for agriculture, housing, commerce and transportation. Fragmentation of the necessary habitat complexes by roads, intensive agriculture and other developments has been intensive. No data are available on specific populations that have been extirpated.

17. Probable Habitat Losses in Future (*Amount, Location, and Type*):

Fragmentation or consumption through development for housing, commerce, transportation, or intensive agriculture are all possible on the one known site.

18. Current Protected Status of Habitat: Comments:

- |   |  |
|---|--|
| <input type="checkbox"/> Unknown Whether Any Protected            |  |
| <input checked="" type="checkbox"/> Believed To Be None Protected |  |
| <input type="checkbox"/> At Least One Protected Occurrence        |  |
| <input type="checkbox"/> Several Protected Occurrences            |  |
| <input type="checkbox"/> Many Protected Occurrences               |  |
| <input type="checkbox"/> Other ( <i>explain</i> )                 |  |



## POPULATION BIOLOGY

19. Population Threats (*Contaminants, Predation, Competition, Disease, Human Disturbance from Recreation, Collection, Harvest, etc.*):

Degree of Threat:

- ☐ Very Threatened, Species Directly Exploited or Threatened by Natural or Man-caused Forces  
☒ Moderately Threatened, Habitat Lends Itself to Alternate Use but is not Currently in Jeopardy  
☐ Little Threat, Self-protecting by Unsuitability for Other Uses  
☐ Unknown

Documentation & Comments:

Habitat is privately owned, relatively level woodland and agricultural land. Collection (informal and commercial pet trade) is a concern. Maintenance and health of wetlands is a concern. Mortality as a result of farm equipment is also possible.

20. Tolerance To Human Activity: Documentation & Comments:

- ☒ Fragile  
☐ Fairly Resistant  
☐ Tough  
☐ Unknown

Please see attached sheet.

21. Reproduction Parameters (*Age to Sexual Maturity, Annual Production of Offspring, Reproductive Life, or Other Factors that Warrant Consideration*):

Please see attached sheet.

22. Reproductive Status:

Documentation & Comments:

- ☐ Reproduces in Vermont  
☐ Confirmed In Last 2 Years  
☐ Confirmed In Last 10 Years  
☒ Confirmed In Last 25 Years  
☐ Confirmed Prior To 25 Years Ago  
☐ Unconfirmed  
☐ Does Not Breed or is Migratory

Estimated age of some turtles (less than 25 years) confirms reproduction in last 25 years.

23. Additional Study or Documentation Needed:

Continuing efforts to locate additional population of this species.

24. Attachments:

- 24.1 Narrative Summary. Yes  
24.2 Relative Reports or Papers. Yes  
24.3 List of Literature Cited or Other References. Yes

25. Scientific Subcommittee Chairman:

Date:



## Species documentation for Spotted turtle (cont.)

12. Efforts have been made to locate this species or records of this species for close to twenty years. Intensive trapping and searching by experienced biologists has been focused on the most likely looking habitat throughout the state but with no success. In addition the scores of volunteers contributing records for the Vermont Atlas have not located a single new population. The only known population of this species is in Vernon. At that site, at least five different turtles have been seen and possibly as many as eight. Single individuals have been reported and photographed from Guilford, Richmond, and a second site in Vernon (see attached sheet) but field work at those sites has not revealed any additional turtles. Turtles of the Vernon population have been seen from 1990 through 1993. The site has not been visited under appropriate viewing conditions since then. This species is secretive and best observed during a limited window of time in early spring. Hence it is possible that it will be located elsewhere. However, considering the large amount of effort by volunteers, contractors, and state biologists, it seems likely that if any unknown populations exist, they are few and small. Even if other populations were found, the amount of habitat fragmentation, low reproductive rate, and commercial demand for this species, puts it at great risk.

13. The one known site has not been studied intensively. Brief observations have revealed a minimum of five different turtles and possibly as many as eight. Single individuals have been reported and photographed from Guilford, Richmond, and a second site in Vernon (see attached sheet) but field work at those sites has not revealed any additional turtles. The total area used by this population is unknown. This species travels overland from a permanent water body to adjacent temporary pools to feed. Hence a complex of wetlands uninterrupted by roads or development is needed to support this species. The entire wetlands complex at this site and the surrounding woods and fields would all be utilized by this species.

20. The requirement of this species for an interconnected wetlands complex makes it less tolerant of human disturbance of habitat. These habitat complexes are not protected by current wetlands regulations. Current buffers for wetlands of 50-100ft. are not sufficient to protect this species. Local habitat fragmentation is a threat to this species as a result of its need to move between wetlands. Isolation of known population from other populations also puts this species at risk. Road mortality and mortality as a result of agricultural, or recreational equipment is a threat to this species. The appeal of turtles to humans is also a threat to this species. Collection of even a small number of adults for commercial purposes or removal of individuals from their habitat by well meaning recreationists is a threat to populations of this species.

21. The reproductive potential of this species is very low. Spotted turtles reach reproductive age in 7-10 years and are reported to lay an average of 2-4 eggs per clutch. As a result of egg mortality they have a realized reproductive potential per clutch of 2.4 young (Ernst, Lovich, and Barbour 1994). Reports vary on the number of clutches laid per year from two per year to one every other year. The rate of predation may be high. Skunks and raccoons, two species whose populations have increased as a result of mans activities, are major predators. One population showed a rate of survivorship of eggs and hatchlings of only 58%. As a result protection of breeding adults is critical.



## Spotted Turtle (*Clemmys guttata*) in Vermont

- 1970, June. Ron Rood finds a **single Spotted turtle** crossing the road in Richmond. Photo's taken. Prior to this date there is no record of Spotted turtles having been collected or reported from Vermont. Five days of unsuccessful fieldwork at this site in the 80's by DesMeules, Fichtel, and others led them to believe that the turtle was a released pet.
- 1981, May. Steve MaCavoy finds a **single Spotted turtle** crossing the road in Vernon (Vernon A). Specimen is taken to his home.
- 1983, June. Vernon A site searched. No turtles found.
- 1983, August. **Single Spotted turtle** photographed from Guilford by Gregg Dechirico.
- 1984, June-August. Many Champlain Valley sites trapped over 28 days. Three species of turtle located but no Spotted turtles.
- 1984, April. Vernon A site searched. No Spotted turtles found.
- 1984, July. Guilford site searched. No Spotted turtles found. Habitat does not look promising.
- 1984, July. Spotted turtle recommended for listing as endangered in a draft report of the Scientific Subcommittee.
- 1984, August. Spotted turtle placed in special concern category by Scientific Subcommittee. It was felt that the species had "not been ascertained to be a viable component of the state's fauna".
- 1988, April-June. Nine days spent searching and trapping at Vernon and Guilford sites. **One male Spotted turtle** trapped at a separate Vernon site in June (Vernon B) by Douglas and Robert Nesbitt working for Marc DesMeules.
- 1988, May. Five days spent trapping and searching at a potential site in Benson. No Spotted turtles found.
- 1988, Marc DesMeules and Chris Fichtel summarize historic records and natural history and report on 1988 efforts in Technical Abstract #1 of the Nongame and Endangered Species Program. Development pressure listed as a concern.
- 1988, November. Spotted turtle proposed as threatened. Ian Worley and C. Gorius voted for a counter motion to list as endangered. Marc DesMeules felt some more field work should be done before proposing the species as endangered. Species eventually listed as threatened.
- 1989, April. Four days spent searching and trapping at Vernon B. No Spotted turtles found.
- 1989, April. One half day spent searching at Guilford site. No Spotted turtles found.
- 1989, May. Three and one half days spent searching and trapping at bogs in northern Vermont. No Spotted turtles found.
- 1990, Progress report written by Marc DesMeules on 1989 efforts in Technical Report #13 of the Nongame and Natural Heritage Program. Development pressure again listed as a concern.
- 1990, April. One half day spent at Vernon B. No Spotted turtles found.
- 1990, April. Two days spent searching and trapping near Vernon A. A **single female Spotted turtle** seen by Marc DesMeules and Chris Fichtel.
- 1991, April. Two days spent searching and trapping at the site near Vernon A. **Three Spotted turtles found** by DesMeules and Fichtel. Two were male and 1 was a female.
- 1992-1993, **Two to five additional Spotted turtles** are located at Vernon A by Marc DesMeules, making a minimum of five different turtles located at or near this site since 1990.
- 1993, November. Protection of the Vernon A site is listed as a protection priority by the Reptile and Amphibian Scientific Advisory Group in its annual report. Development pressure again listed as a concern.
- 1996, November. Reptile and Amphibian Scientific Advisory Group recommends listing the Spotted turtle as endangered.

This species has been reported in Vermont from a total of four sites: two in Vernon, one in Guilford, and one in Richmond. Evidence of a breeding population exists from only the Vernon A site (a minimum of five turtles).



## **Appendix D**

### **Forest Management Recommendations for Reptiles and Amphibians**



## **Forest Management Practices to Minimize Negative Impacts on Vermont Reptiles and Amphibians**

Most amphibians spend the majority of their lives away from water in the surrounding woods. The wetlands, vernal pools, and ponds are critical for breeding of most species but the forests are also critical for the foraging and wintering of those species. Some local amphibians migrate 300 meters or more from wintering and foraging areas to breeding ponds. Most snakes, some turtles, and Vermont's only lizard spend the majority of their lives away from water. Hence management of wetlands and the surrounding woods both have an impact on reptiles and amphibians. Some species of larger snakes and most land turtles require many years to reach breeding age. Direct mortality or removal of breeding adults can have a devastating impact on a population.

### **Specific management plans for rare, threatened, or endangered species**

Learn to recognize Vermont's rare, threatened, and endangered species.

(habitat in which they are found should be managed specifically for them)

(contact the Vermont Non-game and Natural Heritage Program, they will be interested in the distribution information and may be able to make specific management suggestions)

### **General**

Maintain large down trees (2 per acre, 7 per hectare), dead standing trees, and a future supply consisting of older standing trees.

Maintain standing trees with knotholes and dead branches.

Within areas that are heavily cut, patches of older trees should be left in addition to the scattered mature trees.

Maintain a thick layer of deciduous litter.

Softwood plantations limit the number and diversity of amphibians.

(decreased coarse woody debris, decreased structural diversity, decreased hardwood leaf litter, increased acidity)

(in these situations maintaining pockets of hardwoods and leaving large debris on the ground would help to minimize the impact)

Long rotations provide the old mature growth and dense forest cover amphibians prefer.

(as forests age they show increasing amphibian abundance up to an age of 60 to 70 years old in wet cool habitats and up to 120 years in warm, dry, lowland habitats)



Minimize compaction of the soil and direct mortality by keeping heavy equipment off the site when the ground is saturated.

(winter logging or logging in late summer and early fall conditions should help minimize this effect)

Protect and maintain shrub cover in the forest and on forest edges.

### Openings

Maintain a natural pattern of forest cover with small forest breaks.

Large clear-cuts regularly show fewer amphibians than adjacent older growth.

(successive short rotation clear-cuts showed the lowest abundance of amphibians)

(natural disasters such as diseases and storms seem to have less of an effect on amphibian abundance as clear-cuts, probably because of the amount of coarse woody debris left behind)

(large clear-cuts seem to block the movements of some amphibian species)

Small upland meadows with nearby woods provide partial habitat requirements for some snake species.

In small upland meadows exposed rock piles, sawdust piles, and coarse woody debris can provide good habitat for snakes.

### Wetland areas

Maintain the ability of swamps, vernal, and semipermanent pools to hold water.

Do not create ditches and ruts that will hold water only briefly. Amphibians often lay their eggs in these small patches of water which dry too soon to permit the larvae to transform and leave. They should either be prevented or they should be deep and shaded enough to hold water through July.

Streams, ponds, and vernal pools should be kept shaded and silt should be kept out.

(among other effects, silt fills the spaces in stream beds where the larval amphibians hide and feed)

(direct sun may speed the rate of evaporation in vernal pools)

Equipment and logs should be kept out of vernal pools and other wetlands.

(small amounts of coarse woody debris or single trees that fall into a wetland are not harmful but vernal pools should not be filled with debris)



Buffer strips should be maintained around all water bodies including streams, ponds, and vernal pools.

(these strips minimize siltation, maintain shade, maintain undisturbed soil and deep leaf litter, provide patches of older growth as sources for recolonization, and provide movement corridors)

(the width of uncut buffer strips should be a minimum of 30 meters, with a wider zone of up to 100 meters where cutting and its impacts are limited)

(deMaynadier and Hunter suggest no more than 25% of the basal area should be cut in this second tier buffer)

(buffer strips should be widest where streams are larger, where the intensity of harvest is greatest, where the surrounding terrain is steepest, or where rare, threatened, or endangered species are found)

Equipment should be kept out of forested seepage areas.

Forest cover over seepage areas should be maintained.

## Chemicals

Amphibians absorb any chemicals which are in the water (dew, ground water, streams etc.) around them.

(minimize use of herbicides, pesticides, etc.)

(one study suggests that CaCl spread on roads to minimize dust may be a barrier to amphibian movement)

## Roads

Minimize the number of roads, size of roads, and the amount of traffic on roads.

(a rural paved road in upstate New York killed between 50 and 100 percent of migrating amphibians breeding near it)

Permanent roads should be planned not to intercept the annual movements of reptiles and amphibians between breeding, foraging and wintering habitats.

## Other Species

Allow only moderate grazing after the breeding season.

Keep livestock out of the riparian zone and away from vernal pools and ponds.

If livestock need access to a pond or a lake, limit it. Maintain as much naturally vegetated shoreline as possible.

Don't introduce fish in streams and ponds where they were not previously found.

(many fish feed on amphibian eggs and larvae, and absence of predacious fish is a primary requisite of vernal pool breeders)



Open areas with dense annual or shrubby growth near water bodies or on the edge of woods provide foraging areas for some species

open areas that are to be kept open should be cut high and either not raked or raked by hand, (direct mortality should be minimized)

these areas could be cut after the ground is frozen and before the first snows (reptiles and amphibians would no longer be active)

**General amphibian microhabitat requirements include;**

breeding locations that hold water at least through July,  
coarse woody debris in adjacent forested areas,  
foliage height diversity in adjacent forested areas,  
canopy cover over breeding and foraging areas,  
deep deciduous leaf litter for moisture retention and feeding,  
cool and moist conditions.

**General reptile microhabitat requirements include;**

coarse woody debris (standing and down),  
small open patches for basking, mixed with well shaded refugia for warm weather and feeding,  
undisturbed areas in and around wetlands for feeding and breeding,  
access to safe denning areas.

Many of the above ideas were taken from a recent review of the literature regarding amphibians and forest management. This review includes an extensive bibliography that might be of interest.

deMaynadier, P. and M. Hunter. 1995. The relationship between forest management and amphibian ecology: a review of the North American literature. *Environmental Reviews* 3: 230-261.

Additional suggestions for this list were provided by the author (J. Andrews), P. Bartelt, S. Droege, S. Jackson, L. Raw, and R. Waldick.

James Andrews, 7/96



## **Appendix E**

### **A Bibliography of the Literature Dealing with Reptiles, Amphibians, and Roads**



## THE EFFECTS OF ROADS ON REPTILES AND AMPHIBIANS - BIBLIOGRAPHY

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## INTERNET RESOURCES

### Government Sites

US Department of Agriculture. Forest Service, San Dimas Technology and Development Center, and Utah State University. Wildlife Crossing Toolkit.  
<http://www.wildlifecrossings.info/beta2.htm>

US Department of Transportation, Federal Highway Administration  
Critter Crossing: Linking Habitats and Reducing Roadkills.  
[www.fhwa.dot.gov/environment/wildlifecrossings/main.htm](http://www.fhwa.dot.gov/environment/wildlifecrossings/main.htm)  
[www.fhwa.dot.gov/environment/wildlifecrossings/amphibin.htm](http://www.fhwa.dot.gov/environment/wildlifecrossings/amphibin.htm)  
[www.fhwa.dot.gov/environment/wildlifecrossings/tortoise.htm](http://www.fhwa.dot.gov/environment/wildlifecrossings/tortoise.htm)  
[www.fhwa.dot.gov/environment/wildlifecrossings/salamand.htm](http://www.fhwa.dot.gov/environment/wildlifecrossings/salamand.htm)  
Keeping it Simple: Easy Ways to Help Wildlife Along Roads  
<http://www.fhwa.dot.gov/environment/wildlifeprotection/index.cfm>

US Geological Survey. Paynes Prairie Ecopassage Project.  
[www.fcsc.usgs.gov/Amphibians\\_and\\_Reptiles/Paynes\\_Prairie\\_Project/paynes\\_prairie\\_project.html](http://www.fcsc.usgs.gov/Amphibians_and_Reptiles/Paynes_Prairie_Project/paynes_prairie_project.html)

### Private Sites

Berryman Institute. Wildlife and Highways: Seeking solutions to an ecological and socio-economic dilemma.  
[http://gulliover.trb.org/publications/nchrp/nchrp\\_syn\\_305.pdf](http://gulliover.trb.org/publications/nchrp/nchrp_syn_305.pdf)

Center for Transportation and the Environment  
Searchable Database of Wildlife Ecology Literature and Web Sites.  
<http://itre.ncsu.edu/cte/wildlife.htm>  
Wildlife, Fisheries, and Transportation Web Gateway.  
<http://www.itre.ncsu.edu/cte/gateway/home.html>  
<http://www.itre.ncsu.edu/cte/gateway/links.html>  
International Conference on Ecology and Transportation.  
<http://www.itre.ncsu.edu/cte/icoet/index.html>  
Evaluation of a Wildlife Underpass on Vermont State Highways 289 in Essex, Vermont  
<http://utre.ncsu.edu/cte/icoet/downloads/Posters.pdf>  
Wildlife Crossing Structures Field Course  
[http://itre.ncsu.edu/cte/gateway/banff\\_index.html](http://itre.ncsu.edu/cte/gateway/banff_index.html)

Converge: Where Transportation and the Environment Meet. Wildlife, Fisheries, Ecosystems.  
[http://www.converge.ncsu.edu/topics/topics\\_display.asp?topic\\_ref=21](http://www.converge.ncsu.edu/topics/topics_display.asp?topic_ref=21)



Defenders of Wildlife. Habitat and Highways Campaign.

[www.defenders.org/habitat/highways/](http://www.defenders.org/habitat/highways/)

[www.defenders.org/habitat/highways/new/sub/library/laurie's%20bridge%20paper.pdf](http://www.defenders.org/habitat/highways/new/sub/library/laurie's%20bridge%20paper.pdf)

Eco Network Europe. Cost 341 – Habitat Fragmentation caused by Transportation Infrastructure.

[www.cordis.lu/cost-transport/src/cost-341.htm](http://www.cordis.lu/cost-transport/src/cost-341.htm)

Natural Resource Defense Council. The End of the Road – Bibliography.

<http://www.nrdc.org/land/forests/roads/refer.asp>

Surface Transportation Policy Project

[www.tea3.org](http://www.tea3.org)

Wildland Center for Preventing Roads

<http://www.wildlandscpr.org/databases/biblionotes/toads.html>

World Bank. Roads and the Environment Handbook.

<http://www.worldbank.org/transport/publicat/reh/toc.htm>

### **Specific Articles**

Wildlife Habitat Connectivity Across European Highways

<http://www.international.fhwa.dot.gov>

Twinning of the Trans Canada Highway: Highway Service Center: Parks Canada Agency

<http://www.hsctch-twinning.ca/Environmental/inex.htm>

Interaction Between Roadways and Wildlife Ecology: A Synthesis of Highway Practice National Cooperative Highway Research Program (NCHRP): synthesis 305

[http://gulliver.trb.org/publications/nchrp/nchrp\\_syn\\_305.pdf](http://gulliver.trb.org/publications/nchrp/nchrp_syn_305.pdf)



## **Appendix F**

### **Additional Resources on Reptiles and Amphibians**



## Useful Sources of Information on New England Reptiles and Amphibians

Identification. A few good field guides to reptiles and amphibians exist. These help you identify herptiles but do not give you life history information. One that is easy to find, and up to date is:

Conant, R., and J.T. Collins. 1998. A field guide to reptiles and amphibians of eastern and central North America. Third Edition, expanded, Houghton Mifflin Company, Boston Massachusetts 616 pp.

Natural History. These guides focus less on identification and more on natural history, local distribution, and conservation.

DeGraaf, R.M., and D.D. Rudis. 1983. Amphibians and reptiles of New England. The University of Massachusetts Press, Amherst, Massachusetts 85 pp.

Harding, J.H. 1997. Amphibians and reptiles of the Great Lakes Region. The University of Michigan Press, Ann Arbor, Michigan 378 pp. (All our species are included.)

Hulse, A., C. J. McCoy, and E. Censky. 2001. Amphibian and reptiles of Pennsylvania and the Northeast. Cornell University Press, Ithaca, New York 419 pp. (Most of our species are included.)

Hunter, M.L., A. Calhoun, and M. McCullough (eds.). 1999. Maine amphibians and reptiles. The University of Maine Press, Orono, Maine 272 pp. (This edition includes a CD of local frog calls. Call 207-581-1408 to order.)

Klemens, M.K. 1993. Amphibians and reptiles of Connecticut and adjacent regions. State Geological and Natural History Survey of Connecticut, Bulletin No. 112 318 pp. (Unfortunately this is currently out of print.)

Tyning, T.F. 1990. A guide to amphibians and reptiles. Little, Brown and Company. Boston Massachusetts 400 pp.

Calls. A very useful tape to help you learn the calls of frogs and toads is:

Eliot, L. 1992. The calls of frogs and toads; eastern and central North America. Nature Sound Studio. Ithaca New York. (call 1-800-336-6398 to order)

Websites. Many useful sites exist. Some provide more reliable information than others. A few reliable sites, some with many links to other resources are:

Amphibiaweb (an excellent source of information on amphibians)  
<http://elib.cs.berkeley.edu/aw/>

North American Amphibian Monitoring Program (NAAMP)  
<http://www.pwrc.usgs.gov/naamp>

North American Reporting Center for Amphibian Malformations (NARCAM)  
<http://www.npsc.nbs.gov/narcam/>

Society for the Study of Amphibians and Reptiles (SSAR)  
<http://www.ukans.edu/~ssar>

The snakes of Massachusetts (includes all our local snakes)  
[http://www.umass.edu/umext/nrec/snake\\_pit/index.html](http://www.umass.edu/umext/nrec/snake_pit/index.html)



Management Information. Management guides are just beginning to be available. All of these include reptile and amphibian related information.

Biebighauser, T. 2002. A guide to creating vernal ponds. USDA Forest Service in cooperation with the Izaak Walton League of America. Morehead, Kentucky. 33 pp. (Call 606-784-6428 to order or find it on the web.)

Calhoun, A.J.K. and M. W. Klemens. 2002. Best Development Practices: Conserving pool-breeding amphibians in residential and commercial developments in the Northeastern United States. MCA Technical Paper No. 5, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York. 57 pp. (Call 924-925-9175 to order.)

Evink, G. 2002. National Cooperative Highway Research Program Synthesis 305, Interaction between roadways and wildlife ecology, A synthesis of highway practice. Transportation Research Board, Washington D.C. 78 pp. (Impacts of roads on herptiles and some conservation strategies. A big problem, good information. Order at 202-334-3213 or on the web.)

Flatebo, G., C. Foss, and S. Pelletier. 1999. Biodiversity in the forests of Maine: Guidelines for land management. University of Maine Cooperative Extension Bulletin #7147. C. Elliot editor, University of Maine Cooperative Extension, Orono, Maine. 168 pp. (Contact UME Extension Office at 207-581-3188.)

Kingsbury, B. and J. Gibson. 2002. Habitat management guidelines for amphibians and reptiles of the Midwest. Midwest Partners in Amphibian and Reptile Conservation (Midwest PARC). 57 pp. (Visit the PARC website for more information: [www.parcplace.org](http://www.parcplace.org).)



## Additional Reading on Reptiles and Amphibians

### Amphibians

- Bishop, S.C. 1941 (June). The salamanders of New York. New York State Museum bulletin No. 324. The University of the State of New York, Albany, New York 365 pp. (This book is currently out of print, but contains excellent information on Vermont's salamanders.)
- Bishop, S.C. 1994. Handbook of salamanders: The salamanders of the United States, of Canada, and of lower California. Comstock Publishing Associates, A Division of Cornell University Press, Ithaca, New York 555 pp. (A reprint of an old classic. It does not contain as much information on each species as The Salamanders of New York.)
- Dickerson, M.C. 1969. The frog book: North American toads and frogs, with a study of the habits and life histories of those of the northeastern states. Dover Publications, Inc., New York 253 pp. (A reprint of an old classic. Still excellent information but some of it is outdated. No newer comprehensive works on frogs are available.)
- Epple, A.O. 1983. The amphibians of New England. Down East Books, Camden, Maine 138 pp. (A good book for the beginner but without plates or photos.)
- Petranka, J.W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, DC 587 pp. (The most current source for detailed information on salamanders.)
- Pfingsten, R.A. and F.L. Downs. 1989. Salamanders of Ohio. Bulletin of the Ohio Biological Survey Vol. 7, No. 2. College of Biological Sciences, The Ohio State University, Columbus, Ohio 315 pp, 29 plates. (This contains detailed information on the many species of salamander that we share with Ohio.)
- Wright, A.H. and A.A. Wright. 1995. Handbook of frogs and toads of the United States and Canada. Comstock Publishing Associates, A Division of Cornell University Press, Ithaca, New York 640 pp. (A reprint of an old classic. No newer comprehensive works on frogs are available.)

### Reptiles

- Carr, A. 1995. Handbook of turtles: The turtles of the United States, Canada, and Baja California. Comstock Publishing Associates, A Division of Cornell University Press, Ithaca, New York 542 pp. (A reprint of an old classic.)
- Ernst, C.H. and R.W. Barbour. 1989. Snakes of eastern North America. George Mason University Press, Fairfax, Virginia. 282 pp. (An excellent source for detailed information.)
- Ernst, C. H., and E. Ernst. 2003. Snakes of the United States and Canada. Smithsonian Institution Press, Washington D.C. 668 pp. (The latest and most complete source for snakes.)



- Ernst, C.H., J.E. Lovich, and R.W. Barbour. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington D. C. 578 pp. (The best current source for detailed information.)
- Klauber, L.M. 1982. Rattlesnakes: their habits, life histories, & influence on mankind, abridged edition. University of California Press, Berkeley and Los Angeles, California 350 pp. (An edited reprint of an old classic.)
- Klemens, M. (ed.) 2000. Turtle conservation. Smithsonian Institution Press. Washington 334 pp. (A current discussion of conservation challenges.)
- Mitchell, J.C. 1994. The reptiles of Virginia. Smithsonian Institution Press, Washington 352 pp. (This book provides excellent information on the species of reptile that we share with Virginia; most of our species are found in this book.)
- Smith, H.M. 1995. Handbook of lizards: lizards of the United States and Canada. Comstock Publishing Associates, A Division of Cornell University Press, Ithaca, New York 557 pp. (A reprint of an old classic.)
- Tennant, A. 2003. Snakes of North America: eastern and central regions. Lone Star Books, Lanham, Maryland. 605 pp. (One of a two excellent new snake resources.)
- Wright, A.H. and A.A. Wright. 1994. Handbook of snakes of the United States and Canada, volumes 1 and 2. Comstock Publishing Associates, A Division of Cornell University Press, Ithaca, New York 1105 pp. (A reprint of an old classic.)

### Texts

- Duellman, W.E. and L. Trueb. 1994. Biology of amphibians. The Johns Hopkins University Press, Baltimore, Maryland 670 pp. (The standard text for amphibians.)
- Heyer, W.R., M.A. Donnelly, R.W. McDiarmid, L-A. C. Hayek, and M.S. Foster. 1994. Measuring and monitoring biological diversity: standard methods for amphibians. Smithsonian Institution Press, Washington 364 pp. (Useful information for researchers.)
- Mitchell, J.C. 2000. Amphibian monitoring methods and field guide. Smithsonian National Zoological Park's Conservation & Research Center, Front Royal, Virginia 56 pp. (Very accessible, designed for citizen scientists.)
- Stebbins, R.C. and N.W. Cohen. 1995. A natural history of amphibians. Princeton University Press, Princeton, New Jersey 316 pp. (Lots of interesting information in an accessible and easy to read format.)
- West, L. and W.P. Leonard. 1997. How to photograph reptiles & amphibians. Stackpole Books, Mechanicsburg, Pennsylvania 118 pp.
- Zug, G.R. 1993. Herpetology: an introductory biology of amphibians and reptiles. Academic Press, A Division of Harcourt Brace & Company, San Diego, California 527 pp. (A standard text.)



### Novels

Phillips, K. 1994. Tracking the vanishing frogs: an ecological mystery. St. Martin's Press, New York 244 pp. (A good background read on amphibian decline.)

### Other Regional Atlases

Bider, J.R. and S. Matte. 1996. The atlas of amphibians and reptiles of Quebec. St. Lawrence Valley Natural History Society and Ministère de l'Environnement et de la Faune du Québec, Direction de la faune et des habitats, Québec 106 pp.

Taylor, J. 1993. The amphibians and reptiles of New Hampshire with keys to larval, immature and adult forms. Nongame and Endangered Wildlife Program, New Hampshire Fish and Game Department, Concord, New Hampshire 71 pp. (Contains some simple and useful keys.)



# **Appendix G**

## **Background information on Fowler's Toads**



Fowler's Toad (*Bufo fowleri*)  
Vermont Notes, March 14, 2001

Fowler's Toad (*Bufo fowleri*) is a close relative of the more common American Toad (*Bufo americanus*). Most Vermonters are unaware that there are two species of toad in Vermont and would not know to attempt to distinguish between the two possible species when one was caught. However, when examined carefully in the hand, Fowler's Toad can be quite easily distinguished, and it has a very different call from the American Toad. It is slightly smaller than the American Toad with an unmarked (or single spotted) venter (underside) in contrast to the black and white markings on the venter of the American Toad. It also has more numerous small warts in each of the black spots on its back in contrast to the few large warts of the American Toad. Its call is an unmusical short bleat in contrast to the long melodious trill of American Toad.

The species is federally listed as threatened (see Seburn and Seburn, 2000) in Canada with all remaining populations along the north shore of Lake Erie. New York State has populations reaching up the Hudson to the Albany area and one report from further north. New Hampshire has populations from its coastal plain and one reported from the Connecticut River Valley.

Although this species was known from "scattered pockets of well-drained sand and gravel" (Klemens, 1993) in Connecticut and in the central Connecticut lowlands of Massachusetts, it was entirely overlooked in Vermont until reported in 1983 by Michael Caduto and Margaret Barker in White River Junction (town of Hartford). They reported numerous sightings in the vicinity of Hillcrest Terrace in that year. This location made sense as it is an extension of the Connecticut River lowlands populations of Massachusetts.

The 1983 report served as a wake-up call for those of us collecting data on Vermont's amphibians. From then on, toads were checked carefully to rule out the possibility of Fowler's Toads. However, no other toads of this species were located at any site until 1994.

In 1994, Jim Andrews targeted the lowlands of the lower Connecticut River Valley in Vernon to try to locate this species. A visit was timed to coincide with the peak calling season of this species. As a result, a population of this species was seen and heard in the vicinity of Smead Lumber Company on Stebbin's Road in Vernon. Three specimens were caught, two of which were photographed, and an additional chorus was heard.

Despite general herpetological survey efforts covering Windham County by Mike Little and the Bonnyvale Environmental Education Center in Brattleboro and state-wide survey efforts of Jim Andrews and others no additional Fowler's Toads have been seen.

Unverified reports from Guilford, Westminster, Sudbury, and Middlebury are on file. The Guilford and Westminster reports fit with the Connecticut River distribution. The Sudbury and Middlebury reports are in the Lake Champlain Basin. A possible hybrid was later (1996) located in Vernon.

#### Possible threats

Gravel and sand deposits in the lowlands are prime development areas.

Increased road building and road traffic in the river valleys are direct threats to individuals and general threats to breeding and foraging habitats and safe movement between them.



Draining or filling of small wetlands removes breeding habitat.

Species whose habitat needs are more restrictive and whose numbers are limited are at a heightened risk from anthropogenic and natural events.

Species at the edge of their ranges are less able to recolonize after natural or anthropogenic events that reduce or eliminate populations.

Controlling flooding along the lower Connecticut River may have limited habitat for this species which is adapted to shoreline disturbance.

**Reasons the RASAG has not brought this species forward for listing:**

Since this species might be assumed to be the American Toad by many of the volunteers contributing records for the Vermont Herp Atlas, it may be underreported.

No extensive species-specific surveys have been made for Fowler's Toad in the prime habitat areas (Connecticut River Valley).

The one targeted survey of Jim Andrews located a population of this species relatively quickly and easily, suggesting more could be located with additional effort.

We have no quantitative or anecdotal evidence of population decline in Vermont.

Maintaining scientific credibility by not recommending listing of a species that we do not know for sure is at risk.

**Concerns about not listing this species:**

No funds or personnel have been dedicated to targeted surveys. It may be years before these surveys take place, if at all. While we wait, important habitat may be lost.

Perhaps listing of this species will stimulate additional survey work by state personnel.

We have no quantitative or anecdotal evidence of population stability in Vermont.

Mike Little was aware of the possible presence of this species yet his general herp surveys in Windham County located all known amphibians in that county except this species.

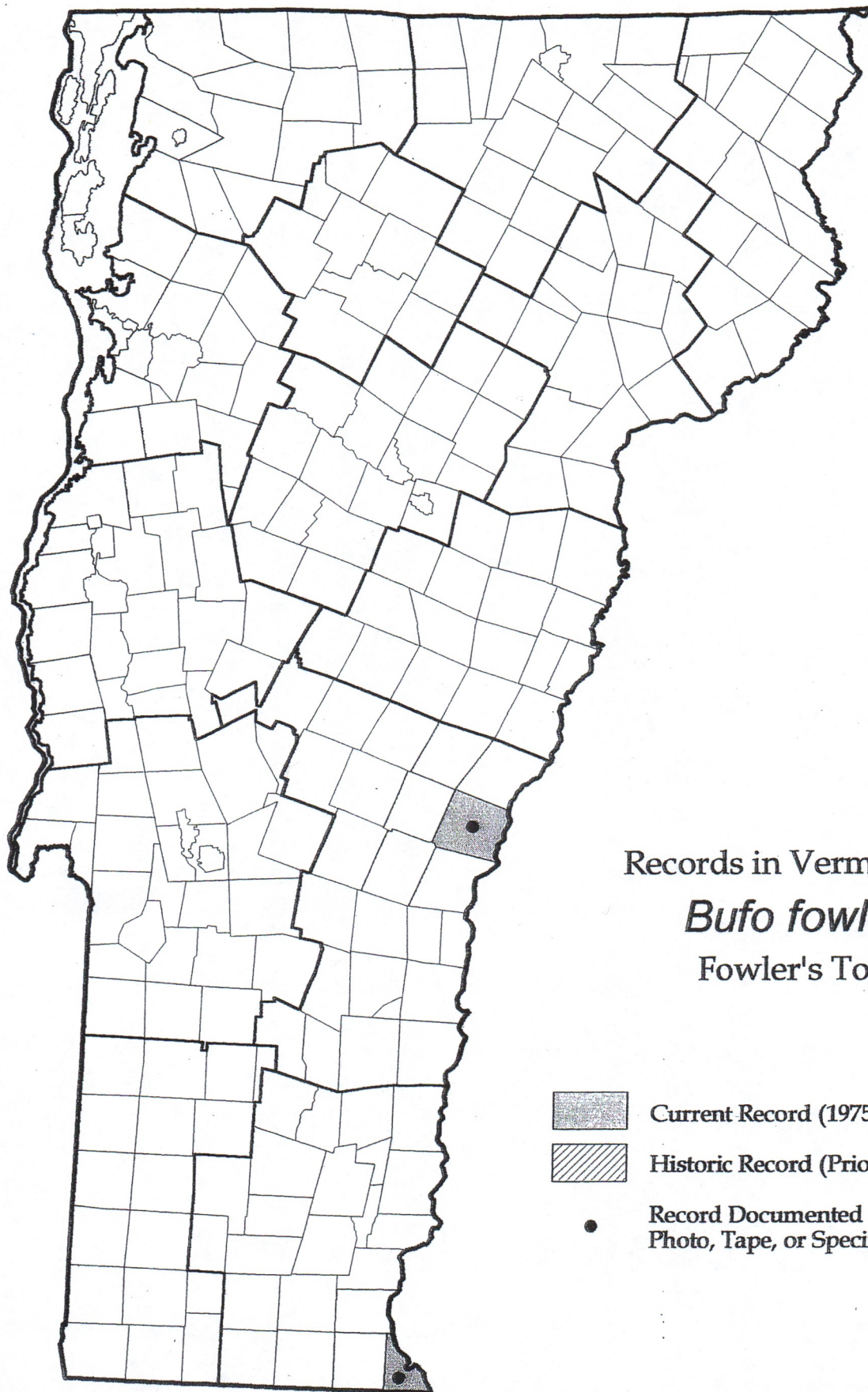
General surveys by Jim Andrews and his employees and interns have covered much of the state over the past five years and no other specimens of this species have been located.

The one targeted survey located only one population at one site despite covering a much larger area.

If this species were widespread, its unique call should have been reported as unusual by some of the more astute naturalists in the state.

A conservative approach would be to monitor and protect the known sites until we can show that this species is more widespread than we thought.





Records in Vermont of  
*Bufo fowleri*  
Fowler's Toad



Current Record (1975 through 1999)



Historic Record (Prior to 1975)



Record Documented with  
Photo, Tape, or Specimen