

Appendix A1

**Amphibian & Reptile
SGCN Conservation Reports**

Wildlife Action Plan 2015

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Common Name: **Jefferson Salamander**
Scientific Name: **Ambystoma jeffersonianum**
Species Group: **Herp**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G4

Global Trend:

State Rank: S2

State Trend: Unknown

Extirpated in VT? No

Regional SGCN? Yes

Assessment Narrative:

Jefferson Salamander is rare in Vermont (S2, SC), and is considered a species of conservation concern within the region due to evidence of population declines and the fact that a high proportion of the global population occurs within the Northeast (Terres). Jefferson Salamander breeding habitat is limited almost exclusively to temporary woodland pools surrounded by relatively large stands of mature hardwoods. There is evidence that the species may be sensitive to forest fragmentation, and in southern New England, some populations appear to have been outcompeted by its congener, the Blue-spotted Salamander (Klemens, personal communication). In addition, unisexual female hybrid populations exist that introduce uncertainties about the species' taxonomy, population biology, persistence, and long-term viability.

Distribution

The distribution of this rare woodland species is widespread but scattered in Vermont; rare or absent from higher elevations of the Green Mountains.

Distribution by Biophysical Region:

| | | | |
|-------------------------------|--------------|-----------------------------|-----------|
| Champlain Valley | Confident | Southern VT Piedmont | Confident |
| Champlain Hills | Probable | Vermont Valley | Confident |
| Northern Green Mtns | Confident | Southern Green Mtns | Probable |
| Northern VT Piedmont | Confident | Taconic Mtns | Confident |
| Northeastern Highlands | Not Probable | | |

Distribution by Watershed:

Known Watersheds

Middle Connecticut
Lake Champlain
Middle Connecticut
West
Upper Connecticut-Mascoma
Black-Ottawquechee
Hudson-Hoosic
Otter Creek
White
Winooski River

Probable Watersheds

Lamoille River
Waits
Deerfield
Passumpsic



Common Name: **Jefferson Salamander**
Scientific Name: **Ambystoma jeffersonianum**
Species Group: **Herp**

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

Habitat mosaics that include breeding pools embedded in closed canopy forest stands is most critical. Maintaining forested corridors connected to other suitable habitat patches with breeding pools is important for juvenile dispersal and to maintain metapopulation dynamics. Requires well-shaded, relatively mature hardwood/hemlock forest stands with abundant coarse woody debris, leaf litter, and underground refugia (small mammal tunnels, rock crevices, etc.) surrounding temporary woodland (vernal) pools (Faccio 2003). May also use semi-permanent pools. Most commonly found in ridgetop, mid-elevation Northern Hardwood forests in the foothills of the Green Mountains.

Habitat Types:

Spruce Fir Northern Hardwood
Northern Hardwood
Oak-Pine Northern Hardwood
Seeps and Pools
Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat
Habitat Alteration
Sedimentation
Habitat Fragmentation
Impacts of Roads or Transportation Systems
Climate Change

Description of habitat threat(s): Any habitat conversion, alteration, or fragmentation that disrupts species' ability to move between breeding and terrestrial sites, disrupts connectivity between breeding sites/metapopulations (Compton et al 2007), changes water/soil chemistry, temperature, pool hydroperiod, humidity, etc, may have negative effects. Road mortality can have major impacts on migrating adults and dispersing juveniles, especially when located between terrestrial and breeding habitats. Climate change that affects hydroperiod and/or water temperature of breeding pools could have significant impacts on productivity (Rowe and Dunson 1995).

Non-Habitat Threats:

Genetics
Competition
Pollution
Reproductive Traits



Common Name: **Jefferson Salamander**
 Scientific Name: **Ambystoma jeffersonianum**
 Species Group: **Herp**

Disease

Trampling or Direct Impacts

Description of non-habitat threat(s): Unisexual, female hybrid populations reproduce via gynogenesis (requires sperm from diploid males which is not incorporated into the genome of embryos; Petranka 1998), resulting in female-biased sex ratios. Since hybrid females require males in the population for successful breeding, but do not produce males to replace those that have been lost, they may have the potential to dilute genetic variability of diploid populations. Competition from the Blue-spotted Salamander, which is more tolerant of disturbed habitats (Klemens 1993), may be a problem in areas where both species are found together (Champlain Valley, southern NE). Two emerging diseases (Ranavirus and Batrachochytrium salamandrivorans (Bs)) could present a threat in the future. Ranavirus was recently shown to be widely distributed in vernal pools in six mid-Atlantic states (Scott A. Smith pers. Comm.), while the fungal disease Bs, which originated in Asia, was recently detected in Europe (Stokstad 2014). Loss of metapopulation structure due to fragmentation of suitable habitats by roads or other non-permeable development is problematic. Jefferson Salamander is more sensitive to acidification of breeding pools compared to other Ambystoma species (Petranka 1998). Complete egg mortality occurs in pools with low pH, and water with a pH <4.5 is often lethal to larvae. Also, widespread treatment of breeding pools to control West Nile Virus would likely have negative effects on amphibians. This is a long-lived amphibian that may not breed every year and produces relatively few eggs per breeding cycle.

Research and Monitoring Needs

| Type | Need | Priority | Description |
|------------|--------------------------------|----------|--|
| Research | Habitat Requirements | Medium | Continue to field-verify mapped potential pools and other breeding sites statewide. |
| Research | Basic Life History | Low | |
| Research | Distribution and Abundance | High | 1) Identify distribution and relative abundance of VT populations 2) Identify significant breeding sites. Large numbers (e.g., >25 egg masses) of breeders or evidence of use by any SGCN. 3) Continue to field-verify mapped potential vernal pools statewide. |
| Research | Threats and Their Significance | High | 1) Conduct sampling to determine if Ranavirus is present in the state, and if so, determine its distribution and which species are affected. 2) Identify sites where road mortality is high annually and evaluate mitigation methods. 3) Identify and evaluate limiting factors. |
| Research | Population Genetics | Medium | Determine population genetics statewide and monitor populations for changes in sex ratios. |
| Research | Taxonomy | Medium | |
| Monitoring | Population Change | High | Implement a statistically robust monitoring protocol to track breeding phenology, population trends, and productivity, as well as changes in breeding site variables (e.g. hydroperiod, water chemistry, etc.). |
| Monitoring | Habitat Change | High | |
| Monitoring | Range Shifts | Medium | |
| Monitoring | Monitor Threats | High | |

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Common Name: **Jefferson Salamander**
 Scientific Name: **Ambystoma jeffersonianum**
 Species Group: **Herp**

Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|---|--------------------------|--|--|---|---|
| Research | High | Determine presence/absence and distribution of Ranavirus in VT, and which species are most affected. | Number and distribution of sites sampled | VCE, Reptile & Amphibian Atlas, ANR Wetlands Division | SWG, Private Grants |
| Standards | | Timber harvest should be conducted on frozen ground and rutting of ground that could change hydrology of an area or intercept amphibians should be avoided. | Number of operations that did not disturb ground | landowners, FPR, USFS, consulting foresters | State Lands Mgmt, GMNF, EQIP, Current Use |
| Standards | | Maintain 75% mature canopy cover beyond the 30-meter buffer in the terrestrial habitat. | Sites with canopy cover | landowners, consulting foresters | State Lands Mgmt funds, EQIP, Current Use |
| Standards | | Maintain 30-meter water quality buffer around entire perimeter of the pool. Timber harvesting, roads and any ground disturbing activities to be excluded within this buffer. | Number of sites having water quality protected | landowners, consulting foresters | EQIP, Current Use |
| Compatible Resource Use | | Maintain permeable forested habitat matrix between and among breeding populations so that individuals can be exchanged among populations. | Number of pools with forest surrounding | landowners, consulting foresters | EQIP, Current Use |
| Technical Assistance, Training, Learning Networks | | Identify significant road crossings and develop safe road crossings to address roadkill. | Number of sites reported | VTrans, Reptile & Amphibian Atlas, VCE | VTrans, FHWA |
| Habitat Restoration | | When existing road traffic is impacting migration of animals from terrestrial habitat to aquatic pool habitat, identify problem areas and redesign roads with crossing structures when roads are being upgraded. | Number of structures installed | VTrans | VTrans, FHWA |
| Standards | | Maintain habitat mosaic and connectivity between breeding pools. If two large sites are separated beyond the dispersal distance of a species it might be helpful to create or enhance pools that would link the two large sites. | Number of pools within habitat matrix | landowners, consulting foresters | State Lands Mgmt fund, EQIP, Current Use |
| Compatible Resource Use | | Site all permanent roads more than 200 meters from a breeding pool, downslope of the pool if possible. | Number of roads sited to minimize impacts to pools | VTrans, developers | VTrans, development conditions |
| Habitat Restoration | | When feasible restore deciduous or mixed forest surrounding breeding pool. | Number of sites restored | landowners, consulting foresters | Current Use, EQIP |

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| | | | | | |
|---|------|--|--|--|--------------------------------|
| Awareness Raising and Communications | | Help people understand the essential needs of all life stages, especially upland habitat in proximity to breeding pool. | Number of people exposed to conservation message | VFWD Outreach Division, media, Reptile & Amphibian Atlas, VCE | marketing funds |
| Compatible Resource Use | | Maintain breeding pools and needed terrestrial habitat--usually directly adjacent to pool perimeter out to 200m but could be the equivalent area along a portion of the perimeter while minimizing edge. | Pools with upland habitat. | landowners, consulting foresters | Current Use, EQIP |
| Compatible Resource Use | | Maintain corridor connections between upland and pool habitat. | Number of sites with upland connections | landowners, consulting foresters | Current Use, EQIP |
| Habitat Restoration | | If loss of important sites is likely due to development, consider creating or enhancing other pools that might allow some adults to transfer to the new site if they encounter it or develop a new breeding population from dispersal of colonizers. | Number of utilized pools. | VTrans, Towns | VTrans, development conditions |
| Technical Assistance, Training, Learning Networks | High | Implement vernal pool management guidelines as described by VFWD. | Number of trainings offered. Number of entities adopting the guidelines. | VFWD, FPR, Coverts, VWA, VT Family Forests, SAF, Land Trusts, Consulting Foresters | SWG |

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Species Group: **Herp**

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Common Name: **Blue-spotted Salamander**
Scientific Name: **Ambystoma laterale**
Species Group: **Herp**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5

Global Trend:

State Rank: S3

State Trend: Unknown

Extirpated in VT?

Regional SGCN? Yes

Assessment Narrative:

Blue-spotted Salamander is rare in Vermont (S3, SC), and is considered a species of conservation concern within the region due to its unknown population status, and taxonomic uncertainty (Terres 1999). The Blue-spotted Salamander is dependent on habitat mosaics consisting of lowland forest adjacent to fishless wetlands suitable for breeding. In addition, unisexual female hybrid populations exist that introduce uncertainties about the species' taxonomy, population biology, persistence, and long-term viability.

Distribution

Well distributed in the Champlain Valley and southern Champlain Hills, with scattered populations elsewhere; rare or absent from higher elevations of the Green Mountains.

Distribution by Biophysical Region:

| | | | |
|-------------------------------|--------------|-----------------------------|-----------|
| Champlain Valley | Confident | Southern VT Piedmont | Confident |
| Champlain Hills | Confident | Vermont Valley | Confident |
| Northern Green Mtns | Unknown | Southern Green Mtns | Probable |
| Northern VT Piedmont | Not Probable | Taconic Mtns | Confident |
| Northeastern Highlands | Confident | | |

Distribution by Watershed:

Known Watersheds

Metawee River
Passumpsic
West
Hudson-Hoosic
Lake Champlain
Lamoille River
Missisquoi River
Otter Creek
St. Francois River
Upper Connecticut
Winooski River

Probable Watersheds

Middle Connecticut
Waits
White



Common Name: **Blue-spotted Salamander**
Scientific Name: **Ambystoma laterale**
Species Group: **Herp**

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

Habitat mosaics that include breeding sites embedded in, or adjacent to, closed canopy forest stands are most critical. Maintaining forested corridors connected to other suitable habitat patches with breeding pools is important for juvenile dispersal and to maintain metapopulation dynamics. Requires hardwood/mixed forest stands with abundant coarse woody debris, leaf litter, and underground refugia (small mammal tunnels, rock crevices, etc.) surrounding a variety of wetland types, including red maple swamps, fens, marshes, temporary woodland (vernal) pools, etc. Most commonly found at lower elevations (<350m), in woodlands adjacent to forested wetlands with sufficient cover for breeding. More tolerant of disturbed habitats and smaller patch size than Jefferson Salamander (Klemens 1993).

Habitat Types:

Spruce Fir Northern Hardwood
Northern Hardwood
Oak-Pine Northern Hardwood
Hardwood Swamps
Softwood Swamps
Seeps and Pools
Open Peatlands
Marshes and Sedge Meadows
Shrub Swamps
Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Transportation Systems
Climate Change

Description of habitat threat(s): Any habitat conversion, alteration, or fragmentation that disrupts species' ability to move between breeding and terrestrial sites, disrupts connectivity between breeding sites/metapopulations (Compton et al 2007), changes water/soil chemistry, temperature, pool hydroperiod, humidity, etc, may have negative effects. Road mortality can have major impacts on migrating adults and dispersing juveniles, especially when located between terrestrial and breeding habitats. Climate change that affects hydroperiod and/or water temperature of breeding pools could have significant impacts on productivity (Rowe and Dunson 1995).

Non-Habitat Threats:

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Common Name: **Blue-spotted Salamander**
 Scientific Name: **Ambystoma laterale**
 Species Group: **Herp**

Genetics

Pollution

Reproductive Traits

Disease

Trampling or Direct Impacts

Description of non-habitat threat(s): Unisexual, female hybrid populations reproduce via gynogenesis requiring sperm from diploid males which is not incorporated into the genome of embryos (Petranka 1998), resulting in female-biased sex ratios. Since hybrid females require males in the population for successful breeding, but do not produce males to replace those that have been lost, they may have the potential to dilute genetic variability of diploid populations. Two emerging diseases (Ranavirus and Batrachochytrium salamandrivorans (Bs)) could present a threat in the future. Ranavirus was recently shown to be widely distributed in vernal pools in six mid-Atlantic states (Scott A. Smith pers. Comm.), while the fungal disease Bs, which originated in Asia, was recently detected in Europe (Stokstad 2014). Loss of metapopulation structure leading to genetic isolation due to fragmentation of suitable habitats by roads or other non-permeable development is problematic. Acid precipitation that lowers pH of breeding pools may reduce productivity. Also, widespread treatment of breeding pools to control West Nile Virus would likely have negative effects on amphibians. This is a long-lived amphibian that may not breed every year and produces relatively few eggs per breeding cycle.

Research and Monitoring Needs

| Type | Need | Priority | Description |
|-------------|--------------------------------|-----------------|--|
| Research | Habitat Requirements | Medium | Continue to field-verify mapped potential pools and other breeding sites statewide. |
| Research | Basic Life History | Low | |
| Research | Distribution and Abundance | High | 1) Identify distribution and relative abundance of VT populations. 2) Identify significant breeding sites. Large numbers (e.g., >25 egg masses) of breeders or evidence of use by any SGCN. 3) Continue to field-verify mapped potential vernal pools statewide. |
| Research | Threats and Their Significance | High | 1) Conduct sampling to determine if Ranavirus is present in the state, and if so, determine its distribution and which species are affected. 2) Identify sites where road mortality is high annually and evaluate mitigation methods. 3) Identify and evaluate limiting factors. |
| Research | Population Genetics | Medium | Determine population genetics statewide and monitor populations for changes in sex ratios. |
| Research | Taxonomy | Medium | |
| Monitoring | Population Change | High | Implement a statistically robust monitoring protocol to track breeding phenology, population trends, and productivity, as well as changes in breeding site variables (e.g. hydroperiod, water chemistry, etc.). |
| Monitoring | Habitat Change | High | |
| Monitoring | Range Shifts | Medium | |
| Monitoring | Monitor Threats | High | |

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Common Name: **Blue-spotted Salamander**
 Scientific Name: **Ambystoma laterale**
 Species Group: **Herp**

Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|---|--------------------------|--|---|--|------------------------------------|
| Technical Assistance, Training, Learning Networks | High | Identify significant road crossings and develop safe road crossings to reduce roadkill. | Number of reported crossings. | VTrans, VCE, Town highway crews & Cons Comms | Vtrans, FHWA |
| Standards | Medium | Maintain 30-meter water quality buffer around entire perimeter of the pool. Timber harvesting, roads and any ground disturbing activities to be excluded within this buffer. | Number of pools with protected buffers. | DEC Wetlands | EPA |
| Habitat Restoration | Medium | If loss of important sites is likely due to development, consider creating or enhancing other pools that might allow some adults to transfer to the new site if they encounter it or develop a new breeding population from dispersal of colonizers. | Connectivity among clusters of pools. No net loss of functional breeding pools. | DEC Wetlands | EPA |
| Standards | Medium | Maintain habitat mosaic and connectivity between breeding pools. If two large sites are separated beyond the dispersal distance of a species it might be helpful to create or enhance pools that would link the two large sites. | Connectivity among clusters of pools. No net loss of functional breeding pools. | DEC Wetlands | EPA |
| Technical Assistance, Training, Learning Networks | High | Identify significant road crossings and develop safe road crossings to reduce roadkill. | Numbers of sites identified and addressed. | VTrans, FHWA | VTrans, FHWA |
| Awareness Raising and Communications | Medium | Help people understand the essential needs of all life stages, especially upland habitat in proximity to breeding pool. | Number of programs and individuals reached with message. | Reptile & Amphibian Atlas, VFWD Outreach Division, VCE | Private Foundation grants |
| Technical Assistance, Training, Learning Networks | High | Implement vernal pool management guidelines as described by VFWD. | Number of trainings offered. Number of entities adopting the guidelines. | VFWD, FPR, Coverts, VWA, VT Family Forests, SAF, Land Trusts, Consulting Foresters | SWG |
| Compatible Resource Use | High | Maintain corridor connections between upland and pool habitat. | Number of pools with secure travel paths to and from upland habitat. No net loss. | Consulting Foresters, USFS | Land Mgmt Agency operating budgets |

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| | | | | | |
|-------------------------|--------|--|---|---|------------------------------------|
| Research | High | Determine presence/absence and distribution of Ranavirus in VT, and which species are most affected. | Number and distribution of sites sampled. | VCE, Reptile & Amphibian Atlas, DEC Wetlands | SWG, Private grants |
| Habitat Restoration | High | When existing road traffic is impacting migration of animals from terrestrial habitat to aquatic pool habitat, identify problem areas and redesign roads with crossing structures when roads are being upgraded. | Number of structures installed. | VTrans, FHWA, Towns | FHWA |
| Standards | High | Timber harvest should be conducted on frozen or dry ground to avoid rutting of ground that could change hydrology of an area or intercept amphibians should be avoided. | Number of harvests conducted on frozen ground. | FPR, Consulting Foresters, USFS | timber sale |
| Standards | High | Maintain 75% mature canopy cover beyond the 30-meter buffer in the terrestrial habitat. | Number and percentage of habitats with adequate canopy. | FPR, Consulting Foresters, USFS | |
| Compatible Resource Use | High | Maintain breeding pools and needed terrestrial habitat--usually directly adjacent to pool perimeter out to 200m but could be the equivalent area along a portion of the perimeter while minimizing edge). | Number of pools with adjacent upland habitat that is permeable for salamanders moving to and from pool. | Landowners | |
| Compatible Resource Use | Medium | Site all permanent roads more than 200 meters from a breeding pool, downslope of the pool if possible. | Number/ percentage of roads sited appropriately. | Developers, Act 250 Commissions | Planning grants, development costs |
| Compatible Resource Use | High | Maintain permeable forested habitat matrix between and among breeding populations so that individuals can be exchanged among populations. | Number of linkages between populations. | Reptile & Amphibian Atlas, Conservation Organizations, USFS | Current Use Program, EQIP |
| Habitat Restoration | Low | When feasible restore deciduous or mixed forest surrounding breeding pool. | Number of pools restored. | Vermont Family Forests | Current Use |

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Common Name: **Blue-spotted Salamander**
Scientific Name: **Ambystoma laterale**
Species Group: **Herp**

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Common Name: **Spotted Salamander**
Scientific Name: **Ambystoma maculatum**
Species Group: **Herp**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5

Global Trend:

State Rank: S5

State Trend:

Extirpated in VT? No

Regional SGCN? No

Assessment Narrative:

Spotted Salamander is found in pools adjacent to woodlands. It is widespread and abundant, but is killed in large numbers when it migrates across roads to and from its breeding pools, and is therefore a SGCN. Conservation status could change over time with increased human pressure that impacts the species in Vermont. For now we consider it to be a medium priority species.

Distribution

The Spotted Salamander is distributed widely in the state of Vermont, including the Green Mountains.

Distribution by Biophysical Region:

| | | | |
|-------------------------------|-----------|-----------------------------|-----------|
| Champlain Valley | Confident | Southern VT Piedmont | Confident |
| Champlain Hills | Confident | Vermont Valley | Confident |
| Northern Green Mtns | Confident | Southern Green Mtns | Confident |
| Northern VT Piedmont | Confident | Taconic Mtns | Confident |
| Northeastern Highlands | Confident | | |

Distribution by Watershed:

Known Watersheds

Black - Ottauquechee
Deerfield
Hudson-Hoosic
Lake Champlain
Lamoille River
Metawee River
Middle Connecticut
Missisquoi River
Otter Creek
Passumpsic
St. Francois River
Upper Connecticut
Upper Connecticut - Mascoma
Waits
West
White
Winooski River



Common Name: **Spotted Salamander**
Scientific Name: **Ambystoma maculatum**
Species Group: **Herp**

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

Spotted Salamanders must have both ephemeral breeding pools and upland habitat in proximity. They may also breed in semi-permanent or permanent wetlands where there is suitable cover to avoid predation by fish. Upland, non-breeding habitat requirements include hardwood/mixed forest stands with abundant coarse woody debris, leaf litter and underground refugia (e.g., small mammal tunnels, rock crevices) surrounding suitable breeding pools (Faccio 2003).

Habitat Types:

Spruce Fir Northern Hardwood
Northern Hardwood
Oak-Pine Northern Hardwood
Floodplain Forests
Hardwood Swamps
Softwood Swamps
Seeps and Pools
Open Peatlands
Marshes and Sedge Meadows
Shrub Swamps
Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Transportation Systems
Climate Change

Description of habitat threat(s): Habitat problems for the Spotted Salamander include loss of upland and pool habitat, loss of movement between habitats, road mortality and less water as a result of climate change.

Non-Habitat Threats:

Pollution
Reproductive Traits
Trampling or Direct Impacts

Description of non-habitat threat(s): Two emerging diseases (Ranavirus and Batrachochytrium



Common Name: **Spotted Salamander**
Scientific Name: **Ambystoma maculatum**
Species Group: **Herp**

salamandrivorans (Bs)) could present a threat in the future. Ranavirus was recently shown to be widely distributed in vernal pools in six mid-Atlantic states (Scott A. Smith pers. comm.), while the fungal disease Bs, which originated in Asia, was recently detected in Europe (Stokstad 2014). Loss of metapopulation structure leading to genetic isolation due to fragmentation of suitable habitats by roads or other non-permeable development is problematic. Acid precipitation that lowers pH of breeding pools may reduce productivity. Also, widespread treatment of breeding pools to control West Nile Virus would likely have negative effects on amphibians. This is a long-lived amphibian that may not breed every year and produces relatively few eggs per breeding cycle.

Research and Monitoring Needs

| Type | Need | Priority | Description |
|-------------|--------------------------------|-----------------|--|
| Research | Habitat Requirements | High | Continue to field-verify mapped potential pools and other breeding sites statewide. |
| Research | Basic Life History | Medium | Need to determine travel distances to pools |
| Research | Distribution and Abundance | Medium | 1) Identify significant breeding sites. Large numbers (e.g., >25 egg masses) of breeders or evidence of use by any SGCN. 2) Continue to field-verify mapped potential vernal pools statewide |
| Research | Threats and Their Significance | High | 1) Conduct sampling to determine if Ranavirus is present in the state, and if so, determine its distribution and which species are affected. 2) Identify sites where road mortality is high annually and evaluate mitigation methods. 3) Identify and evaluate limiting factors. |
| Monitoring | Population Change | High | Implement a statistically robust monitoring protocol to track breeding phenology, population trends, and productivity, as well as changes in breeding site variables (e.g. hydroperiod, water chemistry, etc.). |
| Monitoring | Habitat Change | High | It is important to understand the existing habitat base and track trends. |
| Monitoring | Monitor Threats | High | We should both monitor and manage limiting factors. |

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Common Name: **Spotted Salamander**
 Scientific Name: **Ambystoma maculatum**
 Species Group: **Herp**

Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|---|--------------------------|---|---|--|--|
| Research | High | Determine presence/absence and distribution of Ranavirus in VT, and which species are most affected. | Number and distribution of sites sampled | VCE, Reptile & Amphibian Atlas, DEC Wetlands | SWG, Private grants |
| Standards | | Maintain 75% mature canopy cover beyond the 30-meter buffer in the terrestrial habitat | Number of sites where canopy cover is retained | landowners state and federal lands managers | state lands Mgmt funds, federal lands Mgmt, EQIP |
| Technical Assistance, Training, Learning Networks | | Identify significant road crossings and develop safe road crossings to address roadkill. | Number of sites identified and crossings developed. | Reptile & Amphibian Atlas, VTrans | VTrans, FHWA |
| Habitat Restoration | | When feasible restore deciduous or mixed forest surrounding breeding pool | Number of sites with restored forest cover | landowners, consulting foresters, EQIP biologists | EQIP, Current Use |
| Standards | | Maintain 30-meter water quality buffer around entire perimeter of the pool. Timber harvesting, roads and any ground disturbing activities to be excluded within this buffer | Number of sites where water quality is protected | DEC Water Quality/Wetlands Office, consulting foresters, EQIP biologists | EQIP |
| Standards | | maintain habitat mosaic and maintain connectivity between breeding pools. If two large sites are separated beyond the dispersal distance of a species it might be helpful to create or enhance pools that would link the two large sites. | Number of areas linked. | FPR and VFWD lands managers, USFS, Federal Refuges, private landowners | State lands Mgmt funds, EQIP |
| Compatible Resource Use | | Site all permanent roads more than 200 meters from a breeding pool, downslope of the pool if possible | Number of roads sited that minimize impacts. | VTrans, developers, Towns | Vtrans |
| Awareness Raising and Communications | | Help people understand the essential needs of all life stages, especially upland habitat in proximity to breeding pool. | Number of people who are exposed to message | Reptile & Amphibian Atlas, VCE, SAG-Herps | private grants |
| Compatible Resource Use | | Maintain corridor connections between upland and pool habitat | Number of sites with connections between pool and upland. | Landowners, consulting foresters, EQIP biologists | EQIP, Current Use |

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Common Name: **Spotted Salamander**
 Scientific Name: **Ambystoma maculatum**
 Species Group: **Herp**

| | | | | | |
|---|------|--|--|--|----------------------------|
| Habitat Restoration | | When existing road traffic is impacting migration of animals from terrestrial habitat to aquatic pool habitat, identify problem areas and redesign roads with crossing structures when roads are being upgraded. | Number of structures installed | VTrans | VTrans, FHWA |
| Habitat Restoration | | If loss of important sites is likely due to development, consider creating or enhancing other pools that might allow some adults to transfer to the new site if they encounter it or develop a new breeding population from dispersal of colonizers. | Number of sites enhanced. | VTrans | VTrans |
| Compatible Resource Use | | Maintain breeding pools and needed terrestrial habitat--usually directly adjacent to pool perimeter out to 200m but could be the equivalent area along a portion of the perimeter while minimizing edge. | Number of sites with both pools and upland habitat intact. | Landowners, consulting foresters, Reptile & Amphibian Atlas | EQIP, Partners in Wildlife |
| Standards | | Timber harvest should be conducted on frozen ground and rutting of ground that could change hydrology of an area or intercept amphibians should be avoided. | Number of harvest operations that do not disturb ground. | Consulting foresters, FPR | Current Use |
| Technical Assistance, Training, Learning Networks | High | Implement vernal pool management guidelines as described by VFWD. | Number of trainings offered. Number of entities adopting the guidelines. | VFWD, FPR, Coverts, VWA, VT Family Forests, SAF, Land Trusts, Consulting Foresters | SWG |

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Species Conservation Report



Common Name: **Spotted Salamander**
Scientific Name: **Ambystoma maculatum**
Species Group: **Herp**

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Common Name: **Spotted Salamander**
Scientific Name: **Ambystoma maculatum**
Species Group: **Herp**

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Common Name: **Four-toed Salamander**
Scientific Name: **Hemidactylium scutatum**
Species Group: **Herp**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5

Global Trend:

State Rank: S2

State Trend: Unknown

Extirpated in VT? No

Regional SGCN? No

Assessment Narrative:

The Four-toed Salamander is rare in Vermont (S2, SC) and the region. Although the species is small and secretive, its distribution appears to be limited to low elevations of the Champlain Valley, Taconics, and probably the lower Connecticut River Valley. The species has specialized breeding requirements and is dependent on habitat mosaics consisting of lowland forest adjacent to suitable wetlands for breeding.

Distribution

The distribution of the Four-toed Salamander appears to be limited to low elevations of the Champlain Valley, Taconics, and probably the lower Connecticut River Valley.

Distribution by Biophysical Region:

| | | | |
|-------------------------------|--------------|-----------------------------|--------------|
| Champlain Valley | Confident | Southern VT Piedmont | Confident |
| Champlain Hills | Confident | Vermont Valley | Probable |
| Northern Green Mtns | Not Probable | Southern Green Mtns | Not Probable |
| Northern VT Piedmont | Not Probable | Taconic Mtns | Confident |
| Northeastern Highlands | Not Probable | | |

Distribution by Watershed:

Known Watersheds

West
Upper Connecticut-Mascoma
Mettawee River
Lake Champlain
Middle Connecticut
Mettawee River
Otter Creek
Winooski River

Probable Watersheds

Lamoille River
Missisquoi River

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

Moss or sedge hummocks or moss mats overhanging (often sphagnum) standing water is a critical feature of Four-toed Salamander breeding sites. Eggs are deposited in moss mats and, upon hatching, larvae wiggle through moss and enter pools. Habitat mosaics that include these breeding sites embedded in, or adjacent to, closed canopy forest stands are critical. Maintaining forested corridors connected to other suitable habitat patches with breeding sites is important for juvenile dispersal and to maintain metapopulation dynamics. Eggs



Common Name: **Four-toed Salamander**
Scientific Name: **Hemidactylium scutatum**
Species Group: **Herp**

have also been reported in the literature in rotting logs or leaf litter. Requires relatively mature, moist hardwood/mixed forest stands with abundant coarse woody debris, leaf litter, and underground refugia (small mammal tunnels, rock crevices, etc.) in close proximity to suitable breeding sites. Breeding sites include a variety of mossy wetlands, including red maple swamps, bogs, fens, temporary woodland (vernal) pools, etc. Most commonly found in bottomland forests adjacent to shallow, mossy wetlands with pools and sufficient cover for breeding. In surveys in Massachusetts and Maine, species appears to drop-out of suitable sites above 300 m elevation (A. Richmond, pers. Comm.)

Habitat Types:

Northern Hardwood
Oak-Pine Northern Hardwood
Hardwood Swamps
Softwood Swamps
Seeps and Pools
Open Peatlands
Marshes and Sedge Meadows
Wet Shores
Shrub Swamps
Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Transportation Systems
Climate Change

Description of habitat threat(s): The Four-toed Salamander has specialized breeding requirements that make it vulnerable to habitat disturbance. Any habitat conversion, alteration, or fragmentation that disrupts species' ability to move between breeding and terrestrial sites, changes water/soil chemistry, temperature, pool hydroperiod, humidity, etc, may have negative effects. Road mortality can negatively impact migrating adults and dispersing juveniles, especially when located between terrestrial and breeding habitats. Climate change that affects hydroperiod and/or water temperature of breeding pools could have significant impacts on productivity.

Non-Habitat Threats:

Genetics
Trampling or Direct Impacts
Disease
Pollution

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Common Name: **Four-toed Salamander**
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 Species Group: **Herp**

Description of non-habitat threat(s): Loss of metapopulation structure leading to genetic isolation due to fragmentation of suitable habitats by roads or other non-permeable development is problematic. Widespread treatment of breeding pools to control West Nile Virus would likely have negative effects on many amphibians, including Four-toed Salamanders. Two emerging diseases (Ranavirus and Batrachochytrium salamandrivorans (Bs)) could present a threat in the future. Ranavirus was recently shown to be widely distributed in vernal pools in six mid-Atlantic states (Scott A. Smith pers. comm.), while the fungal disease Bs, which originated in Asia, was recently detected in Europe (Stokstad 2014).

Research and Monitoring Needs

| Type | Need | Priority | Description |
|-------------|--------------------------------|-----------------|--|
| Research | Habitat Requirements | High | Gain better understanding of breeding habitat requirements in Vermont and upper elevational limits. |
| Research | Basic Life History | Medium | |
| Research | Distribution and Abundance | High | 1) Identify significant breeding sites. Large numbers (e.g., >25 egg masses) of breeders or evidence of use by any SGCN. 2) Determine distribution and relative abundance of species in southern Connecticut River Valley, Vermont Valley, Champlain Hills, and Taconics. 3) Confirm whether the disjunct population represented by the near-historic record from 1989 in Fairlee is extant. |
| Research | Threats and Their Significance | High | 1) Conduct sampling to determine if Ranavirus is present in the state, and if so, determine its distribution and which species are affected. 2) Identify sites where road mortality is high annually and evaluate mitigation methods. 3) Identify and evaluate limiting factors. |
| Research | Population Genetics | Low | |
| Monitoring | Population Change | High | |
| Monitoring | Habitat Change | High | It is important to understand the existing habitat base and track trends. |
| Monitoring | Range Shifts | Medium | |
| Monitoring | Monitor Threats | High | We should both monitor and manage limiting factors. |

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Common Name: **Four-toed Salamander**
 Scientific Name: **Hemidactylium scutatum**
 Species Group: **Herp**

Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|---|--------------------------|--|--|--|---|
| Habitat Restoration | High | When existing road traffic is impacting migration of animals from terrestrial habitat to aquatic pool habitat, identify problem areas and redesign roads with crossing structures when roads are being upgraded. | Number of redesigns of roads. | VTrans | VTrans, FHWA |
| Technical Assistance, Training, Learning Networks | High | Identify significant road crossings and develop safe road crossings to address roadkill. | Number of crossing identified and structures installed | VTrans | VTrans |
| Compatible Resource Use | High | Maintain forested habitat matrix around breeding sites. | Number of pools within forested matrix | Landowners | Current Use, EQIP |
| Standards | Medium | Maintain 30-meter water quality buffer around entire perimeter of the pool. Timber harvesting, roads and any ground disturbing activities to be excluded within this buffer. | Number of pool sites managed for good water quality | Consulting Foresters, private and public landowners | Current Use, EQIP |
| Standards | High | Maintain 75% mature canopy cover beyond the 30-meter buffer in the terrestrial habitat. | Number of pools with canopy cover retained | Consulting Foresters, private and public landowners | Current Use, EQIP |
| Compatible Resource Use | High | Maintain corridor connections between upland and pool habitat. | Number of breeding sites with secure upland connection | Landowners, consulting foresters | volunteer compliance, Current Use, EQIP |
| Technical Assistance, Training, Learning Networks | High | Implement vernal pool management guidelines as described by VFWD. | Number of trainings offered. Number of entities adopting the guidelines. | VFWD, FPR, Coverts, VWA, VT Family Forests, SAF, Land Trusts, Consulting Foresters | SWG |
| Habitat Restoration | Medium | If loss of important sites is likely due to development, consider creating or enhancing other pools that might allow some adults to transfer to the new site if they encounter it or develop a new breeding population from dispersal of colonizers. | Number of utilized pools created | Landowners, VTrans | VTrans, volunteer effort |
| Research | High | Determine presence/absence and distribution of Ranavirus in VT, and which species are most affected. | Number and distribution of sites sampled. | VCE, Reptile & Amphibian Atlas, DEC Wetlands | SWG, private grants |

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 Scientific Name: **Hemidactylium scutatum**
 Species Group: **Herp**

| | | | | | |
|---|--------|---|---|----------------------------------|-------------------------------------|
| Standards | High | Maintain habitat mosaic and maintain connectivity between breeding pools. If two large sites are separated beyond the dispersal distance of a species it might be helpful to create or enhance pools that would link the two large sites. | Number of sites enhanced. | Landowners, consulting foresters | Current Use, EQIP |
| Standards | High | Timber harvest should be conducted on frozen ground and rutting of ground that could change hydrology of an area or intercept amphibians should be avoided. | Number of operations that avoid ground alteration. | FPR, Consulting Foresters | State Lands Mgmt, Current Use |
| Awareness Raising and Communications | Medium | Help people understand the essential needs of all life stages, especially upland habitat in proximity to breeding pool. | Number of people who receive message. | Reptile & Amphibian Atlas, VCE | private grant |
| Compatible Resource Use | High | Maintain breeding pools and needed terrestrial habitat--usually directly adjacent to pool perimeter out to 200m but could be the equivalent area along a portion of the perimeter while minimizing edge. | Number of pools with needed upland | landowners, consulting foresters | State Lands Mgmt, Current Use, EQIP |
| Habitat Restoration | Low | When feasible restore deciduous or mixed forest surrounding breeding pool. | Sites with restored forested habitat. | Landowners | volunteer effort, EQIP |
| Compatible Resource Use | Medium | Site all permanent roads more than 200 meters from a breeding pool, downslope of the pool if possible. | Number of roads sited so that pool impacts are minimized. | VTrans, Towns | VTrans, FHWA |
| Technical Assistance, Training, Learning Networks | High | Identify significant road crossings and develop safe road crossings to reduce roadkill. | Number of structures installed. | VTrans, VCE | VTrans |

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Common Name: **Four-toed Salamander**
Scientific Name: **Hemidactylium scutatum**
Species Group: **Herp**

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Scientific Name: **Hemidactylium scutatum**
Species Group: **Herp**

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Common Name: **Mudpuppy**
Scientific Name: **Necturus maculosus**
Species Group: **Herp**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5

Global Trend:

State Rank: S2

State Trend: Declining

Extirpated in VT? No

Regional SGCN? Yes

Assessment Narrative:

The Mudpuppy is native to Lake Champlain where it appears to be restricted to shoals and shallows and the lower reaches of lake's tributaries. The Burlington area is the source of the type specimen from the late 1700s. There is also a Connecticut River population that is generally agreed to be from an introduced source. Recent analysis of genetic samples from Lake Champlain and the Connecticut River (Chellman 2011) confirmed the affinities of the Lake Champlain Mudpuppy with populations of the Ohio River drainage, whereas, the affinities of the Mudpuppy in the Connecticut River drainage are not with populations sampled from the Northeast, further supporting the likelihood that the Connecticut River population was introduced. The Mudpuppy is a long-lived species that does not reach reproductive maturity until about six years old. Survival of breeding adults is very important to the maintenance of populations.

Surveying for the Mudpuppy has proven to be difficult and therefore our understanding of abundance, and even distribution, remains uncertain. U.S. Fish & Wildlife Service attempts to survey for Mudpuppy in and near Lake Champlain met with little success. Two recommendations to list this species as threatened were not accepted by the Agency of Natural Resources.

Widespread lampricide applications in many Lake Champlain tributaries is a risk to the Mudpuppy with large losses documented in some treated rivers. Evidence indicates possible losses of some smaller populations. The largest known kill from lampricide applications took place in the Lamoille River during its first treatment (2009) where 528 dead Mudpuppies were found along the shoreline and shallows of the treated area that was searched for non-target mortality. Rescue operations for non-target species affected by lampricide during the second (2013) application of the same river found fewer than 10 Mudpuppies, strongly suggesting a very significant decline in that river. Specimens in some cage studies during lampricide treatments have survived and we do not fully understand why the effects have been so different among treatments. A smaller population in Lewis Creek appears to have declined to the point where the Mudpuppy is no longer detectable. No specimens have been located in Lewis Creek during non-target post-treatment surveys for the last two decades.

Distribution

Primarily the shoals and shallows of Lake Champlain and lower reaches of its tributaries (to the first impassable falls or dam), and the Connecticut River and its tributaries north to Waterford. In addition, it is reported from some waterbodies easily accessed (no barriers) from the Lake Champlain and Connecticut River populations (for e.g., Lake Morey). This species has also been reported from Otter Creek in Brandon but not since 1998. Populations in and near the Connecticut River appear to be introduced from a source other than our native population in Lake Champlain and its tributaries.

Distribution by Biophysical Region:

| | | | |
|-----------------------------|--------------|-----------------------------|--------------|
| Champlain Valley | Confident | Southern VT Piedmont | Confident |
| Champlain Hills | Confident | Vermont Valley | Not Probable |
| Northern Green Mtns | Not Probable | Southern Green Mtns | Not Probable |
| Northern VT Piedmont | Confident | Taconic Mtns | Not Probable |

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Northeastern Highlands Probable

Distribution by Watershed:

Known Watersheds

Lamoille River
Metawee River
Upper Connecticut - Mascoma
Waits
Winooski River
Middle Connecticut
West
Black-Ottauquechee
Lake Champlain
Missisquoi River
Winooski River

Probable Watersheds

Upper Connecticut

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

The Mudpuppy is a generalist, occupying myriad habitats throughout its range including lakes, rivers, small creeks, canals, irrigation ditches and reservoirs (Escleshymer 1906; Hamilton 1932; Bishop 1941; Harris 1959a, b). Waters inhabited may be clear or turbid; still, slow or rapid flowing; cold or warm and may have gravel, cobbled, or muddy bottoms (Harris 1959a). Adults need suitable habitat with cover (for nesting, protection from predators, and shelter from light) such as flat rocks, slabs, logs or planks (Escleshymer 1906; Pearse 1910; Bishop 1941; Harris 1959a). Juveniles are usually found in greater numbers in the substrate of pools where silt and organic debris have accumulated to a minimal thickness of several mm (Matson 1990).

In one study the maximum distance that a Mudpuppy moved was 256m in its aquatic environment (Shoop and Gunning 1967). There is some evidence of short distance seasonal migrations from shallows to pools or river channels.

Habitat Types:

Aquatic: Fluvial
Aquatic: Lower CT River
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lacustrine
Aquatic: Lake Champlain
Aquatic: Man-Made Water Bodies



Common Name: **Mudpuppy**
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Current Threats

Habitat Threats:

Conversion of Habitat
Habitat Alteration
Sedimentation
Inadequate Disturbance Regime
Habitat Fragmentation

Description of habitat threat(s): The amount of quality habitat for this species at present is likely less than that of 200 years ago but how much less is unknown. Upstream movement for feeding and spawning has probably been limited by dam building. Pollution and sedimentation of nesting sites have caused declines in populations in Ohio (Pfungsten and White 1989) and is likely to have limited appropriate habitat availability in the Lake Champlain drainage system. Removal of snags and other navigational hazards on rivers and lakeshores may have decreased nesting sites.

Non-Habitat Threats:

Reproductive Traits
Trampling or Direct Impacts
Disease
Pollution

Description of non-habitat threat(s): A large percentage of the area of known distribution for the native Mudpuppy in Vermont coincides with the lampricide-treated spawning habitat for Sea Lamprey. Significant mortality has been documented due to TFM lampricide applications in NY and VT. The Mudpuppy can be negatively affected by chemical pesticides (Bonin et al. 1995; Gendron et al. 1997), especially those used in the control of parasitic Sea Lamprey (*Petromyzon marinus*) such as 3-trifluoromethyl-4-nitrophenol (TFM) and TFM/2', 5-dichloro-4-nitrosalicylanide (Niclosamide) mixtures (Matson 1990; Boogaard et al. 2003). Acute toxicity studies of TFM and of TFM/Niclosamide mixtures have been conducted on adult Mudpuppies (Boogaard et al. 2003; Boogaard et al. 2008) and juvenile Mudpuppies (Neuderfer 2002; Neuderfer et al. 2004; Boogaard et al. 2008) including one-year-old Mudpuppies (Durfey and Neuderfer 2009). All of these studies found that TFM and TFM/Niclosamide mixtures caused mortality in Mudpuppies but that the sensitivity to these lampricides was age specific (Neuderfer 2002; Boogaard et al. 2003). Boogaard et al. (2003, 2008) found that adult Mudpuppies were sufficiently more resistant to the lampricides than Sea Lamprey and suggested that there was a sufficient safety margin for selective control of Sea Lamprey in the presence of adult Mudpuppies (i.e., <10% expected mortality). Whereas the information on the acute toxicity of juvenile Mudpuppies between 2 and 5 years of age is limited (Neuderfer 2002), the studies (Neuderfer et al. 2004; Boogaard et al. 2008; Durfey and Neuderfer 2009) on juvenile mudpuppies (young of the year or 1 year of age) has found that this life stage is at risk of substantial treatment related mortality at lampricide concentrations at those needed to control Sea Lampreys. These toxicity studies (Neuderfer 2002; Boogaard et al. 2003; Neuderfer et al. 2004; Boogaard et al. 2008; Durfey and Neuderfer 2009) predict the greatest mortality to young of the year and 1 year old Mudpuppies and little mortality to adult Mudpuppies from exposure to lampricides. The field data from the 2009 Lamoille River lampricide treatment reveal that 19.3% of the dead Mudpuppies detected were adults.

Some individuals are caught on hooks. A large Mudpuppy die off due to botulism was reported in the Great Lakes in 2003.

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Species Group: **Herp**

Research and Monitoring Needs

| Type | Need | Priority | Description |
|-------------|--------------------------------|-----------------|--|
| Research | Habitat Requirements | Medium | Determine how the mudpuppy is using Vermont's lake and river habitat and when. Gather data on egg-laying sites, instream shelter, and seasonal movement patterns. |
| Research | Basic Life History | Medium | Determine if and when mudpuppies are entering or leaving Vermont rivers would to help us understand the potential impacts of TFM treatments. |
| Research | Distribution and Abundance | High | 1) Develop survey techniques to effectively sample the Mudpuppy. 2) Mudpuppy distribution is not well known in VT and we do not have a good idea of population size or trend. Monitor the size and determine the sustainability of existing populations. eDNA methods are currently being tested to evaluate Mudpuppy distribution in the Champlain basin. |
| Research | Threats and Their Significance | High | We need to better understand the impacts of TFM applications, fragmentation and changed river flows due to dams, and sedimentation. |
| Research | Population Genetics | Medium | Determine the genetic source or at least the most closely related population to our Connecticut River Mudpuppy population. |
| Monitoring | Population Change | High | |
| Monitoring | Habitat Change | Medium | |
| Monitoring | Range Shifts | High | Range shift may be a useful index of population change. |
| Monitoring | Monitor Threats | High | |

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Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|---------------------------------------|--------------------------|---|---|--|---|
| Awareness Raising and Communications | Medium | Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information. | Number of programs and individuals reached with message. | ECHO, VFWD Outreach Division | Corporate Sponsors, Lake Champlain Basin Program |
| Habitat Restoration | Medium | Consider removal of stream barriers that restrict upstream movement. | Number of miles of streams reopened. | FERC, Trout Unlimited, VTrans, towns | Power Companies, VTrans, municipalities |
| Habitat Restoration | High | Maintain adequate stream flows to support mudpuppy populations. | Number of streams | DEC Water Quality, Power Generation companies, FERC | Power Generation companies |
| Awareness Raising and Communications | High | Encourage reports of sightings to the Vermont Natural Heritage Inventory and the VT Reptile & Amphibian Atlas. | Numbers of reports received | Reptile & Amphibian Atlas, volunteers | Nongame Wildlife Fund, SWG |
| Invasive Species Control & Prevention | High | Investigate and implement alternative lamprey control methods that have less impacts to mudpuppy populations. | Number of times alternative methods used. | TNC, USFWS, VFWD Fisheries | DJ, USFWS, SWG |
| Habitat Restoration | Medium | Prevent sedimentation that degrades mudpuppy habitat. | Improvements in water quality. Number of miles of buffer strips established. Turbidity measures | DEC Water Quality, Dam operators, Dept. of Agriculture, VTrans, NRCS | Dam operators, Dept. of Agriculture, VTrans, EQIP |
| Planning & Zoning | Medium | Implement stream management to promote better water quality in mudpuppy waters. | Streams with improved water quality | USFWS, VFWD Fisheries, DEC Water Quality | DJ, USFWS |

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Scientific Name: *Necturus maculosus*
Species Group: Herp

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Scientific Name: **Necturus maculosus**
Species Group: **Herp**

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Common Name: **Fowler's Toad**
Scientific Name: **Anaxyrus fowleri**
Species Group: **Herp**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5

Global Trend:

State Rank: S1

State Trend: Unknown

Extirpated in VT? No

Regional SGCN? Yes

Assessment Narrative:

The Fowler's Toad is extremely rare in Vermont (S1) and was listed as state-endangered in 2015. The Fowler's Toad has specialized habitat requirements and depends on habitat mosaics consisting of disturbed shorelines and uplands adjacent to shallow breeding sites. Habitat loss due to succession is also a problem for this species. The last documented sighting in Vermont was in 2007 in Vernon. However, recent reports of calling from islands within the Connecticut River of NH suggest that populations may still exist in Vermont.

Distribution

The Fowler's Toad is primarily a species of the Atlantic Coastal Plain, its distribution in Vermont is limited to the lower Connecticut River valley, with populations documented at one site each in Vernon and White River Junction (Andrews 2001, Barker and Caduto 1984).

Distribution by Biophysical Region:

| | | | |
|-------------------------------|--------------|-----------------------------|--------------|
| Champlain Valley | Not Probable | Southern VT Piedmont | Probable |
| Champlain Hills | Not Probable | Vermont Valley | Not Probable |
| Northern Green Mtns | Not Probable | Southern Green Mtns | Not Probable |
| Northern VT Piedmont | Not Probable | Taconic Mtns | Not Probable |
| Northeastern Highlands | Not Probable | | |

Distribution by Watershed:

| Known Watersheds | Probable Watersheds |
|-------------------------|----------------------------|
| Middle Connecticut | NA |
| Black-Ottawaquechee | NA |
| | NA |

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

The most critical habitat features include dry, sandy woodlands near shallow water for breeding. Breeding sites may include river edges, pond or lake margins, shallow wetlands (forested or emergent), vernal pools, roadside ditches, etc. Fowler's Toads are tolerant of and dependent upon warmer temperatures than American Toads (Frost and Martin, 1971). Along the north shore of Lake Erie all Fowler's Toad reports are within ½ kilometer of the shore and the toads require habitat in the early stages of ecological succession. At those sites they require five habitat types in close proximity to sustain a population (COSEWIC, 2010):

--Hibernation habitat (sandy dunes)

--Breeding, egg-laying habitat (sparsely vegetated still-water ponds, sandy bottom pools, shallow rocky shoals, or rocky pools).



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- Feeding and hydration habitat (sandy riverside and lakeshore habitats with bare to sparse vegetation cover)
- Daytime retreat and aestivation habitat (sandy beaches and shoreline debris), and
- Dispersal corridor habitat.

Overwintering habitat is mentioned as a potential limiting factor in Canada (COSEWIC, 2010). Burrows must be deep enough for the toads to avoid freezing, close enough to the water table to be damp, but not so deep as to be flooded. Toads are not tolerant of freezing or of long-term submergence while over wintering.

Stille (1952) reported small home ranges with most toads emerging from the ground within 60-210 meters of the water's edge. In Canada (COSEWIC, 2010) Fowler's Toads (nocturnal) spend days buried in soil up to 400 m from the water's edge but they must move to the water as soon as they emerge to replace moisture lost while in the soil.

Along Lake Erie, Fowler's Toads depend upon breeding sites that are continually created or maintained by disturbance.

Breeding habitat in Vermont appears to be the disturbed margins of the Connecticut River and its tributaries in Windham and Windsor Counties, and perhaps shorelines of other water bodies near sandy soils in those floodplains. Terrestrial habitat appears to be largely open areas of adjacent floodplains and lower-elevation uplands within a few hundred meters of those breeding sites, particularly those with sandy or gravelly soils. This includes yard edges and moderately developed residential or agricultural areas. According to Klemens (1993) the species prefers well-drained sand and gravel habitat in Connecticut. Wright and Wright (1949) state "wherever Fowler's Toads are sympatric with American Toads (as they are anywhere in Vermont), Fowler's Toads occur in rivers, streams, or lake beaches" and American Toads in the uplands. This appears to be the case in Vermont. Soil maps show large deposits of sand in the Vernon area.

Habitat Types:

Upland Shores

Northern Hardwood

Oak-Pine Northern Hardwood

Floodplain Forests

Hardwood Swamps

Seeps and Pools

Marshes and Sedge Meadows

Wet Shores

Shrub Swamps

Early Succession Pine and Hemlock

Early Succession Northern Hardwoods

Early Succession Upland Oak

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Lawns, Gardens, and Row Crops

Aquatic: Lower CT River



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Aquatic: Lacustrine

Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat

Energy Infrastructure and Development

Habitat Alteration

Inadequate Disturbance Regime

Habitat Fragmentation

Impacts of Roads or Transportation Systems

Climate Change

Description of habitat threat(s): The Fowler's Toad has specialized habitat requirements that make it vulnerable to disturbance. Any habitat conversion, alteration, or fragmentation that disrupts species' ability to move between breeding and terrestrial sites may have negative effects. Road mortality can negatively impact migrating adults and dispersing juveniles, especially when located between terrestrial and breeding habitats. Climate change that affects hydroperiod and/or water temperature of breeding pools could have significant impacts on productivity.

Early successional habitat in sandy soils within 400 meters of the Connecticut River has probably been reduced significantly with the development of an extensive series of flood control dams in the Connecticut River drainage. In addition, sandy and gravelly soils in the floodplain have been desirable sites for shoreline development and agriculture. Some types of low-density development and agriculture (pasture, some crops, new farm ponds) may have created open early-successional foraging habitat or breeding habitat for this species; however, high-density development with heavy road traffic (toads suffer high road mortality), row crops and intensive pesticide or herbicide use (atrazine) are probably not consistent with continued Fowler's Toad use. Bank stabilization activities would also limit the amount of potential habitat for this species.

This floodplain area has also seen significant road building. Routes 91 and 5 both parallel the river within the floodplain on the Vermont side as well as numerous smaller roads such as 142 in Vernont.

Breeding habitat of this species seems to be concentrated on islands and along the shorelines of the Connecticut River, within the disturbance zone. Regular removal of vegetation, new deposits of sand and gravel, and creation of small pools may be necessary to maintain breeding habitat. Dams along the Connecticut River are built to control flooding. It is possible that they control flooding to an extent that limits the amount of breeding habitat for this species. In addition, subdivision and development within the narrow Connecticut River valley may be limiting useful habitat and increasing mortality on roads and by machinery.

This species regularly undergoes large population changes. The existence of nearby healthy populations to recolonize previously occupied areas is essential. In addition, the colonizers within those populations need to be able to safely traverse the landscape along the river for some distance as populations rebuild. Given distances between populations that may be larger than the dispersal range of juvenile toads, all five required habitat types will need to be located fairly regularly (~every 8 miles) along the shore of the Connecticut



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River in order for recolonization to take place from a distant source. Impediments to travel exist in increased road traffic, more intensive or chemical dependent agricultural methods, and intensive development such as in the towns along the river.

Non-Habitat Threats:

Genetics

Pollution

Disease

Trampling or Direct Impacts

Description of non-habitat threat(s): Known populations of this species occur in close proximity to humans, and in a region of the state that continues to see significant development pressure. Fragmentation of suitable habitats by roads or other non-permeable development may result in loss of metapopulation structure and leading to genetic isolation, especially considering the limited and localized populations of this species. Widespread treatment of breeding pools to control West Nile Virus would likely have negative effects on many amphibians, including Fowler's Toad.

According to Freda and Dunson (1986) this species shows decreased larval growth rates with increased acidity (lowered pH) due to acid rain. It is also less tolerant than most amphibians to atrazine (Birge et al., 2000), and is particularly sensitive to the insecticide azinphos-methol (Guthion; Mayer and Ellersieck, 1986). The organochlorides endrin, toxaphene, dieldrin, toxaphene, DDT, and lindane are also highly toxic to larval Fowler's Toads (Sanders, 1970). Adults were also highly sensitive to organochlorides (Ferguson and Gilbert, 1968) as well as pyrethroid insecticides (Bennett et al., 1983) and the metals chromium, gallium, titanium, and aluminum (Birge et al., 2000). In southwestern Ontario, agricultural chemicals were listed as a possible contributing factor to Fowler's Toads declines. The herbicide Trifluralin and the insecticide Endrin were reported to be particularly toxic to toads (COSEWIC, 2010). The disappearance of Fowler's Toads from many of the Massachusetts islands was thought to be the result of DDT use according to Lazell (1976). DDT is also suspected of eliminating populations on Point Pelee in Canada (COSEWIC, 2010). We have not looked at the available data on the level of any of these substances in the Connecticut River or on surrounding lands, although we expect atrazine is widely used on corn crops along the Connecticut River.

Fowler's Toads are susceptible to mycobacterial (Shively et al., 1981) and parasitic infections (Jilek and Wolff, 1978; Ashton and Rabalais, 1978; McAllister et al., 1989; and Vences et al., 2003). Botulism is also considered a potential threat to Fowler's Toads (COSEWIC, 2010). Along the north shore of Lake Erie it was noticed that shoreline mats of algae created the anaerobic conditions that allow *Clostridium botulinum* to survive.

Toads overwinter and avoid predation and desiccation during the day and during dry periods by digging into sandy or loose soil (Harding and Holman, 1992). By the end of the winter they have burrowed to depths of up to 15-30 cm (R. Latham quoted in Oliver, 1955). Tilling of the soil in late fall or early spring may disturb or kill overwintering Fowler's Toads. Tilling during other times of the year could have the same impact on toads underground for the daytime hours or when aestivating to escape dehydration.



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Research and Monitoring Needs

| <i>Type</i> | <i>Need</i> | <i>Priority</i> | <i>Description</i> |
|--------------------|--------------------------------|------------------------|---|
| Research | Habitat Requirements | High | Due to the likely spotty distribution of the rare Fowler's Toad in Vermont, it is important that we document and map habitat including connectivity of patches. |
| Research | Distribution and Abundance | High | 1) There is a need to better document the distribution of the Fowler's Toad in Vermont, which will require dedicated searches during the calling period. 2) Continue to document species distribution in Connecticut River Valley with targeted searches of potential sites, and sites where previously reported. |
| Research | Threats and Their Significance | High | |
| Monitoring | Population Change | High | Monitor known population annually and attempt to determine population size and demographics. |
| Monitoring | Habitat Change | High | The habitat of the Fowler's Toad is likely vulnerable to human development and fragmentation of its habitat, including breeding pools. Monitoring the amount and regularity of habitat creation through flooding would provide better insight into the potential impacts of flood control dams. |
| Monitoring | Monitor Threats | High | |

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 Species Group: **Herp**

Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|---|--------------------------|---|--|--|---------------------------------------|
| Protected Area Management | Medium | Eliminate the use of pesticides and herbicides within protected areas and maintain early successional habitat patches in a way that minimizes direct mortality. | Development and implementation of management plans. | Easement holders, VFWD; VFPR | VHCB, CNWR, Carbon tax revenues |
| Policy & Regulations | High | Through the FERC dam relicensing process insure adequate water releases to create and maintain breeding habitat. | Increased scouring, vegetation removal, and sand and gravel deposits along Connecticut River. | NH F&W, TNC | |
| Easements | Medium | 1) Purchase land or easements along margin of Connecticut River to the 100 year flood high water line to allow safe flooding and scouring. 2) Purchase land or easements for known terrestrial habitat along Stebbins Road in Vernon. | Change in the acreage of conserved land | VLT, Conte NWR, local and national land trusts, RPCs | VHCB, CNWR, Carbon tax revenues |
| Awareness Raising and Communications | High | Encourage reports of sightings to the VT Heritage Inventory and the VT Reptile & Amphibian Atlas. | Number of reports received | Reptile & Amphibian Atlas | Nongame Wildlife Fund, private grants |
| Policy & Regulations | High | Support efforts, such as state, federal, regional and international Climate Change Action Plans to reduce greenhouse gas emissions in the Northeast and climate change risks to SGCN. | Adopt appropriate legislation & policies developed to reduce greenhouse emissions & reduce climate change risks to SGCN. | ANR, Health Dept, USFWS | |
| Technical Assistance, Training, Learning Networks | High | Implement vernal pool management guidelines as described by VFWD. | Number of trainings offered. Number of entities adopting the guidelines. | VFWD, FPR, Coverts, VWA, VT Family Forests, SAF, Land Trusts, Consulting Foresters | SWG |

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Scientific Name: **Anaxyrus fowleri**
Species Group: **Herp**

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Species Group: **Herp**

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Common Name: **Boreal Chorus Frog**
Scientific Name: **Pseudacris maculata**
Species Group: **Herp**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5

Global Trend:

State Rank: S1

State Trend: Declining

Extirpated in VT? No

Regional SGCN? Yes

Assessment Narrative:

Recent genetic research by Moriarty Lemmon et al. (2007) indicated that the chorus frog of northeastern North America previously considered to be *P. triseriata*, which includes Vermont's population, is actually *P. maculata*. This small eastern portion of the species' range is separated from the larger western distribution by a minimum of 200 miles.

The Boreal Chorus Frog previously was considered a western species, present in Ontario and west to the Northwest Territories and eastern British Columbia, and south into the United States from Minnesota to Montana into northern New Mexico. *P. triseriata* was considered to occur from the Saint Lawrence Valley in Quebec westward to Minnesota and South Dakota, and south to Oklahoma, Indiana, and western New York. Genetic evidence presented by Moriarty Lemmon et al. (2007) redefined the geographic boundaries for several members of this genus, including these two species. According to this work, *P. triseriata* is more limited, occurring from western Kentucky and southern Illinois, northeastward through Michigan, southern Ontario, and western New York. *P. maculata* is more widespread, occurring from Illinois north to Ontario and westward, with a disjunct population occurring in southeastern Ontario, and within the Saint Lawrence Valley of Quebec and New York and the northern Lake Champlain Valley.

P. triseriata used to be listed as an SGCN species in Vermont. Based on the study above which is supported by additional anecdotal information (responses to tapes) and gaps in distribution, we feel the best current science suggests that the species we thought was *P. triseriata* is actually *P. maculata*. This taxonomy has not been accepted by all authorities, but seems to be the most supported at present. As a result, in 2011 *P. triseriata* was removed from our list of Vermont endangered species and *P. maculata* was added. We are now removing *P. triseriata* from our list of SGCN and replacing it with *P. maculata*. The supporting information here is an updated version of the same information previously presented but under a corrected name.

This species was located in townships along northern Lake Champlain from Swanton/Alburg to Georgia in the 1970s. Searches in 1988, 1996, and 1997 at the original site and along roads in the northwestern corner of the state were unsuccessful. A novel occurrence of singing male chorus frogs was observed in 1998 and 1999 in Alburg, with only two heard during each visit. This breeding site is located less than one mile from the Quebec border. Annual searches in 2000-2009 have not located chorus frogs at either of the two last known sites or other locations. It has also disappeared from the NY portion of the Lake Champlain Basin (see Corser et al. 2012) and many of its historic locations in Quebec and eastern Ontario. The COSEWIC website states "populations in Quebec are documented to have declined at a rate of 37% over 10 years and are expected to continue to decline. Despite there being some areas where chorus frogs remain evident, surveys of populations in Ontario indicate a significant decline in abundance of 30% over the past decade". In Vermont this species is state-listed as endangered.

Habitat loss due to development, succession, and drainage of pools in agricultural fields are all reported problems for this species. Species may also be vulnerable to taking by mowing of agricultural fields and newer chemicals (herbicides) used in agriculture. Recent studies also show this genus to be sensitive to chemicals produced by the invasive plant species European Buckthorn (*Rhamnus cathartica*). This plant is currently widespread in the Lake Champlain basin. Habitat in Vermont seems to be flooded or ponded pasture with shrubs. There is evidence to support calling competition between this species and the Spring Peeper (*Pseudacris crucifer*), so calling times and perhaps localized distribution may need to be isolated from each



Common Name: **Boreal Chorus Frog**
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other. There appears to be appropriate habitat remaining within this species historic distribution within Vermont, leading this writer to suspect that changes other than or in addition to habitat loss and fragmentation are causing declines.

Distribution

This species was located in townships along northern Lake Champlain from Swanton/Alburg to Georgia in the 1970s. Searches in 1988, 1996, and 1997 at the original site and along roads in the northwestern corner of the state were unsuccessful. A novel occurrence of singing male chorus frogs was observed in 1998 and 1999 in Alburg, with only two heard during each visit. This breeding site is located less than one mile from the Quebec border. Annual searches in 2000-2009 have not located Chorus Frogs at either of the two last known sites or other locations.

Distribution by Biophysical Region:

| | | | |
|-------------------------------|--------------|-----------------------------|--------------|
| Champlain Valley | Probable | Southern VT Piedmont | Not Probable |
| Champlain Hills | Not Probable | Vermont Valley | Not Probable |
| Northern Green Mtns | Not Probable | Southern Green Mtns | Not Probable |
| Northern VT Piedmont | Not Probable | Taconic Mtns | Not Probable |
| Northeastern Highlands | Not Probable | | |

Distribution by Watershed:

Known Watersheds

Lake Champlain

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

The Boreal Chorus Frog (*P. maculata*) is primarily a terrestrial species, occurring in moist, marshy, vegetated environments near breeding sites (NatureServe 2011, IMNH 2000). It may be found in grassy and shrubby areas, meadows, open woodlands, fens, bogs, or similar low habitats (NatureServe 2011, IMNH 2000, Bider and Matte 1996) not far from open ponds, ditches, marshes, temporary pools, or other wetlands (NatureServe 2011, IMNH 2000, HerpNet). The species is generally not found in forested areas (Bider and Matte 1996). *P. maculata* breeds in temporary to semi-permanent waters of no current, often quite small with no or few fish predators (HerpNet, Lannoo 2005). These are typically open habitats (no canopy) with abundant emergent vegetation which provides both cover and egg attachment sites (IMNH 2000, Lannoo 2005). Boreal chorus frogs are considered poor dispersers, though individual studies have found adults traveling 275 (Quebec) and 685 m (Colorado) from breeding sites (HerpNet, Whiting 2004). Outside the breeding season, this is generally a nocturnal species, being inactive during the day, and is active into September or October (Lannoo 2005, NatureServe 2011). Overwintering occurs under protective cover or underground in the upland areas surrounding a breeding site (NatureServe 2011). Some indirect evidence suggests limited possible hibernation within the breeding pool (Whiting 2004).

In Vermont, the breeding sites observed in 1985 and 1998 were both small, open cattail ponds adjacent to agricultural lands and larger wetland systems. No habitat analyses were undertaken, but the available terrestrial



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and aquatic habitat types available agreed with those described in literature for *P. maculata*. The field notes taken by Fred Schueler during his 1975 survey indicate the Vermont chorus frog to be somewhat of a generalist, using a variety of open habitats. He observed breeding in ditches, pools, potholes, and ponds with grasses and cattails, located within or adjacent to meadows, hayfields, woods, pastures, alder swamps, and "cattail swamps."

Habitat Types:

Hardwood Swamps
Seeps and Pools
Marshes and Sedge Meadows
Shrub Swamps
Grasslands, Hedgerows, Old Field, Shrub, or Orchard
Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat
Habitat Succession
Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Transportation Systems
Invasion by Exotic Species
Climate Change

Description of habitat threat(s): Shallow wetland habitat appears to be limited and no strong population center known that would provide colonizers. Appears to be limited to NW Vermont. Known distribution retracted from northeastern shore of Lake Champlain (Canadian border to Georgia) to isolated site in Alburg. Also declines in Quebec and eastern Ontario. Needs early successional, open or edge habitat, does not compete well with Wood Frogs, genus has shown sensitivity to a chemical (emodin) released by invasive buckthorn (*Rhamnus cathartica*). Shallow open seasonal wetlands in the Lake Champlain Basin are particularly likely to be drained for agriculture. These lands are also exposed to regularly chemical use and mechanized cutting.

Non-Habitat Threats:

Genetics
Harvest or Collection
Reproductive Traits
Trampling or Direct Impacts
Competition
Disease
Pollution

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Predation or Herbivory

Description of non-habitat threat(s): Pesticides, herbicides, and runoff. may be inadvertently collected when Leopard Frogs are collected by sweep net or drift fence. Chytrid fungus or ranavirus may play a role in declines either alone or synergistically. Any remaining populations are likely genetically isolated. Call does not compete well with Spring Peeper (*Pseudacris crucifer*). More successful if isolated in time or space from their calls. Does not coexist well with Wood Frogs (*Lithobates sylvaticus*) perhaps as a result of predation. Modern agricultural harvesting equipment is probably too fast and efficient to coexist with populations.

Research and Monitoring Needs

| Type | Need | Priority | Description |
|-------------|--------------------------------|-----------------|--|
| Research | Habitat Requirements | High | Determine habitat needs. |
| Research | Basic Life History | Low | |
| Research | Distribution and Abundance | High | Thoroughly survey for this species in Vermont. |
| Research | Threats and Their Significance | High | Determine the primary limiting factors for this species. |
| Research | Population Genetics | Medium | Confirm species, Determine if genetically isolated. |
| Monitoring | Population Change | High | |
| Monitoring | Habitat Change | High | |
| Monitoring | Range Shifts | High | Determine how Vermont fits in with regional population change. |
| Monitoring | Monitor Threats | High | |

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Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|---------------------------------------|--------------------------|--|--|--|---|
| Research | Medium | Determine which species of Chorus Frog we have/had, how genetically isolated/inbred it is/was and what can be done to address issues if needed. | Genetic assessments | Academic Community, Province of Quebec, NY DEC | SWG, Nongame Fund, private grants |
| Research | Medium | Determine the presence/absences of amphibian diseases in the historic area of the Chorus Frog and to control their spread and impact. | Disease surveys | Regional Wildlife Health Lab, Academic community | SWG, Nongame Fund, Private grants |
| Invasive Species Control & Prevention | Medium | Examine presence/absence of invasives in historic habitat of this species. Conduct lab experiments of impacts of Emodin on this species. | | Academic community, TNC | SWG, Nongame Fund, private grants |
| Protected Area Management | Medium | Manage selected areas for early succession, work with agriculturalists to manage lands in a way that maintains early successional habitat in a way that is amphibian friendly. Encourage light pasturing rather than harvesting and cultivating near wetlands. | Change in the acres of wetland/grassland mosaics | Sportsmen, Audubon, groups interested in early successional bird species | SWG, VHCB, DU, |
| Policy & Regulations | Medium | Improve agricultural practices that degrade or remove wetlands and surrounding habitat and replace and restore wetlands altered or lost by agriculture. | Wetland Acreage Conserved, Created, or Recreated | DEC, Environmental Organizations, LCI, Lake Champlain protection groups | Private Foundations, water quality grants |
| Policy & Regulations | High | Support efforts, such as state, federal, regional and international Climate Change Action Plans to reduce greenhouse gas emissions in the Northeast and climate change risks to SGCN. | Adopt appropriate legislation & policies developed to reduce greenhouse emissions & reduce climate change risks to SGCN. | ANR, Health Dept, USFWS | |
| Awareness Raising and Communications | Medium | Encourage reports of sightings to the VT Wildlife Diversity Program and the VT Reptile & Amphibian Atlas | Number of training sessions, person-nights surveyed, Number of reports received | Reptile & Amphibian Atlas | SWG, Nongame Wildlife Fund |
| Easements | | Attempt to protect (through easement or purchase) any sites found with breeding populations and adjacent terrestrial habitat. | Acreage and number of sites conserved | Reptile & Amphibian Atlas, Lake Champlain Land Trust, VLT | VHCB |

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Common Name: **Spotted Turtle**
Scientific Name: **Clemmys guttata**
Species Group: **Herp**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5

Global Trend:

State Rank: S1

State Trend: Declining

Extirpated in VT? No

Regional SGCN? Yes

Assessment Narrative:

The state-endangered Spotted Turtle is known from three locations in Vermont and is a species of regional conservation concern. It is on Appendix II of CITES, the IUCN lists it as endangered on its Red List, and is a SGCN in Vermont. Two Spotted Turtle sites in Vermont are compromised by surrounding landuse. At one site a RR bisects the wetland. Twenty under rail crossings have been installed to allow safe passage of the turtles. A road parallels much of the other compromised site. Both are believed to have very small populations. The third known site is more robust and found within a large wetland complex, which provides some buffering from surrounding landuse.

Distribution

There are three widely separated known populations in Vermont. The disjunct nature of the three known occurrences means that each needs to maintain itself with little likelihood of rescue from nearby populations. It is possible that some migrants from Massachusetts could reach one of our southern populations. The species is not a migrant but some individuals do wander. Based on limited telemetry work in Vermont it may be young adult males are more prone to dispersal. Because of the vulnerability of this species to illegal collection and the protections of our state law, specific locations are not being shared in this summary.

Distribution by Biophysical Region:

| | | | |
|-------------------------------|--------------|-----------------------------|--------------|
| Champlain Valley | Confident | Southern VT Piedmont | Confident |
| Champlain Hills | Not Probable | Vermont Valley | Not Probable |
| Northern Green Mtns | Not Probable | Southern Green Mtns | Not Probable |
| Northern VT Piedmont | Not Probable | Taconic Mtns | Confident |
| Northeastern Highlands | Not Probable | | |

Distribution by Watershed:

Known Watersheds

Hudson-Hoosic
Lake Champlain
Middle Connecticut

Probable Watersheds

NA

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

Based on field inventory and monitoring, the Spotted Turtle uses red maple swamps and other wetland habitats in Vermont. In Massachusetts it has been documented to patch together woodland vernal pools in some localities and can also use ponds. The two smaller Vermont sites are linear riparian wetlands. The third and larger population is part of a large wetland complex. Nesting by this species is reported in the literature to



Common Name: **Spotted Turtle**
Scientific Name: **Clemmys guttata**
Species Group: **Herp**

include sphagnum moss and at the larger site a hatchling was documented on a large sphagnum mat. Some sphagnum occurs at one of the smaller sites, but nesting has been documented along a railroad bed. At the other smaller site two female Spotted Turtles have been located near a dirt road during the nesting season.

Potential wetland habitats include Hardwood Swamps, Marshes and Sedge Meadows, Shrub Swamps, Open Peatlands. We have located this species in red maple swamps, shrub swamps, and a bog/fen wetland as well as an adjacent emergent swamp. In Vermont we have found this species at low elevation sites less than 100 m in elevation. Home range is often reported as less than 5ha, but linear movements can be quite long. At one riparian wetland a female Spotted Turtle moved over 300 m. We believe large wetland complexes provide the best habitat by buffering from outside influences and providing options during different moisture regimes. This may become more important with weather patterns linked to climate change. Movement corridors are important in some situations where Spotted Turtles piece together needed resources within a habitat mosaic and this has been documented in Massachusetts with turtles traveling between a large wetland and dispersed vernal pools in surrounding uplands. Long-distance movements are unlikely and assisted migration may need to be considered in the future.

Habitat Types:

Northern Hardwood
Oak-Pine Northern Hardwood
Hardwood Swamps
Softwood Swamps
Seeps and Pools
Open Peatlands
Marshes and Sedge Meadows
Wet Shores
Shrub Swamps
Aquatic: Lacustrine
Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Transportation Systems
Climate Change

Description of habitat threat(s): Habitat threats for the Spotted Turtle include loss of wetland overwintering and foraging habitat, loss of nesting areas, fragmentation isolating populations and separating needed seasonal habitats, as well as road and railroad mortality. Climate change could affect the Spotted Turtle if a change in water regime results in wetlands and pools drying.



Common Name: **Spotted Turtle**
 Scientific Name: **Clemmys guttata**
 Species Group: **Herp**

Non-Habitat Threats:

- Genetics
- Harvest or Collection
- Reproductive Traits
- Trampling or Direct Impacts
- Predation or Herbivory

Description of non-habitat threat(s): The Spotted Turtle is vulnerable to collection, nest predation, road mortality, and population rescue is unlikely. If close to humans, risks increase.

Research and Monitoring Needs

| Type | Need | Priority | Description |
|-------------|--------------------------------|-----------------|---|
| Research | Habitat Requirements | High | 1) Given the rarity of this species, examine critical habitat (e.g., wintering sites). 2) Gather data on specific habitat requirements of Vermont populations: denning sites, egg-laying sites, foraging areas, overwintering areas and movement corridors. |
| Research | Distribution and Abundance | High | Pursue further surveys for Spotted Turtles in Vermont. Need to document all populations and their abundance, as well as the spatial relationship of populations. |
| Research | Threats and Their Significance | High | Need to identify and resolve potential limiting factors. |
| Research | Population Genetics | Medium | We don't know if population genetics is a problem or not, but species is isolated in Vermont. |
| Monitoring | Population Change | High | 1) Track population size, age and sex distribution. 2) Monitor the size and determine the sustainability of existing populations through age-class or genetic analysis. |
| Monitoring | Habitat Change | High | It would be important to track changes in quality and quantity of habitat, as well as connectivity between habitats. |
| Monitoring | Monitor Threats | High | We need to determine if we are making progress alleviating limiting factors. |

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Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|---|--------------------------|--|---|--|------------------------------------|
| Technical Assistance, Training, Learning Networks | | With staff turnover try assigning responsibility for species recovery to new VFWD employees to address limited staffing realities. | Recovery plans written and implemented, actions taken, results documented | ESC, Orriane Society | SWG, Nongame Fund, Orriane Society |
| Compatible Resource Use | | Control ATV and other off road usage in known habitat to avoid impacts. | Frequency of ATV use | Railroad, Game Wardens, VASA | operating funds |
| Compatible Resource Use | | Continue to work with landowners and users of area to protect known habitat. | Number of cooperating landowners | local game warden, landowners, country forester | SWG, Nongame Wildlife Fund |
| Habitat Restoration | | Create nesting sites and passages connecting wetland habitats. (e.g. Railroad used American Recovery and Reinvestment Act funds to construct 20 passages in 2012). | Number of enhancements (e.g., 20 passages under rails and 13 nesting pits created at one site). | railroad, local warden | railroad, Nongame Wildlife Fund |
| Standards | | Develop land management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web. | Number of landowners and managers who receive and use guidelines | landowners, consulting foresters, EQIP biologists | SWG, EQIP, Current Use |
| Awareness Raising and Communications | | Encourage reports of sightings to the VT Natural Heritage Inventory and the VT Reptile & Amphibian Atlas. | Number of reports received annually | Reptile & Amphibian Atlas | Nongame Wildlife Fund |
| Species Restoration | | Consider reintroduction or augmentation from closest healthy source. Maintaining and enhancing extant populations is always a priority and should be continued. | number of populations. | Bonnyvale Environmental Center | SWG |
| Species Restoration | | Protect nests and adults by predator trapping and removal. | number of raccoons harvested per year. | Trappers Assoc., landowners | Trappers Assoc members |
| Easements | | Conserve known habitat through fee simple purchase, development rights or easements, management agreements, and education of private landowners and managers regarding appropriate management. | acres of land conserved. | VHCB | VHCB |
| Awareness Raising and Communications | | Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information. | Number of people exposed to message | VFWD Outreach division, Bonnyvale Environmental Center | marketing funds, private grants |

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| | | | | |
|--------------------------------------|---|--|---|-------------|
| Habitat Restoration | Work to maintain connectivity with populations to the south in Massachusetts. | Number of potential connections to populations south of Vermont | Mass Fish and Wildlife, private landowners, VLT | VHCB |
| Compatible Resource Use | Review all roadway projects in appropriate habitat, check against known crossing areas VTRANS, VFWD, VT Reptile & Amphibian Atlas, survey appropriate habitat when unknown. | Number of projects reviewed with spotted turtle planning information | Reptile & Amphibian Atlas, VTrans | VTrans |
| Awareness Raising and Communications | Encourage reports of road-killed specimens, road crossing, and road basking areas to VFWD, VTRANS, and the VT Reptile & Amphibian Atlas. | Number of reports. | Reptile & Amphibian Atlas, VTrans | VTrans, SWG |

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Common Name: **Wood Turtle**
Scientific Name: **Glyptemys insculpta**
Species Group: **Herp**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G4

Global Trend:

State Rank: S3

State Trend: Declining

Extirpated in VT? No

Regional SGCN? Yes

Assessment Narrative:

With more than 50% of its distribution in the Northeast the Wood Turtle was selected as a Regional Species of Greatest Conservation Need (RSGCN) among the 13 Northeastern states. Vermont is at the core of its range. The Wood Turtle is listed as an Appendix II species by Convention on International Trade in Endangered Species (CITES), meaning that it not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival. It has been petitioned in the past for listing as a federally listed species. The Wood Turtle is believed to still be widely distributed, but potentially declining throughout its range due to its long age to maturity and increasing losses of long-lived adults. It is still encountered over a wide region, which may be masking the conservation peril this species faces. Two populations have been monitored in Vermont (Parren 2013) and Vermont was included in a Northeast range-wide assessment (Jones et al. 2014). This species is getting regional recognition as an RCN species.

The Wood Turtle is found in riparian habitats and upland habitats adjacent to streams, providing it is not heavily developed or intensively used for agriculture. It is vulnerable to mowing of agricultural fields and to road mortality. Habitat loss due to succession is also a challenge for this species, but it seeks out and uses even small suitable patches within woodlands. It is also at risk to collection.

Distribution

The Wood Turtle is well distributed throughout Vermont, but not at very high elevations and rarely encountered at the lowest levels of the Champlain Valley. A suitable medium gradient river or large creek is required.

Distribution by Biophysical Region:

| | | | |
|-------------------------------|-----------|-----------------------------|-----------|
| Champlain Valley | Confident | Southern VT Piedmont | Confident |
| Champlain Hills | Confident | Vermont Valley | Confident |
| Northern Green Mtns | Confident | Southern Green Mtns | Confident |
| Northern VT Piedmont | Confident | Taconic Mtns | Confident |
| Northeastern Highlands | Confident | | |

Distribution by Watershed:

Known Watersheds

Middle Connecticut
West
Upper Connecticut-Mascoma
Black-Ottawquechee
Hudson-Hoosic
Mettawee River

Probable Watersheds

Waits
Upper Connecticut-Mascoma
Passumpsic
St. Francois River
Upper Connecticut



Common Name: **Wood Turtle**
Scientific Name: **Glyptemys insculpta**
Species Group: **Herp**

Lake Champlain
Lamoille River
Missisquoi River
Otter Creek
White
Winooski River

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

The Wood Turtle is found in a landscape of rolling hills. Upland habitat adjacent to streams needs to be permeable to Wood Turtle terrestrial wanderings. It uses shrub swamps, alder swamps, and can use human-altered landscapes if not too severely changed, but it must have a suitable home stream. Home range can be calculated as less than a hectare if long-distant movements for females to nest or for males to patrol a river or stream to breed females (1.5 km) are not included. Micro Habitat: moderate gradient streams with refuge sites, sand gravel & rock streambeds.

Habitat Types:

Spruce Fir Northern Hardwood
Northern Hardwood
Oak-Pine Northern Hardwood
Floodplain Forests
Hardwood Swamps
Softwood Swamps
Seeps and Pools
Open Peatlands
Marshes and Sedge Meadows
Wet Shores
Shrub Swamps
Early Succession Pine and Hemlock
Early Succession Northern Hardwoods
Early Succession Upland Oak
Early Succession Other Types
Grasslands, Hedgerows, Old Field, Shrub, or Orchard
Aquatic: Fluvial
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Man-Made Water Bodies



Common Name: **Wood Turtle**
Scientific Name: **Glyptemys insculpta**
Species Group: **Herp**

Current Threats

Habitat Threats:

Conversion of Habitat
Habitat Succession
Habitat Alteration
Habitat Fragmentation
Incompatible Recreation

Description of habitat threat(s): Loss of upland habitat adjacent to Wood Turtle home stream is real problem. It can tolerate a fair amount of succession providing some suitable patches remain. Although the Wood Turtle can use an agricultural landscape, too intensive a use such as row crops, is unsuitable. Mowing and driving over fields can directly impact Wood Turtles found in agricultural fields (Erb and Jones 2011). Habitat is being broken up by development and roads. Trails can bring more people into contact with Wood Turtles and their populations are often impacted (Graber and Burger 1995). Roads paralleling Wood Turtle streams directly impact Wood Turtle populations and can over time reduce the use of habitat by removal of turtles (Parren 2013). Wood Turtles seem well adapted to finding food resources within a broad habitat matrix, but this requires wandering a large area with associated risks.

Non-Habitat Threats:

Harvest or Collection
Trampling or Direct Impacts
Predation or Herbivory

Description of non-habitat threat(s): Wood Turtles are susceptible to collection as pets and we have detected for profit illegal collection in Vermont. Nest depredation is a threat all turtles face and Wood Turtles also suffer limb and tail loss to predators. In some cases direct mortality occurs. Road traffic causes Wood Turtle mortality and the roads themselves can be thought of as a landscape feature limiting Wood Turtle habitat (see above). Proximity to human habitation and our land use is a risk to Wood Turtle survival due to collection, direct mortality from vehicles and other equipment, as well as increased predators such as skunks and raccoons.

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Common Name: **Wood Turtle**
 Scientific Name: **Glyptemys insculpta**
 Species Group: **Herp**

Research and Monitoring Needs

| Type | Need | Priority | Description |
|-------------|--------------------------------|-----------------|--|
| Research | Habitat Requirements | Medium | 1) Identification and protection of communal wintering and nesting sites is critical. 2) Gather data on specific habitat requirements of Vermont populations: denning sites, egg-laying sites, foraging areas, and movement corridors. |
| Research | Basic Life History | Low | |
| Research | Distribution and Abundance | High | Identify distribution and relative abundance of populations in Vermont as good knowledge of current distribution and abundance is essential for good monitoring. |
| Research | Threats and Their Significance | High | It is important to have a solid understanding of limiting factors and how they impact populations of Wood Turtles. |
| Research | Population Genetics | Low | |
| Research | Taxonomy | Low | |
| Monitoring | Population Change | High | It is essential to monitor population change for this vulnerable species, consider doing so by monitoring the size and determine the sustainability of existing populations through age-class or genetic analysis. |
| Monitoring | Habitat Change | High | Since habitat loss/change affects the resilience of Wood Turtle populations, it is important to monitor habitat change. |
| Monitoring | Range Shifts | High | The VT Reptile & Amphibian Atlas has provided a pretty good baseline of Wood Turtle distribution by township. Failure to detect Wood Turtles in these same townships in the future will be cause for alarm. |
| Monitoring | Monitor Threats | High | Road mortality, collection, and nest success should be monitored. |

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Common Name: **Wood Turtle**
 Scientific Name: **Glyptemys insculpta**
 Species Group: **Herp**

Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|--------------------------------------|--------------------------|--|--|--|--|
| Compatible Resource Use | | Encourage holding off field mowing until October in Wood Turtle habitat or setting mowing bar at 6 inches or higher. | Number of areas adhering to mowing guidance | Corps of Engineers, EQIP biologists | Corps of Engineers, EQIP |
| Compatible Resource Use | | Encourage land-use practices on private lands that continue to allow the Wood Turtle to maintain itself in Vermont. | Number of enrolled landowners | FPR, EQIP, USFWS, private landowners | Current Use Program, EQIP, Partners in Wildlife |
| Easements | | Conserve known habitat through fee simple purchase, development rights or easements, management agreements, and education of private landowners and managers regarding appropriate management. | Number of sites protected | VLT, local land trust, towns | VHCB |
| Compatible Resource Use | | Direct trail development away from streams to avoid impacts to Wood Turtle populations. | Number of trails sited in a way to avoid impacts | recreation planners, developers, regulators | private grants, SWG, Nongame Wildlife Fund, Technical Assistance |
| Habitat Restoration | | Develop, implement, and monitor, road crossing structures and barriers for this species. | Effectiveness of crossing structures | VTrans | VTrans, FHWA |
| Easements | | Use conservation easements to protect suitable habitat on privately owned land. | Number of sites protected | VLT, local land trusts | VHCB, private funds |
| Species Restoration | | If populations limited, consider reintroduction or augmentation from closest healthy source. Maintaining and enhancing extant populations is always a priority and should be continued. | Number of reintroduced or augmented populations | Landowners, Corps of Engineers, SAG-Herps | SWG |
| Compatible Resource Use | | Site new roads 1000' away from Wood Turtle streams and avoid parallel roads. | Number of new roads sited away from streams | VTrans | VTrans |
| Publically-Owned Protected Areas | | Protect suitable habitat on publicly owned land. | Number of sites on public land | ANR, TNC, USFS | state lands Mgmt funds, TNC, GMNF |
| Awareness Raising and Communications | | Encourage reports of sightings to the VT Natural Heritage Inventory and the VT Reptile & Amphibian Atlas. | Number of reports | Reptile & Amphibian Atlas Project, Orriane Society | Nongame Wildlife Fund, SWG, Orriane Society |

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Common Name: **Wood Turtle**
 Scientific Name: **Glyptemys insculpta**
 Species Group: **Herp**

| | | | | |
|--------------------------------------|--|--|--|---|
| Planning & Zoning | Include Wood Turtle habitat in town zoning to limit impacts from development. | Number of towns considering wood turtle habitat in zoning | Cons Comms, VLCT | SWG |
| Standards | Develop land management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web. | Number of landowners and managers who receive and use guidelines | Reptile & Amphibian Atlas, EQIP biologists | SWG, EQIP |
| Compatible Resource Use | Manage ATV and other off road usage in known habitat to avoid impacts to Wood Turtles. | Number of sites where ATV use is managed | landowners, state and federal lands managers, VASA | state lands Mgmt funds, landowner decisions |
| Awareness Raising and Communications | Encourage reports of road-killed specimens, road crossing, and road basking areas to VFWD, VTRANS, and the VT Reptile & Amphibian Atlas. | Number of reports | VTrans, Reptile & Amphibian Atlas Project | VTrans |

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Common Name: **Wood Turtle**
Scientific Name: **Glyptemys insculpta**
Species Group: **Herp**

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Common Name: **Eastern Musk Turtle**
Scientific Name: **Sternotherus odoratus**
Species Group: **Herp**

Conservation Assessment

Final Assessment: Medium Priority **Global Rank:** G5 **Global Trend:**
State Rank: S2 **State Trend:** Unknown
Extirpated in VT? No **Regional SGCN?** No

Assessment Narrative:

The Musk Turtle is only recorded from the Champlain Valley of Vermont in about ten townships. It is small with limited dispersal capabilities. Home range is less than 2ha. Water chestnut control harvesting is a potential limiting factor to this species.

This species might be impacted by shoreline development that leads to loss of aquatic vegetation and suitable nesting sites (Harding 1997). In Vermont, ANR staff involved in water chestnut harvesting are aware of the potential to impact Musk Turtles that might be collected with the vegetation, and operate the harvester slowly and are on the lookout for turtles.

It is very easy to overlook Musk Turtles and they can be mistaken for Painted Turtles when observed on a road.

Distribution

Musk turtle reports are clustered in Colchester-Milton-Grand Isle, Ferrisburgh, and West Haven, Benson, Orwell, Castleton, Hubbardton, Sudbury.

Distribution by Biophysical Region:

| | | | |
|-------------------------------|-----------|-----------------------------|----------|
| Champlain Valley | Confident | Southern VT Piedmont | Unknown |
| Champlain Hills | Unknown | Vermont Valley | Probable |
| Northern Green Mtns | Unknown | Southern Green Mtns | Unknown |
| Northern VT Piedmont | Unknown | Taconic Mtns | Unknown |
| Northeastern Highlands | Unknown | | |

Distribution by Watershed:

Known Watersheds

Lake Champlain

Probable Watersheds

Otter Creek

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

Shallow permanent water of lakes and large ponds with aquatic vegetation, and large slow rivers. Shallow permanent water of lakes and large ponds with aquatic vegetation, and large slow rivers. This species is sometimes referred to as a bottom walker. It nests under logs and at the debris line of shorelines. It is largely restricted to the lowest elevations in Vermont within the Champlain Valley (<60m elevation).



Common Name: **Eastern Musk Turtle**
Scientific Name: **Sternotherus odoratus**
Species Group: **Herp**

Habitat Types:

Marshes and Sedge Meadows
Shrub Swamps
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lacustrine
Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat

Description of habitat threat(s): Development of shoreline that impacts nesting sites and aquatic vegetation.

Non-Habitat Threats:

Trampling or Direct Impacts

Description of non-habitat threat(s): Mechanical harvesting of water chestnut. Literature suggests anglers sometimes persecute. Might be subject to some collection as pets but it is not well documented.

Research and Monitoring Needs

| Type | Need | Priority | Description |
|-------------|--------------------------------|-----------------|---|
| Research | Habitat Requirements | Medium | Gather data on specific habitat requirements of Vermont populations: nesting sites, foraging areas, over wintering sites. |
| Research | Basic Life History | Low | |
| Research | Distribution and Abundance | High | Conduct statewide survey of Musk Turtle in Vermont. Identify distribution and relative abundance of populations in Vermont. |
| Research | Threats and Their Significance | Medium | Consider impacts of chestnut harvesting and shoreline development. |
| Research | Population Genetics | Low | |
| Research | Taxonomy | Low | |
| Monitoring | Population Change | High | Once baseline is established it would be helpful to monitor population over time. |
| Monitoring | Habitat Change | High | It would be good to detect habitat change while there is still time to act. |
| Monitoring | Range Shifts | Low | |
| Monitoring | Monitor Threats | High | |

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Common Name: **Eastern Musk Turtle**
 Scientific Name: **Sternotherus odoratus**
 Species Group: **Herp**

Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|---|--------------------------|--|--|---|----------------------------------|
| Technical Assistance, Training, Learning Networks | | Encourage observation and rescue of Musk Turtles removed from lakes by mechanical weed harvesting. Develop a training program to train weed harvesters how to do this. | Number of harvest operations that properly screen for turtles. | DEC Water Chestnut Program, Towns that manage aquatic weeds, lake association | |
| Standards | | Develop land and water management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web. | Number of owners and managers who receive information. | ECHO Leahy Center for Lake Champlain | Lake Champlain Basin Program |
| Awareness Raising and Communications | | Encourage reports of Musk Turtle sightings to the VT Natural Heritage Inventory and the VT Reptile & Amphibian Atlas. | Number of reports received. | Reptile & Amphibian Atlas | Nongame Wildlife Fund |

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Common Name: **Eastern Musk Turtle**
Scientific Name: **Sternotherus odoratus**
Species Group: **Herp**

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Common Name: **Spiny Softshell Turtle**
Scientific Name: **Apalone spinifera**
Species Group: **Herp**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5

Global Trend:

State Rank: S1

State Trend: Declining

Extirpated in VT? No

Regional SGCN? Yes

Assessment Narrative:

The Spiny Softshell Turtle is restricted to Lake Champlain in VT and Province of Quebec, and is not found elsewhere in New England as wild populations. It is not known from the NY side of Lake Champlain. All other historical locations in Quebec have been lost and the Winooski River population in Vermont has been lost. Shoreline development has limited nesting and basking areas for this species.

The Softshell is a very strong swimmer, but it is restricted to habitats in or near Lake Champlain and is unlikely to gain immigrants from outside Lake Champlain. Habitat loss due to succession is also a problem for this species, but can be corrected with vegetative management and natural processes such as ice scour of nesting beaches. Increasing lake use is limiting this species directly by boat strikes and limiting habitat through lakeshore development, especially sea walls and riprap. Human disturbances limit basking and can chase nesting females away from nesting beaches. Egg predator populations are abnormally high due to lack of larger predators and trapping pressure, and are subsidized by humans in the form of increased food supplies (garbage, pet food, corn).

A sustained nest management effort appears to be reducing nest depredation and many hatchlings have been documented to have emerged from nests and others have been taken into captive care and then released. It is hoped that these efforts will be successful in enhancing the population of this state-threatened species in Lake Champlain. A recovery plan has been written and accepted by the Agency of Natural Resources (VFWD 2009). The ongoing nest management actions include monitoring of nest clutch size which should detect recruitment of surviving females as they enter the breeding population at about age 14.

Galois et al. (2002) reported home range size to be 3,200 ha (12.8 sq. miles) for females and 275 ha for the smaller males. Individual adult females are known to travel from the Bay Bridge to the Pike River, a distance of ~19km and some females move upstream to nest. The large home range estimates of adult females is a result of lengthy movements between seasonal habitats.

Distribution

The Softshell is currently restricted to Missisquoi Bay and surrounding areas of shore and lower reaches of rivers and creeks from Pike River to St. Alban's Bay and a smaller subpopulation is associated with the lower Lamoyille River and surrounding lake.

Distribution by Biophysical Region:

| | | | |
|-------------------------------|--------------|-----------------------------|--------------|
| Champlain Valley | Confident | Southern VT Piedmont | Not Probable |
| Champlain Hills | Not Probable | Vermont Valley | Not Probable |
| Northern Green Mtns | Not Probable | Southern Green Mtns | Not Probable |
| Northern VT Piedmont | Not Probable | Taconic Mtns | Not Probable |
| Northeastern Highlands | Not Probable | | |



Common Name: **Spiny Softshell Turtle**
Scientific Name: **Apalone spinifera**
Species Group: **Herp**

Distribution by Watershed:

Known Watersheds

Lake Champlain

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

The following is based on general and regional literature as well as extensive local knowledge. The Spiny Softshell Turtle is a highly aquatic species inhabiting lakes, larger rivers, and associated wetlands. In general, important habitat features include a soft bottom with some aquatic vegetation for foraging and escape cover and fallen trees with underwater limbs, sandbars, and mudflats for basking. Individual or group basking sites such as rocks, logs, mud, sandbanks, or floating debris are also considered important (Ernst et al. 1994). Graham and Graham (1997) found partially submerged dead tree trunks to be the preferred basking substrate in the Lamoille River. Nesting sites are generally free of vegetation, have adequate solar exposure, are well drained throughout the nesting and incubation periods and occur on open sand and gravel/shale pebble deposits. Hatchlings prefer small shallow puddles or shallow waters on the lee end of sandbars that provide warmer and quieter water than surrounding areas (Plummer 1977a). This preference may be attributed to one or a combination of the following: food resources, swimming ability, differences in thermal preferences, social interactions, and predator avoidance (Congdon et al. 1992). Hibernacula must provide well oxygenated water and be free of ice scour, human disturbance, and predators. Turtles during hibernation are particularly vulnerable as they live under the ice for several months with low metabolism and reduced activity. The importance of adequate overwintering sites cannot be overstated, particularly at our latitude.

Habitat Types:

Upland Shores

Marshes and Sedge Meadows

Wet Shores

Shrub Swamps

Aquatic: Large Lake Champlain Tribs Below Falls

Aquatic: Lacustrine

Aquatic: Lake Champlain

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Succession

Habitat Alteration

Inadequate Disturbance Regime

Habitat Fragmentation

Description of habitat threat(s): Shoreline development is the biggest habitat threat. Both nesting and basking substrates are lost. Natural processes that create and clear nesting areas along shoreline are now



Common Name: **Spiny Softshell Turtle**
Scientific Name: **Apalone spinifera**
Species Group: **Herp**

impaired. Dams can cut off upstream populations or even divide populations. Marinas or other deep water development can impact hibernacula.

Non-Habitat Threats:

Pollution

Predation or Herbivory

Trampling or Direct Impacts

Description of non-habitat threat(s): Softshell Turtles are subject to intense nest depredation due to high levels of nest predators and concentrated nesting in a few locations. The nesting sites are impacted by human disturbance during nesting by shoreline and water recreation and nearby camps. Activity on nesting beaches can directly impact eggs and we have documented one case of equipment being driven over nests and causing damage. Human disturbance limits basking opportunities and duration. Pollution may have played a role in the decline of the Winooski River population and there remains concern about contaminants in Lake Champlain and possible impacts from toxic blue-green algal booms.

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Common Name: **Spiny Softshell Turtle**
 Scientific Name: **Apalone spinifera**
 Species Group: **Herp**

Research and Monitoring Needs

| Type | Need | Priority | Description |
|-------------|--------------------------------|-----------------|--|
| Research | Habitat Requirements | High | 1) Determine feasibility of a Winooski River softshell population restoration. 2) Conduct habitat surveys and assessments that provide useful information about distribution, quality, and level of disturbance by humans. |
| Research | Basic Life History | Low | 1) Continue studies monitoring individuals via radio-tagging in an effort to document habitat utilization and movements between those habitats among seasons and years. Movements of radio-tagged individuals will aid in our understanding of the extent of interchange between populations. 2) Develop emergence estimates based on the number of hatchlings produced from each nest, through either direct observation or the counting of eggshell fragments. 3) Nest success can be documented by monitoring nests and calculating the proportion of nests that successfully hatch young by the end of the nesting season. |
| Research | Distribution and Abundance | Medium | Have a pretty good handle on adults but not on juveniles. Document that recruitment of young into the breeding population is occurring. |
| Research | Threats and Their Significance | High | 1) Assess recovered dead specimens for size, weight, length, age estimate, sex, and the cause of death determined. 2) Employ tracking boards and camera sets to determine what species are predated a nesting site. 3) Investigate sensitivity to environmental contaminants. |
| Research | Population Genetics | Medium | Investigate if Lake Champlain softshells are genetically distinct as there is interest in the uniqueness of Lake Champlain turtle population. Some work has been conducted by UVM researchers. |
| Research | Other Research | High | All individuals captured for research should be measured, age estimated, sexed, and possibly marked via pit tags which would provide long-term information. |
| Monitoring | Population Change | High | Consider the use of genetic methods for investigating populations. |
| Monitoring | Habitat Change | High | |
| Monitoring | Range Shifts | High | |
| Monitoring | Monitor Threats | High | |

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Common Name: **Spiny Softshell Turtle**
 Scientific Name: **Apalone spinifera**
 Species Group: **Herp**

Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|---|--------------------------|--|---|---|--|
| Alliance Development | | Collaborate with other American and Canadian investigators, organizations, and agencies. | Number of interactions with partners. | Société de la faune et des parcs du Québec, Société d'Histoire Naturelle de la Vallée du St-Laurent | |
| Compliance & Enforcement | | Protect high-use basking areas from human disturbance via on and offshore signage and law enforcement. | Number of sites with signage and patrol. | VFWD Outreach Div., game wardens | Nongame Wildlife Funds |
| Compliance & Enforcement | | Protect nesting beaches from human disturbance during nesting season via on and offshore signage, law enforcement, and, if appropriate, visual screens. | Number of sites managed. | USDA Wildlife Service, game wardens | SWG |
| Technical Assistance, Training, Learning Networks | | Encourage softshell habitat landowners to become monitors and land stewards of that habitat for the purpose of softshell conservation. | Numbers of cooperating landowners. | Lake Champlain Land Trust | Lake Champlain Land Trust, Nongame Wildlife Fund |
| Awareness Raising and Communications | | Develop and place signage along important habitat areas. | Number of sites with signage. | USDA Wildlife Service, State Parks staff | SWG, Nongame Wildlife Fund |
| Species Restoration | | Consider recruiting volunteers to monitor potential nesting sites during the nesting season in an effort to identify previously undocumented nesting sites. | Number of trained volunteers and hours expended. | Lake Champlain Land Trust, Audubon VT | volunteer effort |
| Species Restoration | | Create nesting habitat in suitable areas close to water. | Number of created nesting area | Corps of Engineers, Missisquoi National Wildlife Refuge | SWG |
| Species Restoration | | Explore other deterrents such as fencing (chain link/floppy), electric wire, discouraging winter denning near nesting sites, night shooting, and night patrols with a trained dog to lessen predation. | Number of sites where alternative methods employed. | USDA Wildlife Services | SWG |

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Common Name: Spiny Softshell Turtle
Scientific Name: Apalone spinifera
Species Group: Herp

| | | | | |
|--------------------------------------|---|---|---|--|
| Awareness Raising and Communications | Develop and place informational brochures at fishing license agents, marinas, fishing derbies, and State Parks and camping areas. | Brochures distributed | State Parks, VFWD Outreach Div. | Marketing funds, Nongame Wildlife Fund |
| Species Restoration | Removing debris and large rocks, provide sand-shale substrate, trim or remove shading brush, and dig out encroaching vegetation in old shale deposits at nesting beaches. | Area improved for nesting. | volunteers, Audubon VT, UVM students | volunteer time |
| Species Restoration | Consider headstarting young if their survival in the nest is compromised. | Number of young salvaged. | ECHO Center for Lake Champlain, Ecomuseum (Montreal) | volunteer effort |
| Species Restoration | Employ mammalian predator trapping programs at nesting beaches that exhibit a relatively high concentration of nests to reduce the number of nests predated. | Number of predators removed. | USDA Wildlife Services | SWG |
| Market Forces | Develop an incentives program for dairy farmers to halt the access and trampling of sandy shorelines by cows (i.e., provide farmers with large water tanks and electric fencing). | Number of sites were livestock trampling of shoreline controlled. | NRCS, Farm Bureau | NRCS |
| Species Restoration | Basking habitat could be created via floating platforms or permanent structures. | Number of sites benefiting from basking structures. | Normandea u Inc | VTrans bridge project |
| Awareness Raising and Communications | A Spiny Softshell Turtle reporting program that encourages the public to document softshell sightings should be part of the overall public outreach effort for this species. | Number of reports received. | Reptile & Amphibian Atlas project | Nongame Wildlife Fund |
| Awareness Raising and Communications | Incorporate softshells into existing Vermont Agency of Natural Resources fish and wildlife publications (i.e., law digest and fishing guide). | Number of times message is carried in ANR publications. | VFWD outreach division and commissioner | marketing funds |
| Species Restoration | Protect known habitats from disturbance: nesting, wintering, basking, foraging. | Number of sites protected. | Missisquoi National Wildlife Refuge, Société de la Faune et Des Parcs du Québec, TNC of Canada, FPR, VFWD | Lake Champlain Mgmt funds, Lake Champlain Basin Program funds, SWG |
| Awareness Raising and Communications | Recruit local volunteers for the purpose of monitoring nesting beaches and increasing the general public's awareness of Lake Champlain Spiny Softshells. | Number of volunteers and effort expended | Audubon VT | Nongame Fund, Audubon VT |

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Common Name: Spiny Softshell Turtle
Scientific Name: Apalone spinifera
Species Group: Herp

| | | | | | |
|---|-----|--|--|--|----------------------------|
| Species Restoration | | When feasible, protect nests with ½" x ½" hardware cloth or vinyl-coated wire mesh cages by state and federal biologists in an effort to reduce the number of depredated nests. | Number of successful nests protected, | USDA Wildlife Services | SWG |
| Awareness Raising and Communications | | Organize workshops at boat-ramps to educate anglers on turtle identification and fishing hook removal. | Number of workshops held and numbers of people who attend. | angler organization, Lake Champlain Committee, LCI | LCI |
| Compliance & Enforcement | | Identify areas that provide critical foraging habitat, particularly for juveniles, and protect vulnerable areas from human disturbance via on and offshore signage and law enforcement if the areas are reasonably small and identifiable. | Number of areas documented. | TNC of Canada, Normandea u Associates | VTrans bridge monitoring |
| Compliance & Enforcement | | Develop and maintain internal communications with law enforcement and biologists to build awareness and support for turtle protection. | Number/frequency of exchanges of information. | Game wardens, fisheries biologists | SWG, Nongame Wildlife Fund |
| Habitat Restoration | | When feasible, basking areas will be enhanced via natural (e.g., tree limbs and trunks) structures in an effort to increase basking surface area. | Number of basking areas | Missisquoi National Wildlife Refuge | refuge operating budget |
| Habitat Restoration | | Improve water quality in Lake Champlain by reducing sources of existing pollution and prevent future pollution impacts. | Improvements in water quality | DEC, Farmers, Towns | Clean and Clear Program |
| Technical Assistance, Training, Learning Networks | Low | Identify significant road crossings and develop safe road crossings to reduce the potential for roadkill. Softshells rarely venture far from water so are less vulnerable to road mortality than other turtles. | Number of sites identified and crossings developed. | Reptile & Amphibian Atlas, | VTrans, FHWA |
| Species Restoration | | Trap nesting areas that exhibit a relatively high concentration of nests in an effort to reduce the number of predated nests. | Number of areas trapped | USDA Wildlife Services | SWG |
| Compliance & Enforcement | | Further develop program by which softshell sightings and/or harassment can be reported to Vermont's Wildlife Diversity Program. | Number of reports received | Reptile & Amphibian Atlas | Nongame Wildlife Fund |
| Policy & Regulations | | Explore and implement legal protection to benefit the Spiny Softshell Turtle, including the establishment of a legal means of designating and protecting habitats critical for softshells, both on land and water. | Number of legal tools provided. | Game wardens | state general |

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Common Name: Spiny Softshell Turtle
Scientific Name: Apalone spinifera
Species Group: Herp

| | | | | |
|---|---|---|---|--|
| Publically-Owned Protected Areas | Pursue acquisition of those areas identified as important for maintaining and enhancing Spiny Softshell Turtles. | Number of sites and acreage conserved. | Lake Champlain Land Trust, Nature Conservancy of Canada | VHCB funds |
| Awareness Raising and Communications | Develop and distribute information to landowners of current and potential riverine and lakeside softshell habitat. | Numbers of landowners/camp owners contacted. | Lake Champlain Land Trust | Lake Champlain Land Trust, Nongame Wildlife Fund |
| Compliance & Enforcement | Monitor hibernacula when Spiny Softshells have congregated (September – May) to ensure disturbance is minimal. | Frequency of monitoring | Société de la faune et des parcs du Québec | Québec grant |
| Technical Assistance, Training, Learning Networks | Inform state biologists of potential problem for hibernacula (e.g., potential marina development) and take appropriate actions when a hibernaculum's physical characteristics and/or hibernating individuals are limited. | Number of actions taken to protect turtles and their habitat. | Act 250 coordinator, game warden, Missisquoi National Wildlife Refuge | |

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Common Name: **Common Five-lined Skink**
Scientific Name: **Plestiodon fasciatus**
Species Group: **Herp**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5

Global Trend:

State Rank: S1

State Trend: Unknown

Extirpated in VT? No

Regional SGCN? No

Assessment Narrative:

The Five-lined Skink is an S1, state-endangered species, that is known from only three locations in West Haven, VT. All Five-lined Skink sites in Vermont feature talus and exposed rock within a mile of Lake Champlain. Total records of individual sightings number approximately 40. We have almost no data on their abundance and natural history in VT. We would benefit from data on distribution, behavior, seasonal movements, egg-laying sites, predators, food, population size, genetic heterozygosity and microhabitat requirements.

Distribution

The Five-lined Skink is known from three locations in West Haven, VT.

Distribution by Biophysical Region:

| | | | |
|-------------------------------|--------------|-----------------------------|--------------|
| Champlain Valley | Confident | Southern VT Piedmont | Not Probable |
| Champlain Hills | Not Probable | Vermont Valley | Not Probable |
| Northern Green Mtns | Not Probable | Southern Green Mtns | Not Probable |
| Northern VT Piedmont | Not Probable | Taconic Mtns | Not Probable |
| Northeastern Highlands | Not Probable | | |

Distribution by Watershed:

Known Watersheds

Mettawee River
Lake Champlain

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

The Five-lined Skink is known currently only on talus slopes and nearby cliff faces, exposed rocky ridges, and rocky shorelines. The ridges are composed off a mixture of ledge, broken rock, and scattered juniper or hardwoods. All known sites have a south or southwestern exposure, low elevation, nearby water, and relatively warm climates for Vermont. Anecdotal historic reports mention the use of exposed faces of old buildings near the above habitat and old mining areas. A skink sighting of this nature was recently documented in an abandoned shanty.

Known in Vermont only from West Haven/Benson along Lake Champlain where talus slopes and exposed cliff faces and ridges of low elevation are close to water. Critical habitat includes leaf litter and coarse woody debris mixed with exposed broken rock/ledge seems to be preferred.



Common Name: **Common Five-lined Skink**
Scientific Name: **Plestiodon fasciatus**
Species Group: **Herp**

Habitat Types:

Outcrops and Alpine
Cliffs and Talus
Northern Hardwood
Oak-Pine Northern Hardwood
Subterranean
Building or Structure
Mine
Other Cultural

Current Threats

Habitat Threats:

Habitat Succession
Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Transportation Systems

Description of habitat threat(s): Five-lined Skinks need solar exposure, rock slides and fire may play a roll in keeping talus and ledges exposed. Development of lake-shore areas where the skink is found, removal of coarse woody debris, and introduction of cats could prove to eliminate local populations. Skinks may move from denning sites on talus to feeding areas nearby. Short-distance seasonal movements seem likely. They do not seem to move across open field but rather short distances from talus to cliff, ridge, field edge, or lake-shore. Moderate traffic, wide roads and large agricultural fields could limit movements. Future sources of coarse woody debris need to be maintained (old snags, large dead trees, etc.).

Non-Habitat Threats:

Genetics
Trampling or Direct Impacts
Predation or Herbivory
Loss of Prey Base

Description of non-habitat threat(s): Genetic isolation of very localized populations are potentially a problem. Predation by cats or other introduced or subsidized predators could be a problem. Insecticide use could impact their prey base. When cold, lizards move slowly. Excessive trampling (intensive agricultural, residential, or recreational use could be a problem). Sites may have become isolated by large agricultural fields. Continuous sunny and rocky edge habitat may connect one large meta-population (Bald Mountain, Austin Hill, and adjacent rocky shorelines and talus slopes). Two other known locations (Dresden Narrows, Benson) may be isolated.

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Common Name: **Common Five-lined Skink**
Scientific Name: **Plestiodon fasciatus**
Species Group: **Herp**

Research and Monitoring Needs

| Type | Need | Priority | Description |
|-------------|--------------------------------|-----------------|---|
| Research | Habitat Requirements | Medium | 1) Gather data on specific habitat requirements of Vermont populations: denning sites, egg-laying sites, foraging areas, and movement corridors. 2) Identify critical habitat that includes basking sites. |
| Research | Basic Life History | Medium | |
| Research | Distribution and Abundance | High | 1) Determine distribution and abundance in Vermont. 2) Survey anthropogenic sites such as old mines and talus piles in western Rutland County for this species. 3) Identify appropriate habitat in Western Rutland and Addison Counties from maps and photos. |
| Research | Threats and Their Significance | High | Recover any dead specimens or use other means to obtain genetic tissue samples as the basis for genetic assessment/demographic info. |
| Research | Population Genetics | High | Recover any dead specimens or use other means to obtain genetic tissue samples as the basis for genetic assessment/demographic info. |
| Monitoring | Population Change | High | Monitor the size and determine the sustainability of existing populations through age-class and/or genetic analysis. |
| Monitoring | Habitat Change | High | |
| Monitoring | Range Shifts | Medium | |
| Monitoring | Monitor Threats | High | |

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Species Conservation Report



Common Name: **Common Five-lined Skink**
 Scientific Name: **Plestiodon fasciatus**
 Species Group: **Herp**

Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|---|--------------------------|--|---|--|--|
| Technical Assistance, Training, Learning Networks | | Train Rattlesnake researchers and game wardens to keep data on the sightings and habits of this species. | Number of cooperators who gather information on skinks. | game wardens, volunteers | SWG, TNC |
| Standards | | Develop land management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web. | Number of landowners and managers who receive and use guidelines | VFWD district biologists, consulting foresters | SWG |
| Technical Assistance, Training, Learning Networks | Medium | Train Rattlesnake "Responders" to collect and submit data on the sightings and habits of the five-lined skink. | Number of cooperators who gather information on skinks. Number of skink tissue samples collected. | Game Wardens, volunteers, VFWD district biologists | SWG, TNC |
| Awareness Raising and Communications | | Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information. | Number of people who receive message. | VFWD Outreach Division, TNC | Outreach marketing funds |
| Easements | | Conserve known habitat through fee simple purchase, development rights or easements, management agreements and education of private landowners and managers regarding appropriate management. | Number of sites and acreage conserved. | TNC, VLT | VHCB funds |
| Awareness Raising and Communications | | Encourage reports of sightings to the VFWD Wildlife Diversity Program and the Vermont Reptile and Amphibian Atlas. | Number of reports received | Reptile & Amphibian Atlas, TNC | Private grants, Nongame Wildlife Fund, SWG |
| Species Restoration | | Work to maintain connectivity with populations to the west in New York State and between the two known populations. Collect tissue sample when/where possible for genetic assessment. | Quality and quantity of connecting habitat. | New York DEC, TNC, VLT | VHCB, TNC, SWG |
| Habitat Restoration | | Experiment with habitat enhancement such as creating small openings in heavily shaded areas along the top of cliffs and talus slopes, dropping logs onto the talus, maintaining coarse woody debris and scattered cover. | Number of sites with active management that have been monitored. | TNC | TNC, SWG |
| Alliance Development | | Continue to work cooperatively with important landowners such as the Nature Conservancy. Develop and maintain allies in local government and private citizens. | Number of joint meetings with partners. | TNC, landowners | various |

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Common Name: Common Five-lined Skink
Scientific Name: *Plestiodon fasciatus*
Species Group: Herp

| | | | | |
|--------------------------------------|--|---|---|--------------------|
| Compatible Resource Use | Manage ATV and other off road usage in known habitat to avoid impacts. | Number of sites where ATV use is controlled. | Landowners, TNC, Game Wardens, VASA | Land Mgmt funds |
| Awareness Raising and Communications | Keep cats away from known habitat. Discourage or re-direct residences away from known habitats. | Number of areas fenced or otherwise protected | Landowners, TNC | TNC |
| Awareness Raising and Communications | Encourage reports of road-killed specimens, road crossing, and road basking areas to VFWD, VTRANS, and the VT Reptile & Amphibian Atlas. | Number of sites reported | VTrans, Reptile & Amphibian Atlas, volunteers TNC | Vtrans, TNC |
| Species Restoration | If local populations are determined to be unsustainable, consider reintroduction or augmentation from closest healthy source. Maintaining and enhancing extant populations is always a priority and should be continued. | Number of extant sites | TNC, NYDEC | Private grant, SWG |

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Common Name: **Common Five-lined Skink**
Scientific Name: **Plestiodon fasciatus**
Species Group: **Herp**

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Common Name: **North American Racer**
 Scientific Name: **Coluber constrictor**
 Species Group: **Herp**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5

Global Trend:

State Rank: S1

State Trend:

Extirpated in VT? No

Regional SGCN? Yes

Assessment Narrative:

The North American Racer is currently known from only one site in Vermont. It had not been documented in Vermont since 1985 and had been feared extirpated until relocated in 2003. It is a very rare species in Vermont (S1) and was listed as threatened in 2005. Anecdotal historic reports in the southern Connecticut River Valley and on nearby ridges repeatedly speak of a North American Racer that was commonly seen in this area twenty-five or more years ago. Recent Reptile & Amphibian Atlas records include racer reports in a six-town area in this region although the species is currently known from only one site in VT. Focused Racer research from 2004-2007 identified eight individuals in Vernon/Gilford which were PIT-tagged and monitored. Subsequent survey efforts occurred annually but no animals were seen between 2008 - 2014 sparking added fears of extirpation. Two sightings were most recently documented in 2014 in Gilford. Habitat loss due to succession is likely negatively affecting this species. Since 2007, habitat improvement efforts directed specifically towards Racers have occurred at the Gilford I-91 weigh-station site.

Historically, this species probably expanded in numbers as Vermont's forests were cleared. Open pasture, fields mowed by hand or horse, or fields not mechanically baled probably provided expanded habitat. Currently, with farm loss/abandonment over the past several decades, habitat favorable to Racers has declined significantly.

Distribution

The only known population of the North American Racer in Vermont uses early successional open ledge, grass, fern, and other herbaceous cover exclusively during the summer. It does move through short (30m) sections of woodlands between patches. It may move larger distances through woodlands to denning sites. Telemetry research on this species in 2004-2007 identified long, narrow home range movements covering some three miles, tightly associated with a major powerline and grass margins of the Interstate right-of-way. The animal is known to den along ledges with talus slopes and exposed rock in other northern locations. One former denning site in Vermont has been located. Recent racer habitat improvement efforts have focused on creating early successional (grass/shrub) habitat, creation of experimental hibernacula, egg-laying substrate and basking habitat at the animal's last known occurrence site in Gilford.

Distribution by Biophysical Region:

| | | | |
|-------------------------------|--------------|-----------------------------|-----------------------|
| Champlain Valley | Not Probable | Southern VT Piedmont | Confident |
| Champlain Hills | Not Probable | Vermont Valley | Not Probable |
| Northern Green Mtns | Not Probable | Southern Green Mtns | Historic Records Only |
| Northern VT Piedmont | Not Probable | Taconic Mtns | Not Probable |
| Northeastern Highlands | Not Probable | | |

Distribution by Watershed:

Known Watersheds

Middle Connecticut

Probable Watersheds

West

Black-Ottawquechee



Common Name: **North American Racer**
Scientific Name: **Coluber constrictor**
Species Group: **Herp**

Deerfield Hudson-Hoosic
Mettawee River
Lake Champlain
Otter Creek

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

The North American Racer is currently known only from a very limited portion of a two-town area in the Connecticut River Valley. The species primarily uses early successional and sunny habitat along low rocky ridges in warm portions of the state. It probably moves from ridges to adjacent open areas at lower elevations to feed during the summer months. It needs to get below frost line for denning. Overwintering mortality has been documented for this species. Connected mosaics of early successional habitat and rocky exposed ledges is probably required.

Habitat Types:

Outcrops and Alpine
Cliffs and Talus
Oak-Pine Northern Hardwood
Early Succession Pine and Hemlock
Early Succession Upland Oak
Subterranean
Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Current Threats

Habitat Threats:

Conversion of Habitat
Habitat Succession
Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Transportation Systems

Description of habitat threat(s): This species probably expanded in numbers as early Vermont was cleared. Open pasture, fields mowed by hand or horse, or fields not mechanically baled probably provided expanded habitat. Loss of early successional habitat including small farms, increased row cropping, increasing speed and mechanization of mowing and baling and increased parcelization are believed to have limited appropriate habitat.

Non-Habitat Threats:

Genetics
Reproductive Traits



Common Name: **North American Racer**
 Scientific Name: **Coluber constrictor**
 Species Group: **Herp**

Trampling or Direct Impacts

Disease

Description of non-habitat threat(s): Isolation of appropriate habitat patches and small population size may have led to genetic isolation. Snake Fungal Disease is a potential threat but as yet unknown in VT racers. Increasing mechanization and speed of mowing and bailing causes direct mortality. Increasing ATV use in rural areas is a direct problem. Direct persecution from encounters with humans and possibly dogs needs to be addressed.

Research and Monitoring Needs

| Type | Need | Priority | Description |
|-------------|--------------------------------|-----------------|--|
| Research | Habitat Requirements | Medium | While the Racers' general requirements are known from literature, we lack full understanding of VT habitat utilization. Gather specific habitat requirement data for VT populations: denning sites, egg-laying sites, foraging areas, and movement corridors. |
| Research | Distribution and Abundance | High | 1) Continue racer surveys at known sites and for additional populations. Identify distribution and relative abundance of populations. Look for/examine evidence of Rutland/Bennington county populations. 2) Identify appropriate southeastern VT habitat from maps, photos, aerial surveys, and ground survey and interviews in likely areas. |
| Research | Threats and Their Significance | High | Opportunistically capture racers and recover any dead specimens to assess health status, obtain demographic information and genetic tissue samples for analysis. |
| Monitoring | Population Change | High | 1) Monitor the size and determine the sustainability of existing populations through age-class or genetic analysis. 2) Review pertinent literature to investigate/inform the possibility of augmentation from closest, healthy source population. |
| Monitoring | Habitat Change | High | Continue on-going habitat improvement/maintenance schedules and monitor weigh station sites for evidence of racer use/occupation. |
| Monitoring | Monitor Threats | High | Watch for Snake Fungal Disease in Racer populations. |

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Common Name: **North American Racer**
 Scientific Name: **Coluber constrictor**
 Species Group: **Herp**

Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|--------------------------------------|--------------------------|---|--|--|----------------------------------|
| Habitat Restoration | | Continue to maintain and create early successional habitat. Create/enhance denning, basking, egg-laying habitat if limited. Monitor existing improvements for evidence of use. Educate private landowners about maintaining habitat in a snake friendly manner. | Number of acres and specific sites maintained or enhanced. | VELCO, local landowners, VFWD district biologists, VTrans | VELCO, VFWD, VTrans, SWG |
| Alliance Development | Medium | Continue to work cooperatively with organizations and individuals in southeastern Vermont. Develop and maintain allies. | Number of partners. | Bonnyvale Environmental Center, local conservation commission, landowners, consulting foresters, VTrans, Reptile & Amphibian Atlas | SWG |
| Awareness Raising and Communications | | Educate landowners in area about snakes in general and encourage coexistence with snakes. Inform them about the identification, natural history, and conservation problems and needs of this species. | Number of people who receive message. | VFWD Outreach Division | marketing funds, SWG |
| Species Restoration | | If local populations are determined to be unsustainable, consider augmentation from closest healthy source. Maintaining and enhancing extant populations is always a priority and should be continued. | Number of extant populations. | Mass F&W, NH F&W | SWG |
| Planning & Zoning | | Review all roadway projects in appropriate habitat, check against known crossing areas VTRANS, VFWD, VT Reptile & Amphibian Atlas, survey appropriate habitat when unknown. | Number of projects that utilize racer information. | VTrans, Reptile & Amphibian Atlas | FHWA, SWG |
| Awareness Raising and Communications | Medium | Encourage reports of sightings to the VT Heritage Inventory and the VT Reptile & Amphibian Atlas. | Number of reports received. | Reptile & Amphibian Atlas | Nongame Wildlife Fund |
| Awareness Raising and Communications | | Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information. | Number of people who received message. | VFWD Outreach Division | Nongame Wildlife Fund, SWG |

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Common Name: North American Racer
Scientific Name: Coluber constrictor
Species Group: Herp

| | | | | |
|---|---|---|---|------------------------------|
| Standards | Develop land management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web. | Number of managers and landowners who receive message. | Consulting foresters, VELCO, VTrans | SWG |
| Technical Assistance, Training, Learning Networks | Establish a web site with conservation information on this species and trained local contacts who can relocate snakes. | Establishment of web site containing information on racer. | VFWD Outreach Division, VTrans, Bonnyvale Environmental Center, Reptile & Amphibian Atlas | VTrans, VFWD marketing funds |
| Habitat Restoration | Develop, implement, and monitor, road crossing structures and barriers for this species. | Number of structures installed. | VTrans | FHWA |
| Easements | Conserve know habitat through fee simple purchase, development rights or easements, management agreements, and education of private landowners and managers regarding appropriate management. | Number of areas conserved. | consulting foresters, landowners, VLT, Vtrans, local land trusts | VHCB, FHWA |
| Species Restoration | Work to maintain connectivity with populations to the south in Massachusetts. | Maintenance of connectivity. | VTrans, VFWD, Mass Highway Dept. Town Planning Commission | FHWA, Vtrans |
| Awareness Raising and Communications | Encourage reports of road-killed specimens, road crossing, and road basking areas to VFWD, VTRANS, and the VT Reptile & Amphibian Atlas. | Number of reports received. | VTrans, Reptile & Amphibian Atlas | Nongame Wildlife Fund |
| Compatible Resource Use | Manage ATV and other off road usage in know habitat to avoid impacts. | Number of areas where ATV use is controlled. | Landowners, VELCO, VTrans, VASA | VELCO, VTrans |
| Awareness Raising and Communications | Quickly and thoroughly, counter myths and misinformation appearing in the press that may limit this species. | Number of press articles. Numbers of individuals who received message | Bonnyvale Environmental Center, Reptile & Amphibian Atlas | Private funds and grants |

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Common Name: **North American Racer**
Scientific Name: **Coluber constrictor**
Species Group: **Herp**

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Common Name: **Eastern Ratsnake**
Scientific Name: **Pantherophis alleghaniensis**
Species Group: **Herp**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5

Global Trend:

State Rank: S2

State Trend: Declining

Extirpated in VT? No

Regional SGCN? No

Assessment Narrative:

The Eastern Ratsnake is a S2 species that is listed as state-threatened. Development, habitat fragmentation, road mortality, and direct persecution limit both Ratsnake populations in Vermont. The northern population appears to be entirely isolated. Anecdotal reports strongly suggest that both populations are declining.

Distribution

The Eastern Ratsnake is known from only two regions of VT. One meta-population can be found in western Rutland County and extending into southwestern Addison County. The second population is very localized on the border of Monkton, Bristol, and New Haven. The southern population is essentially bounded on the south by Route 4, on the west by Route 30, and on the north by Route 73 with an extension on Bald Hill in Sudbury reaching across Otter Creek into Leicester. The northern population is essentially bordered on the south by Plank Road, on the west by North Street (and the adjoining wooded swamp) on the north by Piney Hill Road and on the East by the Monkton-Bristol Road. Recent work in Vermont (Andrews 2012) has shown that individual snakes migrate at least 1.5 miles to and from hibernacula. Many, but not all, of these dens are on or immediately below south or southwest facing cliffs along the shore of Lake Champlain or similar but more interior cliffs and talus slopes. At least one population must use less-exposed ledges due to an apparent lack of cliffs within known migration distances.

Distribution by Biophysical Region:

| | | | |
|-------------------------------|--------------|-----------------------------|--------------|
| Champlain Valley | Confident | Southern VT Piedmont | Not Probable |
| Champlain Hills | Not Probable | Vermont Valley | Not Probable |
| Northern Green Mtns | Not Probable | Southern Green Mtns | Not Probable |
| Northern VT Piedmont | Not Probable | Taconic Mtns | Confident |
| Northeastern Highlands | Not Probable | | |

Distribution by Watershed:

Probable Watersheds

Lake Champlain
Metawee River
Otter Creek

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

This species dens in cracks and caves on cliff faces, in rocky talus slopes often at the base of cliffs, and possibly in rocky woodlands and along ledges at low elevation (<400m) with a southern or southwestern exposure. Many of these dens are along the shore of Lake Champlain or similar but more interior cliffs and



Common Name: **Eastern Ratsnake**
Scientific Name: **Pantherophis alleghaniensis**
Species Group: **Herp**

talus slopes are also used. At least one population must use less-exposed but deeply eroded ledges due to an apparent lack of cliffs within known migration distances.

From these dens individuals travel distances of 1.5 miles or more to summer foraging areas that consist primarily of cliff tops, field edges, old fields, old orchards, abandoned or seldom used buildings and barns, or wetland margins. Large exposed dead or partly dead hollow trees along field edges, cliff tops, on talus slopes, or along margins or wetlands and water bodies are often used as refuges, as well as basking and feeding areas. Habitat mosaics including rocky slopes, cliffs, large dead and hollow trees, old fields, wetlands, and old buildings are ideal. Areas that also include abundant amphibians such as Northern Leopard Frogs seem to be most frequented. Along Lake Champlain while traveling between dens and foraging areas, ratsnakes spend most of their travel time within the thickly-vegetated shoreline margin of the lake. In other areas they appear to use densely vegetated corridors and hedgerows as their travel corridors. They also return to favored barns and protected refugia year after year.

Appropriate denning areas (talus, rock crevices) with spring basking opportunities, low elevation warm rocky woodlands, and safe connectivity to woodland or edge foraging areas with low human and road density appear to be important. Standing hollow snags with good sun exposure provide feeding, protection, and basking.

Habitat Types:

Upland Shores
Outcrops and Alpine
Cliffs and Talus
Oak-Pine Northern Hardwood
Hardwood Swamps
Marshes and Sedge Meadows
Early Succession Upland Oak
Building or Structure
Mine
Grasslands, Hedgerows, Old Field, Shrub, or Orchard
Other Cultural

Current Threats

Habitat Threats:

Conversion of Habitat
Habitat Succession
Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Transportation Systems
Climate Change

Description of habitat threat(s): This species often travels relatively long distances from den sites for foraging areas. As development continues, this travel may require movement through increasingly



Common Name: **Eastern Ratsnake**
 Scientific Name: **Pantherophis alleghaniensis**
 Species Group: **Herp**

mechanized agricultural areas, and across increasingly busy roads. This movement in combination with their affinity for edge habitat, old buildings, barns, and outbuildings often brings them into contact with humans. Increasing development brings snakes into contact with more humans, and their machines.

Non-Habitat Threats:

Genetics

Reproductive Traits

Trampling or Direct Impacts

Disease

Description of non-habitat threat(s): Some populations appear to be completely isolated, others may become so. This is a long-lived species, consequently direct persecution from humans and increased road mortality of adult breeders can outpace production. Roads attract and hold cold snakes as basking areas. Increasing road density and traffic are a problems. Increased ATV use in and near woodland fragments is known to cause mortality to snakes basking in trails. Increasing efficiency and speed of farm equipment for the planting and harvest of crop lands increases mortality from this source. Snake fungal disease has recently been identified in this area and is known to cause mortality in ratsnakes. It may have impacts on our populations but the extant of and impacts from the disease in Vermont are currently unknown.

Research and Monitoring Needs

| Type | Need | Priority | Description |
|-------------|--------------------------------|-----------------|---|
| Research | Habitat Requirements | High | Determine food requirements, denning sites, nesting locations, foraging areas, movement corridors, annual range, and other important natural history information that can be used to better protect and/or enhance habitat. |
| Research | Basic Life History | Medium | |
| Research | Distribution and Abundance | High | 1) Identify distribution and relative abundance (population sizes) of populations in Vermont. 2) Survey all areas from which reports have originated in the last ten years. |
| Research | Threats and Their Significance | High | Is this species susceptible to or carrying Snake Fungal Disease or other diseases in Vermont? Are there specific locations where snake fencing and underpasses would benefit this species? |
| Research | Population Genetics | Medium | Is the northern population in danger due too limited genetic diversity? |
| Monitoring | Population Change | High | Are populations associated with any of the dens declining? If so, at what rate? |
| Monitoring | Habitat Change | High | How and at what rate is habitat changing? Is traffic increasing? |
| Monitoring | Range Shifts | High | Has this species disappeared from any historic range. Is it moving into any previously uninhabited range? |
| Monitoring | Monitor Threats | High | |

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Common Name: **Eastern Ratsnake**
 Scientific Name: **Pantherophis alleghaniensis**
 Species Group: **Herp**

Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|---|--------------------------|--|--|--|----------------------------------|
| Awareness Raising and Communications | High | Educate landowners and residents within the snake's range to encourage coexistence with snakes. | Number of programs and number of people who receive message. | landowners, Cons Comms | SWG, Private grants |
| Technical Assistance, Training, Learning Networks | High | Work with VTrans crew and other land managers to raise awareness of conservation need and implement conservation actions that benefit snakes. | Number of crew members who receive training | VTrans | VTrans training funding |
| Alliance Development | High | Continue working cooperatively with important landowners such as The Nature Conservancy. Develop and maintain allies in local government and private citizens. | Number of joint meetings held with partners. | TNC, landowners, towns | SWG, Nongame Wildlife Fund |
| Natural Processes Restoration | Medium | Develop, implement, and monitor, road crossing structures and barriers for this species. | Number of structures installed | VTrans, Academic community | SWG, VTrans, FHWA |
| Species Restoration | Medium | Work to maintain connectivity with populations to the west in New York State and between known populations. | Quantity (acorage) and quality of connective habitat. | NY DEC, VLT, Champlain Land Trust | VHCB |
| Standards | Medium | Review all roadway projects in appropriate habitat, check against known crossing areas VTRANS, VFWD, VT Reptile & Amphibian Atlas, survey appropriate habitat when unknown. | Number of projects where ratsnake information was used for planning | VTrans, Reptile & Amphibian Atlas | VTrans, FHWA |
| Compatible Resource Use | | Manage selected areas for early succession, work with agriculturalists to manage lands to maintain early successional habitat does not cause direct mortality (e.g., light pasturing rather than harvesting/cultivation near wetlands and denning habitat. | Acres of wetland/grassland mosaics within safe travel distance of known denning habitat. | Sportsmen, Audubon VT | SWG, VHCB |
| Planning & Zoning | High | Identify important denning areas and movement corridors and minimize development, clearing, road building and increased traffic in these areas. Maintain low density human use in mosaics in known areas. | Number of specific sites identified. Number of sites with compatible land use. | TNC, landowners, land managers, VTrans, town government s, Town/ Regional Planners | SWG, TNC, VTrans |
| Compatible Resource Use | Medium | Manage ATV and other off road usage in known habitat to avoid impacts. | Number of sites where ATV use is controlled | Landowners, Game Wardens, TNC, VASA | ATV License fees, SWG |

Vermont Department of Fish and Wildlife
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Common Name: Eastern Ratsnake
Scientific Name: Pantherophis alleghaniensis
Species Group: Herp

| | | | | | |
|---|--------|---|--|--|---|
| Research | Medium | Determine the presence/absences of reptile diseases in the historic area of the Chorus frog and to control their spread and impact. | Disease surveys | Regional Wildlife Health Lab, Academic community | SWG, Nongame Fund, Private grants |
| Awareness Raising and Communications | High | Quickly and thoroughly, counter myths and misinformation appearing in the press that may limit this species. | Number of press responses carried by media. | SAG-Herps, Reptile & Amphibian Atlas, VFWD Outreach Division | SWG, Marketing funds |
| Technical Assistance, Training, Learning Networks | | Maintain and support the network of trained snake relocators for this species as well as Rattlesnakes. Put information about Ratsnakes and this service on the same materials and website as for rattlesnake. | Number of requests for assistance. | Volunteers, Reptile & Amphibian Atlas, TNC, Orianna Society | TNC, Orianna Society |
| Awareness Raising and Communications | Medium | Encourage reports of sightings to the VT Wildlife Diversity Program and the VT Reptile & Amphibian Atlas. | Number of reports received | Reptile & Amphibian Atlas | Nongame Wildlife Fund, SWG |
| Standards | Medium | Develop land management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web. | Numbers of landowners and managers who become aware and use guidelines | VFWD district biologists, consulting foresters | SWG |
| Awareness Raising and Communications | Medium | Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information. | Number of people who receive information | ECHO Center for Lake Champlain, VFWD Outreach Division | Corporate Sponsors, Lake Champlain Basin Program, Marketing funds |
| Awareness Raising and Communications | Medium | Encourage reports of road-killed specimens, road crossing, and road basking areas to VFWD, VTrans, and the VT Reptile & Amphibian Atlas. | Number of sites reported | VTrans, Reptile & Amphibian Atlas. | VTrans, FHWA, SWG |
| Publically-Owned Protected Areas | High | Protect through easement or purchase or collaboration, denning sites, travel corridors and foraging areas. | Acreage and number of sites conserved | Reptile & Amphibian Atlas, Lake Champlain Land Trust, VLT | VHCB |

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Common Name: **Eastern Ratsnake**
Scientific Name: **Pantherophis alleghaniensis**
Species Group: **Herp**

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Common Name: **Common Watersnake**
Scientific Name: **Nerodia sipedon**
Species Group: **Herp**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5

Global Trend:

State Rank: S3

State Trend: Unknown

Extirpated in VT? No

Regional SGCN? No

Assessment Narrative:

The Common Watersnake (previously known as the Northern Watersnake) is mainly a Champlain Valley species in Vermont, but also found in SE Vermont. This species is relatively large and aggressive, so is sometimes killed by humans. This species does suffer some road mortality and is purposely killed by some. It is usually associated with large wetlands of the Champlain Valley. Shoreline development may increase negative impacts from humans. Literature suggests pollution may be a problem (Harding 1997; Hunter, Calhoun, McCollough 1999). In some locations, the Northern Water Snake can be found in large numbers (e.g., Bristol Pond).

Distribution

The Common Watersnake is known from the Champlain Valley, Shaftsbury, and Vernon.

Distribution by Biophysical Region:

| | | | |
|-------------------------------|--------------|-----------------------------|--------------|
| Champlain Valley | Confident | Southern VT Piedmont | Confident |
| Champlain Hills | Confident | Vermont Valley | Not Probable |
| Northern Green Mtns | Not Probable | Southern Green Mtns | Not Probable |
| Northern VT Piedmont | Not Probable | Taconic Mtns | Certain |
| Northeastern Highlands | Not Probable | | |

Distribution by Watershed:

Known Watersheds

Middle Connecticut
Hudson-Hoosic
Mettawee River
Lake Champlain
Missisquoi River
Otter Creek

Probable Watersheds

West
Lamoille River
Missisquoi River

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

Wetlands associated with permanent water bodies. Also used flooded meadows. Avoids deeply shaded areas (Hunter et al. 1999). Uses overwintering sites in upland rock outcrops with cracks. Basking sites near water.



Common Name: **Common Watersnake**
Scientific Name: **Nerodia sipedon**
Species Group: **Herp**

Habitat Types:

Marshes and Sedge Meadows
Shrub Swamps
Aquatic: Large Lake Champlain Tribs Below Falls
Aquatic: Lacustrine
Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Transportation Systems
Climate Change

Description of habitat threat(s): Loss and conversion of wetlands, and shoreline development

Non-Habitat Threats:

Trampling or Direct Impacts
Disease
Pollution

Description of non-habitat threat(s): Northern Water Snakes may be impacted by pollution of their aquatic habitat. They are sometimes persecuted by people and are run over when crossing roads. Northern Water Snakes have become entangled in plastic erosion control/landscape netting. Snake fungal disease has recently been identified in this area and may potentially cause mortality in this species. Ranavirus may also impact population.

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Common Name: **Common Watersnake**
Scientific Name: **Nerodia sipedon**
Species Group: **Herp**

Research and Monitoring Needs

| Type | Need | Priority | Description |
|-------------|--------------------------------|-----------------|---|
| Research | Habitat Requirements | Medium | 1) Identification of wintering sites would be important. 2) Gather data on specific habitat requirements of Vermont populations: denning sites, birthing sites, foraging areas, and movement corridors. |
| Research | Basic Life History | Low | |
| Research | Distribution and Abundance | High | 1) Need to develop a good baseline for this species. Identify distribution and relative abundance of populations in Vermont. 2) Target some surveys along the Connecticut River Valley. |
| Research | Threats and Their Significance | High | 1) It would be helpful to know the level of mortality due to human activity. 2) Investigate water quality and human impacts to snakes. |
| Research | Population Genetics | Low | |
| Research | Taxonomy | Low | |
| Monitoring | Population Change | High | Need to monitor population and distribution change in order to take action while there is still time. |
| Monitoring | Habitat Change | Medium | |
| Monitoring | Range Shifts | High | Monitor for changes in Vermont distribution and manage accordingly. |
| Monitoring | Monitor Threats | High | 1) Monitor for snake fungal disease. 2) It is important to monitor limiting factors to gauge impacts to the species. |

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Common Name: **Common Watersnake**
 Scientific Name: **Nerodia sipedon**
 Species Group: **Herp**

Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|--------------------------------------|--------------------------|---|--|---|--|
| Compatible Resource Use | | Maintain or regain water quality in known use areas. | Maintenance or improvement in water quality. | Wetlands managers, farmers, Towns | Clean and Clear funding |
| Compatible Resource Use | | Manage ATV and other off road usage in known habitat to lessen impacts. | Number of areas where ATV use is controlled. | Missisquoi National Wildlife Refuge, landowners, state lands managers, VASA | Refuge Mgmt funds, State Lands Mgmt |
| Awareness Raising and Communications | | Quickly and thoroughly, counter myths and misinformation appearing in the press that may limit this species. | Number of media outlets that carry rebuttal of myths. | Reptile & Amphibian Atlas, SAG-Herps, media, VFWD Outreach Division | Marketing funds, volunteer efforts |
| Species Restoration | | Reexamine species status at regular intervals (no longer than every 10 years) to determine if listing is appropriate. | Frequency of reviews. | SAG-Herps | volunteer effort |
| Species Restoration | | Protect denning areas. | Number of sites protected. | landowners, managers | EQIP |
| Policy & Regulations | | Establish and maintain 100-foot buffers of natural vegetation along water bodies in known habitat. | Number of sites with protected buffer habitat. | landowners, wetland managers | state lands Mgmt funds, EQIP, Partners in Wildlife |
| Planning & Zoning | | Review all roadway projects in appropriate habitat, check against known crossing areas VTRANS, VFWD, VT Reptile & Amphibian Atlas, survey appropriate habitat when unknown. | Number of projects that use watersnake information for planning. | VTrans | VTrans FHWA |
| Standards | | Develop management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web. | Numbers of landowners and managers who receive and use guidelines. | Wetlands Managers, landowners | SWG |
| Habitat Restoration | | Develop, implement, and monitor, road crossing structures and barriers for this species. | Number of structures installed. | VTrans | VTrans, FHWA |

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Common Name: **Common Watersnake**
 Scientific Name: **Nerodia sipedon**
 Species Group: **Herp**

| | | | | | |
|--------------------------------------|--------|---|---|---|---------------------------------------|
| Standards | Medium | Encourage compliance with ANR Stormwater Guidelines regarding erosion control matting, in both regulated and non-regulated contexts. | Number of contractors and homeowners who use non-plastic EC and landscape matting. Number of retailers stocking and selling non-plastic matting. | VT Stormwater Office, VT Association of General Contractors. Product manufacturers and distributors. | SWG |
| Awareness Raising and Communications | | Put information about watersnakes on the web. | Number of sites with posting. | Lake Champlain Committee, ECHO Leahy Center for Lake Champlain, Lake Champlain Basin Program | Lake Champlain Basin Program funds |
| Awareness Raising and Communications | | Place informational posters at access areas where this species is known (Button Bay, Shelburne Pond, Bristol Pond, Vernon Pond). | Number of sites with signage. | game wardens | Nongame Wildlife Fund |
| Awareness Raising and Communications | | Encourage reports of sightings to the VT Heritage Inventory and the VT Reptile & Amphibian Atlas. | Number of reports received. | Reptile & Amphibian Atlas | private grants, Nongame Wildlife Fund |
| Awareness Raising and Communications | | Encourage reports of road-killed specimens, road crossing, and road basking areas to VFWD, VTRANS, and the VT Reptile & Amphibian Atlas. | Number of sites reported. | VTrans, Reptile & Amphibian Atlas | VTrans |
| Easements | | Conserve known habitat through fee simple purchase, development rights or easements, management agreements and education of private landowners and managers regarding appropriate management. | Number of sites and acreage conserved | VLT, Missisquoi National Wildlife Refuge | VHCB funds, refuge acquisition |
| Awareness Raising and Communications | | Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information. | Number of people exposed to message. | Reptile & Amphibian Atlas, VFWD Outreach Division | marketing funds |
| Awareness Raising and Communications | | Educate anglers regarding the conservation needs, habits of this species, and inform them of the protected status of this species. | Number of anglers exposed to message. | VFWD Outreach Division, angler groups, refuge staff | Marketing funds |

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Common Name: Common Watersnake
Scientific Name: *Nerodia sipedon*
Species Group: Herp

| | | | | |
|-----------|---|-----------------------------------|--------------------------------|--|
| Easements | Consider creation of basking, denning, and refuge areas (rock piles) near appropriate foraging habitat. | Number of sites created and used. | Wetland managers, refuge staff | state land Mgmt funds, refuge operating budget |
|-----------|---|-----------------------------------|--------------------------------|--|

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Common Name: **DeKay's Brownsnake**
Scientific Name: **Storeria dekayi**
Species Group: **Herp**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5

Global Trend:

State Rank: S4

State Trend: Unknown

Extirpated in VT? No

Regional SGCN? Yes

Assessment Narrative:

The DeKay's Brownsnake is an S4 species in Vermont, but populations are small and highly localized. The Brown Snake reaches its ecological limit across northern New England (Hunter et al. 1999), where it is less tolerant of disturbed sites and dependent upon habitat mosaics consisting of wetlands or riparian margins adjacent to upland forest overwintering sites.

Distribution

The Brown Snake is primarily found in the Champlain Valley, Taconics, and a few scattered records from the southern CT River Valley. It is widespread and more common in southern New England (Klemens 1993).

Distribution by Biophysical Region:

| | | | |
|-------------------------------|-----------|-----------------------------|-----------|
| Champlain Valley | Confident | Southern VT Piedmont | Probable |
| Champlain Hills | Probable | Vermont Valley | Confident |
| Northern Green Mtns | Probable | Southern Green Mtns | Probable |
| Northern VT Piedmont | Probable | Taonic Mtns | Confident |
| Northeastern Highlands | Unknown | | |

Distribution by Watershed:

Known Watersheds

Middle Connecticut
West
Upper Connecticut-Mascoma
Black-Ottauquechee
Deerfield
Lake Champlain
Lamoille River
Otter Creek
Winooski River

Probable Watersheds

Hudson-Hoosic
Missisquoi River

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

DeKay's Brown Snake primarily occupies wet woods and fields, sedge meadows, seeps, and wetland or stream margins adjacent to upland forest. They are typically found under a variety of cover objects, including logs, stones, brush piles, leaf litter, etc. Critical habitat for this snake includes lowland wetlands or riparian margins adjacent to upland forest where it overwinters.



Common Name: **DeKay's Brownsnake**
Scientific Name: **Storeria dekayi**
Species Group: **Herp**

Habitat Types:

Northern Hardwood
Oak-Pine Northern Hardwood
Floodplain Forests
Hardwood Swamps
Seeps and Pools
Open Peatlands
Marshes and Sedge Meadows
Shrub Swamps
Early Succession Northern Hardwoods
Grasslands, Hedgerows, Old Field, Shrub, or Orchard
Lawns, Gardens, and Row Crops
Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat
Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Transportation Systems

Description of habitat threat(s): Any habitat conversion, alteration, or fragmentation that disrupts species' ability to move between foraging and overwintering sites may have negative effects. Road mortality can negatively impact migrating adults and dispersing juveniles, especially when located between hibernaculum and foraging habitats. In Vermont this species appears less tolerant of disturbed habitats than in southern New England near the core of its range.

Non-Habitat Threats:

Trampling or Direct Impacts

Description of non-habitat threat(s): This species often occurs in close proximity to humans, and its distribution is primarily in a region of the state that continues to see significant development pressure. Fragmentation of suitable habitats by roads or other non-permeable development may result in loss of metapopulation structure leading to genetic isolation and prevention of recolonization, especially considering the limited and localized populations of this species.

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Common Name: **DeKay's Brownsnake**
Scientific Name: **Storeria dekayi**
Species Group: **Herp**

Research and Monitoring Needs

| <i>Type</i> | <i>Need</i> | <i>Priority</i> | <i>Description</i> |
|--------------------|--------------------------------|------------------------|--|
| Research | Habitat Requirements | High | 1) Gather data on specific habitat requirements of Vermont populations: denning sites, birthing sites, foraging areas, and movement corridors. 2) Determine if and how habitat differs in Vermont compared to the core of the Brown Snake range. |
| Research | Distribution and Abundance | High | Determine species statewide distribution and relative abundance with emphasis in Taconics and southern CT River Valley. |
| Research | Threats and Their Significance | High | |
| Research | Other Research | Medium | Develop enhancement techniques for birthing and overwintering habitat. |
| Monitoring | Population Change | High | Monitor population sizes and distribution changes. |
| Monitoring | Habitat Change | High | |
| Monitoring | Range Shifts | High | Range distribution monitoring may be how we are able to track population change in Vermont (maintenance or loss of populations). |
| Monitoring | Monitor Threats | High | |

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Common Name: **DeKay's Brownsnake**
 Scientific Name: **Storeria dekayi**
 Species Group: **Herp**

Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|--------------------------------------|--------------------------|---|--|--|----------------------------------|
| Awareness Raising and Communications | | Encourage reports of sightings to the VT Heritage Inventory and the VT Reptile & Amphibian Atlas. | Number of reports received. Geographic coverage of reports. | Reptile & Amphibian Atlas | Nongame Wildlife Fund |
| Compatible Resource Use | | Review all roadway projects in appropriate habitat, check against known crossing areas VTRANS, VFWD, VT Reptile & Amphibian Atlas, survey appropriate habitat when unknown. | Number of sites where information on crossing areas | VTrans, Reptile & Amphibian Atlas | VTrans planning funds |
| Compatible Resource Use | | Manage ATV and other off road usage in known habitat to lessen impacts. | Number of brownsnake areas with restricted or managed ATV use. | Land managers, private landowners, VASA | |
| Awareness Raising and Communications | | Encourage reports of road-killed specimens, road crossing, and road basking areas to VFWD, VTRANS, and the VT Reptile & Amphibian Atlas. | Number of areas reported. | VTrans, Reptile & Amphibian Atlas | VTrans funds |
| Habitat Restoration | | Maintain habitat mosaic and connectivity necessary for this species, particularly in Champlain Valley. | Number of intact habitats and connections | Consulting Foresters, landowners, Cons Comms | Current Use, EQIP |
| Standards | | Develop land management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web. | | | |
| Easements | | Conserve known habitat through fee simple purchase, development rights or easements, management agreements and education of private landowners and managers regarding appropriate management. | Number of known sites conserved. | Consulting foresters, local Cons Comms | VHCB funds |
| Species Restoration | High | Reexamine species status at regular intervals (no longer than every 10 years) to determine if Endangered Species Act listing is appropriate. | Frequency of review | SAG-Herps | donated time |
| Awareness Raising and Communications | | Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information. | Number of people exposed to message. | VFWD Outreach Division | Marketing funds |
| Species Restoration | | Develop, install, and monitor, road crossing structures and barriers for this species. | Number of structures installed. | VTrans | FHWA |

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Common Name: **DeKay's Brownsnake**
Scientific Name: **Storeria dekayi**
Species Group: **Herp**

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Common Name: **Eastern Ribbonsnake**
Scientific Name: **Thamnophis sauritus**
Species Group: **Herp**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5

Global Trend:

State Rank: S2

State Trend: Unknown

Extirpated in VT? No

Regional SGCN? Yes

Assessment Narrative:

The Eastern Ribbonsnake is a rare species in Vermont (S2) and is considered a species of special concern in Vermont. The Eastern Ribbonsnake is one of the rarest of snakes in Vermont based on the number of known current sites. It seems to depend on a combination of a relatively warm, undeveloped lowland site and wetlands.

Distribution

It is currently documented from only six locations in Vermont: five in western Rutland County and one along the southern Connecticut River valley. A handful of historic records and sightings come from further north in the Lake Champlain basin and the Connecticut River Valley.

Distribution by Biophysical Region:

| | | | |
|-------------------------------|--------------|-----------------------------|--------------|
| Champlain Valley | Probable | Southern VT Piedmont | Confident |
| Champlain Hills | Not Probable | Vermont Valley | Not Probable |
| Northern Green Mtns | Not Probable | Southern Green Mtns | Probable |
| Northern VT Piedmont | Not Probable | Taconic Mtns | Confident |
| Northeastern Highlands | Not Probable | | |

Distribution by Watershed:

Known Watersheds

West
Mettawee River
Lake Champlain

Probable Watersheds

Middle Connecticut
Hudson-Hoosic
Otter Creek
Winooski River

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

This species requires wetland edges with sunny exposed basking sites in warm, low-elevation, largely undeveloped, areas. The presence of nearby rocky woodlands and talus seems to increase the chances of finding this species.



Common Name: **Eastern Ribbonsnake**
Scientific Name: **Thamnophis sauritus**
Species Group: **Herp**

Habitat Types:

Cliffs and Talus
Oak-Pine Northern Hardwood
Seeps and Pools
Marshes and Sedge Meadows
Shrub Swamps
Grasslands, Hedgerows, Old Field, Shrub, or Orchard
Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Transportation Systems

Description of habitat threat(s): Conversion or drainage of wetlands, shoreline development, and fragmentation due to road density could all be problems.

Non-Habitat Threats:

Genetics
Trampling or Direct Impacts
Loss of Prey Base

Description of non-habitat threat(s): Some populations may be genetically isolated and others are becoming more so as a result of development. This species may be dependent on local amphibian populations that are known to vary annually. ATV use, increased traffic, cutting and bailing, and lawn mowing could all increase mortality significantly. It has not been located in moderately or heavily developed areas.

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Common Name: **Eastern Ribbonsnake**
Scientific Name: **Thamnophis sauritus**
Species Group: **Herp**

Research and Monitoring Needs

| <i>Type</i> | <i>Need</i> | <i>Priority</i> | <i>Description</i> |
|--------------------|--------------------------------|------------------------|---|
| Research | Habitat Requirements | High | This species may use a wider variety of habitats in Vermont than is currently known. 1) Gather data on specific habitat requirements of Vermont populations: denning sites, birthing sites, foraging areas, overwintering sites and movement corridors. |
| Research | Distribution and Abundance | High | Identify distribution and relative abundance of populations in Vermont. Search for ribbonsnakes in areas of open talus in the Champlain, Connecticut River valley, and other relatively warm valleys, especially if adjacent to wetland foraging areas. |
| Research | Threats and Their Significance | High | Monitor for signs of Snake Fungal Disease in this species. |
| Research | Other Research | Medium | Develop enhancement techniques to improve for birthing and overwintering habitat. |
| Monitoring | Population Change | High | Monitor population sizes and distribution changes. |
| Monitoring | Habitat Change | High | |
| Monitoring | Monitor Threats | High | |

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Common Name: **Eastern Ribbonsnake**
 Scientific Name: **Thamnophis sauritus**
 Species Group: **Herp**

Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|--------------------------------------|--------------------------|---|---|---|---------------------------------------|
| Awareness Raising and Communications | | Quickly and thoroughly, counter myths and misinformation appearing in the press that may limit this species. | Number of response carried by media. | Media, SAG-Herps, Reptile & Amphibian Atlas, VFWD Outreach Division | volunteer, marketing funds |
| Publically-Owned Protected Areas | | Locate populations on public lands and manage some specifically for this species. | Number of sites managed for ribbonsnake | FPR, USFS, VFWD | State Lands Mgmt funds, GMNF funds |
| Awareness Raising and Communications | Medium | Encourage reports of sightings to the VT Heritage Inventory and the VT Reptile & Amphibian Atlas. | Number of reports received. | Reptile & Amphibian Atlas | Nongame Wildlife Fund, private grants |
| Awareness Raising and Communications | | Encourage reports of road-killed specimens, road crossing, and road basking areas to VFWD, VTrans, and the VT Reptile & Amphibian Atlas. | Number of sites reported. | VTrans, volunteers | VTrans |
| Compatible Resource Use | | Review all roadway projects in appropriate habitat, check against known crossing areas VTrans, VFWD, VT Reptile & Amphibian Atlas, survey appropriate habitat when unknown. | Number of projects reviewed with planning information on snakes. | VTrans, Reptile & Amphibian Atlas | VTrans |
| Compatible Resource Use | | Manage ATV and other off road usage in known habitat to lessen impacts. | Number of sites where ATV use is controlled. | Land managers, landowners, VASA | |
| Easements | | Conserve known habitat through fee simple purchase, development rights or easements, management agreements and education of private landowners and managers regarding appropriate management. | Number of sites conserved. | Vermont Land Trust | VHCB funds |
| Awareness Raising and Communications | | Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information. | Number of people who receive message. | VFWD Outreach Division | Marketing funds |
| Standards | | Develop land management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web. | Number of landowners and managers who receive and use guidelines. | VFWD district biologists, consulting foresters | SWG |
| Habitat Restoration | Medium | Develop, implement, and monitor, road crossing structures and barriers for this species. | Number of structures installed. | VTrans | FHWA |

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Common Name: Eastern Ribbonsnake
Scientific Name: *Thamnophis sauritus*
Species Group: Herp

| | | | | | |
|---------------------|------|---|------------------------------------|-----------|-----------|
| Species Restoration | High | Reexamine species status at regular intervals (no longer than every 10 years) to determine if ESA listing is appropriate. | Number of years since last review. | SAG-Herps | volunteer |
|---------------------|------|---|------------------------------------|-----------|-----------|

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Common Name: **Smooth Greensnake**
Scientific Name: **Opheodrys vernalis**
Species Group: **Herp**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5

Global Trend:

State Rank: S4

State Trend:

Extirpated in VT? No

Regional SGCN? Yes

Assessment Narrative:

Few people encounter the Smooth Greensnake and it is thought to be found less frequently than in the past. Little is known about its distribution in Vermont and its considered uncommon in Vermont (S3). It's conservation status is uncertain and its considered a medium-priority SGCN.

Habitat loss due to development is also a problem for this species, especially in the lowlands. In past large beaver meadows may have been connected. Mechanization of agriculture, lawn mowing, and roads all are likely impacts. In the southern Great Lakes Basin it is reported to be decreasing due to intensive conversion of its habitat to agricultural uses and pesticides (Harding 1997. The Amphibians and Reptiles of the Great Lakes Region).

Distribution

Primarily at mid-elevational levels. Missing from Northeastern Vermont

Distribution by Biophysical Region:

| | | | |
|-------------------------------|-----------|-----------------------------|-----------|
| Champlain Valley | Confident | Southern VT Piedmont | Confident |
| Champlain Hills | | Vermont Valley | Probable |
| Northern Green Mtns | Confident | Southern Green Mtns | Confident |
| Northern VT Piedmont | Confident | Taconic Mtns | Confident |
| Northeastern Highlands | Unknown | | |

Distribution by Watershed:

Known Watersheds

Middle Connecticut

West

Waits

Upper Connecticut-Mascoma

Deerfield

Hudson-Hoosic

Mettawee River

Lake Champlain

Lamoille River

Missisquoi River

Otter Creek

White

Winooski River



Common Name: **Smooth Greensnake**
Scientific Name: **Opheodrys vernalis**
Species Group: **Herp**

Black-Ottauquechee

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

Greensnakes use sedge meadows, marsh borders, pastures, powerlines, shrub areas, and early successional habitat not mowed regularly. Micro Habitat: dense annual vegetation. Critical habitat includes overwintering habitat (ant mounds), early successional foraging habitat, and areas for egg laying.

Habitat Types:

Open Peatlands
Marshes and Sedge Meadows
Wet Shores
Shrub Swamps
Early Succession Northern Hardwoods
Early Succession Upland Oak
Early Succession Other Types
Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Current Threats

Habitat Threats:

Conversion of Habitat
Habitat Succession
Habitat Alteration
Habitat Fragmentation
Impacts of Roads or Transportation Systems

Description of habitat threat(s): Mowing and pesticides are limiting factors for this species. Baling also does impact snakes.

Non-Habitat Threats:

Trampling or Direct Impacts
Disease
Pollution

Description of non-habitat threat(s): Mowing of habitat, road traffic, and pesticide use. Snakes have become entangled in plastic erosion control/landscape netting. Snake fungal disease has recently been identified in this area and may potentially cause mortality in this species. Ranavirus may also impact populations.

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Common Name: **Smooth Greensnake**
Scientific Name: **Opheodrys vernalis**
Species Group: **Herp**

Research and Monitoring Needs

| Type | Need | Priority | Description |
|-------------|--------------------------------|-----------------|---|
| Research | Habitat Requirements | Medium | Gather data on specific habitat requirements of Vermont populations: denning sites, egg-laying sites, foraging areas, overwintering sites and movement corridors. |
| Research | Basic Life History | Low | |
| Research | Distribution and Abundance | High | Identify distribution and relative abundance of populations in Vermont. |
| Research | Threats and Their Significance | High | |
| Research | Population Genetics | Low | |
| Research | Other Research | Medium | Gather data from known habitat on how it is kept in early succession and apply this knowledge. |
| Monitoring | Population Change | High | Monitor population sizes and distribution changes. |
| Monitoring | Habitat Change | High | |
| Monitoring | Range Shifts | Low | |
| Monitoring | Monitor Threats | High | Monitor for Snake Fungal Disease. |

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Common Name: **Smooth Greensnake**
 Scientific Name: **Opheodrys vernalis**
 Species Group: **Herp**

Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|--------------------------------------|--------------------------|---|--|--|--------------------------------------|
| Standards | Medium | Encourage compliance with ANR Stormwater Guidelines regarding erosion control matting, in both regulated and non-regulated contexts. | Number of contractors and homeowners who use non-plastic EC and landscape matting. Number of retailers stocking and selling non-plastic matting. | VT Stormwater Office, VT Association of General Contractors. | SWG |
| Compatible Resource Use | | Maintain connectivity between areas of appropriate early successional habitat. | Number of acres linked through connectivity | landowners | EQIP, Current Use |
| Habitat Restoration | | Develop, implement, and monitor, road crossing structures and barriers for this species. | Number of structures installed | VTrans | VTrans, FHWA |
| Awareness Raising and Communications | | Encourage reports of sightings to the VT Heritage Inventory and the VT Reptile & Amphibian Atlas. | Number of reports received | Reptile & Amphibian Atlas | private grant, Nongame Wildlife Fund |
| Easements | | Conserve known habitat through fee simple purchase, development rights or easements, management agreements and education of private landowners and managers regarding appropriate management. | Number of sites and acreage conserved | VLT, local land trusts | VHCB funds |
| Compatible Resource Use | | Manage ATV and other off road usage in known habitat to lessen impacts. | Number of sites where ATV use is controlled | landowners, land managers, VASA | EQIP, state lands Mgmt funds |
| Standards | | Develop land management guidelines for owners and managers of appropriate habitat and make them readily available through multiple media, including print and the web. | | | |
| Awareness Raising and Communications | | Encourage reports of road-killed specimens, road crossing, and road basking areas to VFWD, VTRANS, and the VT Reptile & Amphibian Atlas. | Number of reports received | VTrans | VTrans |
| Planning & Zoning | | Review all roadway projects in appropriate habitat, check against known crossing areas VTRANS, VFWD, VT Reptile & Amphibian Atlas, survey appropriate habitat when unknown. | Number of projects reviewed using green snake information | VTrans, Reptile & Amphibian Atlas | VTrans, FHWA |
| Species Restoration | | Reexamine species status at regular intervals (no longer than every 10 years) to determine if listing is appropriate. | Frequency of reviews | SAG-Herps | volunteer effort |

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Common Name: **Smooth Greensnake**
 Scientific Name: **Opheodrys vernalis**
 Species Group: **Herp**

| | | | | |
|--------------------------------------|---|--|---|------------------------|
| Awareness Raising and Communications | Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information. | Number of people exposed to message. | Reptile & Amphibian Atlas, VFWD Outreach Div | Marketing funds |
| Publically-Owned Protected Areas | Locate populations on public lands and manage some specifically for this species. | Number of sites managed for green snake. | district foresters and wildlife managers | state lands Mgmt funds |
| Standards | Work with power companies, airports, horse farmers, and other landowners that provide large areas of early successional habitat to maintain it in a manner safe for this species. | Number of sites maintained in a safe manner. | Managers of powerlines, airport staff, landowners | VELCO, VTrans, EQIP |

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Common Name: **Smooth Greensnake**
Scientific Name: ***Opheodrys vernalis***
Species Group: **Herp**

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Common Name: **Timber Rattlesnake**
Scientific Name: **Crotalus horridus**
Species Group: **Herp**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G4

Global Trend:

State Rank: S1

State Trend:

Extirpated in VT? No

Regional SGCN? Yes

Assessment Narrative:

The Timber Rattlesnake is a state-endangered S1 species that was historically known from a much wider range in VT and the region. Current estimates of population and species distribution hover near some 75-85% loss and range contraction from historic levels. Recent telemetry research in Vermont further refined local home ranges by sex and range distribution of one population and concomitantly highlighted strategic rattlesnake habitats for future conservation efforts. Genetic analysis indicated relatively low heterozygosity in this cohort although random mating still appears to be occurring. Roads with high traffic levels appeared to present significant barriers to movement and dispersal. (Spear et.al. 2013).

Extant rattlesnake populations are known only from two denning areas in Vermont. Since it is a venomous species, it is more widely feared and persecuted—a significant threat to the species in Vermont. The species had a bounty on it until 1971. The bounty was lifted in 1987, but direct persecution and occasional takings still occur. Its habit of denning communally at sites which are now quite widely known make it unusually vulnerable to takings. This behavior also provides opportunities for geographically targeted protection. In 2012, a novel and lethal snake fungal disease, *Ophidiomyces ophidicola*, was isolated and identified in Vermont's Timber Rattlesnake populations and has since been found in various snake species in a dozen eastern states. This finding has prompted an in-depth, regional investigation of this disease in which Vermont is participating. Known as Snake Fungal Disease (SFD) it imposes an unknown but potentially devastating threat to the species. As the animals' name implies, the Timber Rattlesnake depends on warm low-elevation woodlands that are sparsely populated. Habitat fragmentation and concomitant increases in roads/traffic, human interactions present an increasing threat of mortalities.

Distribution

Two isolated populations of the Timber Rattlesnake are restricted to areas near the southern portion of Lake Champlain in western Rutland County below 1000 ft. in elevation. Research conducted in 2011-2012 indicates that genetic exchange between the two populations is likely non-existent. Populations in other parts of the state have been lost.

Distribution by Biophysical Region:

| | | | |
|-------------------------------|--------------|-----------------------------|-----------------------|
| Champlain Valley | Confident | Southern VT Piedmont | Historic Records Only |
| Champlain Hills | Not Probable | Vermont Valley | Not Probable |
| Northern Green Mtns | Not Probable | Southern Green Mtns | Historic Records Only |
| Northern VT Piedmont | Not Probable | Taconic Mtns | Confident |
| Northeastern Highlands | Not Probable | | |

Distribution by Watershed:

Known Watersheds

Mettawee River



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Scientific Name: **Crotalus horridus**
Species Group: **Herp**

Lake Champlain

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge Extensive Local Knowledge Regional Literature General Literature

The Timber Rattlesnake in Vermont is documented only from western Rutland County at elevations below 1000 feet. In this region snakes den communally on south or southwest facing talus slopes which are near rocky ridges with exposed ledge and large undeveloped or sparsely developed areas of oak-hickory and maple-ash-hickory-oak vegetative communities. Males range annually about 2.5 miles from the natal den with females ranging up to 1.5 miles and gravid females utilizing still smaller ranges. Small, scattered canopy openings and forest wetlands along with their buffers are readily utilized and enhance habitat for foraging rattlesnakes. In Vermont, forested lands of approximately 5500 acres adjacent to the dens, sparsely developed and largely unfragmented by roads, support Vermont's discrete rattlesnake populations. (Spear et. al. 2013) Habitual movement corridors between dens and summer range are utilized annually. Roads present significant barriers and are deleterious to seasonal movement and dispersing snakes. Successful long distance movements between extant dens are now highly unlikely and may require human intervention/assistance in the future. Rattlesnakes maintain strict annual fidelity to their traditional, communal den sites. In Vermont's harsh climate, overwintering, frost-free den site requirements are exacting and thus, extremely limiting.

Critical habitat features are the rocky talus slopes with traditional dens, nearby ridges with exposed ledges, and extensive associated woodlands of oak-hickory and Pennsylvania sedge.

Habitat Types:

Outcrops and Alpine
Cliffs and Talus
Oak-Pine Northern Hardwood
Hardwood Swamps
Shrub Swamps
Early Succession Northern Hardwoods
Early Succession Upland Oak
Subterranean
Mine
Grasslands, Hedgerows, Old Field, Shrub, or Orchard
Lawns, Gardens, and Row Crops

Current Threats

Habitat Threats:

Conversion of Habitat
Habitat Alteration
Habitat Fragmentation



Common Name: **Timber Rattlesnake**
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Impacts of Roads or Transportation Systems

Description of habitat threat(s): The most immediate threat to Timber Rattlesnakes with potential population consequences is the documented presence of Snake Fungal Disease (SFD) in extant populations. The lethality and severity of SFD has the potential to overwhelm other efforts on behalf of the species. The rattlesnake uses large contiguous woodland areas adjacent to their dens. Heavy agricultural or residential use, or conversion to open land are all problems. Direct loss of habitat, increased habitat fragmentation and road-density with higher traffic levels result higher road mortality, population isolation and increased snake/ human interactions. Roads present a highly fragmenting landscape feature, heightened chances of direct mortality and formidable barriers to successful snake movement, dispersal and genetic exchange. Lowland wooded patches are popular building sites and thus are becoming increasingly fragmented. The resultant direct persecution stemming from human fear and intolerance especially towards adult rattlesnakes can profoundly impact a population.

Non-Habitat Threats:

Genetics

Harvest or Collection

Reproductive Traits

Trampling or Direct Impacts

Disease

Description of non-habitat threat(s): Snake Fungal Disease is an immediate and potentially overwhelming threat to Vermont's population. Genetic exchange between Vermont's two populations is likely non-existent. Exchange with New York's nearest rattlesnake population is unknown. Although protected, this venomous species is still illegally collected for various purposes and snakes that have been killed are occasionally discovered. Known traditional den sites and predictable patterns of behavior make the species very vulnerable to collection and persecution. Birthing sites also appear to be limited and traditional. This is a long-lived, K-selected species that can successfully reproduce only every 4-5 years. Consequently, loss of breeding adults, particularly adult females is a problem to the sustainability of the species. Heavy ATV use, increased traffic, and heavy recreational use along ridges during key time-periods is also a problem. Since this species is venomous, it is often feared and killed when found near residences.

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Common Name: **Timber Rattlesnake**
Scientific Name: **Crotalus horridus**
Species Group: **Herp**

Research and Monitoring Needs

| Type | Need | Priority | Description |
|-------------|--------------------------------|-----------------|---|
| Research | Habitat Requirements | Medium | Better determine range and habitat usage and protect critical areas. |
| Research | Basic Life History | Low | |
| Research | Distribution and Abundance | High | Determine Population Status: continue monitoring during ingress/egrees periods.Focus on adult females/reproductive status/litters as an index. |
| Research | Threats and Their Significance | High | Monitor Snake Fungal Disease Status (SFD), continue surveillance, disease testing in cooperation with Regional SFD Investigation. |
| Research | Population Genetics | Medium | Conduct periodic genetic assessment to inform genetic exchange/variability. Consider techniques to facilitate gene flow (translocation/captive rearing/headstarting). |
| Monitoring | Population Change | High | Monitor the size and determine the sustainability of existing populations through age-class and/or genetic analysis. |
| Monitoring | Habitat Change | Medium | Continue vigilance with regulatory habitat protections (Act 250, CPG's). |
| Monitoring | Range Shifts | Low | |
| Monitoring | Monitor Threats | High | Continue the Rattlesnake Responder Program which 1) protects both snakes and residents and provides opportunity for outreach/education. 2) continue law enforcement efforts. Also See Threats research regarding SFD. |

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Species Strategies

| Strategy Type | Strategy Priority | Strategy Description | Performance Measure | Potential Partners | Potential Funding Sources |
|---|--------------------------|--|--|--|---|
| Alliance Development | Medium | Continue to work cooperatively with important landowners such as the Nature Conservancy. Develop and maintain allies in local government and private citizens. | Number of partner contacts made annually. | TNC, towns, landowners | SWG |
| Technical Assistance, Training, Learning Networks | High | Maintain and support the network of trained Snake Responders. Put information about Rattlesnakes and this service on the web. Educate local landowners. Distribute Responder Team refrigerator magnets. | Number of times public receives technical assistance. | Volunteers, local warden, town officials, TNC, Reptile & Amphibian Atlas | TNC |
| Awareness Raising and Communications | High | Continue the Rattlesnake Responder Program to protect people and animals and take advantage of "teachable moments." Patrol denning and birthing areas during necessary times to protect all life stages and send an important message to the public. | Number of animals safely moved. Number of sites that are patrolled. | Rattlesnake responder team, Game Wardens | SWG |
| Habitat Restoration | Medium | Develop, implement, and monitor, road crossing structures and barriers for this species. | Number of structures installed. | VTrans, Consulting herpetologists | VTrans |
| Species Restoration | Medium | Work to maintain connectivity with populations to the west in New York State and between the two known populations. | Quantity and quality of landscape connections. | New York DEC, TNC, VLT | VHCB |
| Awareness Raising and Communications | Medium | Quickly and thoroughly, counter myths and misinformation appearing in the press that may limit this species. | Number of press responses carried by media. | SAG-Herps, Reptile & Amphibian Atlas, VFWD Outreach Div., TNC | SWG, volunteer efforts, marketing funds |
| Easements | Medium | Conserve known habitat through fee simple purchase, development rights or easements, management agreements, and education of private landowners and managers regarding appropriate management. | Number of sites conserved. | landowners, TNC, VLT, TPL, Orianna Society | VHCB, Orianna Society |
| Standards | Medium | Develop land management guidelines for owners and managers regarding appropriate management and make them readily available through multiple media, including print and the web. | Number of landowners and managers who receive and use the guidelines. | landowners and land managers, TNC, Towns | SWG, TNC |

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Scientific Name: *Crotalus horridus*
Species Group: Herp

| | | | | | |
|---|--------|--|---|--|-------------------------------|
| Planning & Zoning | Medium | Review all roadway projects in appropriate habitat, check against known crossing areas VTRANS, VFWD, VT Reptile & Amphibian Atlas, survey appropriate habitat when unknown. | Number of projects reviewed using rattlesnake planning information. | VTrans, Reptile & Amphibian Atlas, Towns | VTrans, |
| Research | High | Monitor Snake Fungal Disease status, continue surveillance, disease testing in cooperation with Regional SFD Investigation. | Relative prevalence of SFD in populations. | TNC, Orianna Society, Veterinarians, Castleton State College | SWG, other research grants |
| Species Restoration | High | If local populations are determined to be unsustainable, consider augmentation from closest healthy source. Maintaining and enhancing extant populations is always a priority and should be continued. | Number of successful reintroductions or augmentations. | New York DEC | SWG |
| Technical Assistance, Training, Learning Networks | Medium | Work with District 3 VTrans crew and other land managers to raise awareness of conservation need and implement conservation actions that benefit snakes. | Number of VTrans and others managers cooperating. | VTrans | VTrans |
| Compatible Resource Use | High | Protect known denning areas and adjacent ledges and woodlands from incompatible development and heavy use during critical time periods. Protect foraging land from development. | Number of sites conserved. | TNC, landowners, VLT, Act 250 Staff | VHCB |
| Awareness Raising and Communications | Medium | Encourage reports of road-killed specimens, road crossing, and road basking areas to VFWD, VTRANS, and the VT Reptile & Amphibian Atlas. | Number of sites reported. | VTrans, Reptile & Amphibian Atlas, TNC | VTrans, Nongame Wildlife Fund |
| Compatible Resource Use | Medium | Manage ATV and other off road usage in known habitat to avoid impacts, including foraging habitat. | Number of sites where ATV use is controlled. | Landowners, land managers, VASA, other ATV user groups | land Mgmt funds/decisions |
| Awareness Raising and Communications | Medium | Encourage reports of sightings to the Vermont Wildlife Diversity Program and the VT Reptile & Amphibian Atlas. | Number of reports received. | Reptile & Amphibian Atlas | SWG, Nongame Wildlife Fund |
| Awareness Raising and Communications | Medium | Help Vermonters assign value to this species through educational programs, printed material, web site information, field trips, TV and video information. | Number of people exposed to message | VFWD outreach division, Reptile & Amphibian Atlas | marketing funds |

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Species Conservation Report



Common Name: **Timber Rattlesnake**
Scientific Name: **Crotalus horridus**
Species Group: **Herp**

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Common Name: **Timber Rattlesnake**
Scientific Name: **Crotalus horridus**
Species Group: **Herp**

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