

Blue Ridge Reptiles and Amphibians Guild

Bog Turtle *Clemmys (Glyptemys) muhlenbergi*

Eastern Milk Snake *Lampropeltis triangulum triangulum*

Timber Rattlesnake *Crotalus horridus* – mountain race

Coal Skink *Eumeces anthracinus*

Seepage Salamander *Desmognathus aeneus*

Shovel-nose Salamander *Desmognathus (Leurognathus) marmoratus*

Green Salamander *Aneides aeneus*

Wood Frog *Rana sylvatica*

Dwarf Black-bellied Salamander *Desmognathus folkerstii*

Patch-nosed Salamander *Urspelaperes brucei*

Contributors (2005): Stephen H. Bennett and Kurt Buhlmann [SCDNR]

Reviewed and Edited (2012): Stephen H. Bennett (SCDNR), Kurt Buhlmann (SREL), Jeff Camper (Frances Marion University), Eran Kilpatrick (USC-Salkehatchie), and Will Dillman (SCDNR)

GUILD DESCRIPTION

This grouping includes several amphibian and reptile species that are not necessarily related in terms of their life histories or habitat requirements.

These species are restricted to or primarily occur in the Blue Ridge Physiographic Province (Southern Appalachian Ecoregion) and upper piedmont (foothills) of South Carolina; some are peripheral to our state. Several members of this group are, in fact, quite common in the core of their geographic ranges to the north of South Carolina. Several large public lands are located within the ranges of these species and those land managers will be responsible for management of these species. These land holdings include

Sumter National Forest and the Jocassee Gorges Wildlife Management Area as well as several South Carolina State Parks. Thus, presenting these species together as a “guild” may help land managers develop a holistic, multiple species conservation plan and minimize management conflicts that may occur if the species are treated separately.

The Southern Appalachian Ecoregion (Blue Ridge Province) and upper piedmont of South Carolina support a diverse and rich herpetofaunal Assemblage. Many species found in this region occur nowhere else in South Carolina with the majority of their geographic range lying to the north of the State. While a number of the species represented in this grouping are relatively common outside of South Carolina, some, such as the bog turtle, are not. Other species, such as the green salamander and coal skink have disjunct ranges and are considered to be of conservation concern in other portions of their range.

PUBLIC LANDS IN THE BLUE RIDGE PROVINCE



Although most of these species are peripheral to South Carolina, we can make a case for their conservation in our state based on the overall rarity of some and the consideration that most species are most vulnerable at the edge of their geographic range. In addition, the edge of a species' range is often where it experiences the greatest possibility for some evolutionary change, making these populations of potential interest to evolutionary biologists as well as conservation biologists.

BOG TURTLE

DESCRIPTION

The bog turtle is a small, semi-aquatic turtle that can reach 7.5 to 9 cm (2.9 to 3.5 in.) in length; maximum is approximately 11 cm (4.3 inches). Bog turtle shells are typically dark brown with light yellow or red centers on the large scutes. The bog turtle has a distinctive orange or yellow blotch on the head located just behind the eye (Conant and Collins 1991).

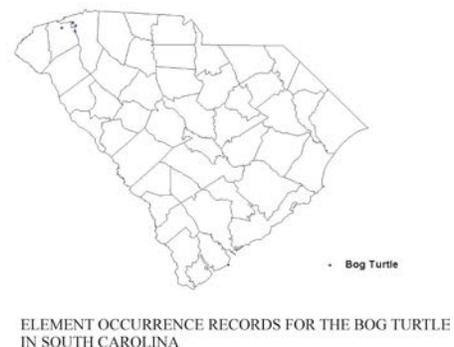


Status

The bog turtle is currently listed as threatened in South Carolina with a state rank of S1, critically imperiled, and a global rank of G3, vulnerable (NatureServe 2013). In the Southern Appalachians, the bog turtle population is listed as federally threatened. This species was discovered in South Carolina in the 1980s.

POPULATION SIZE AND DISTRIBUTION

The bog turtle was first documented in South Carolina in 1988 (SC Heritage Trust Program). To date, only four specimens have been found in this state. All four records from this species came from separate areas or sites. To date no populations of bog turtles have been documented. In South Carolina, the bog turtle is not a truly mountain species, occurring primarily in the foothills region of the state.



HABITAT AND NATURAL COMMUNITY REQUIREMENTS

The bog turtle is typically found in streamside bogs, seeps, beaver ponds and other wetlands. In South Carolina, the few specimens found have been discovered in streamside bogs or crossing roads adjacent to streams or beaver ponds. Bog turtle wetlands are generally characterized by wet meadow habitats described as open canopies with spring-fed water and deep silts (Palmer

and Braswell 1995). In South Carolina, this habitat type is generally found in the upper piedmont and foothills in association with small streams and rivers.

CHALLENGES

The wet meadow habitats in which bog turtles are found are associated with farm areas. As farming has declined, the wet meadow bogs have undergone natural succession to red maple swamps (Buhlmann et al. 1997; Herman and Tryon 1997). As succession occurs, the previously open canopy of a bog closes, limiting light to the ground layer. Canopy closure results in changes to the vegetative composition of the bog and the physical structure of the bog, resulting in degraded habitat for bog turtles.

EASTERN MILK SNAKE

DESCRIPTION

The eastern milk snake is the nominative species for a group of related snakes that includes the more common scarlet kingsnake in South Carolina. The eastern milk snake is a slender, strongly blotched snake that reaches lengths of 61 to 90 cm (24 to 35 in.); the maximum length is approximately 132 cm (52 in.) (Conant and Collins 1991; Martof et al. 1980). Milk snakes typically possess

reddish-brown blotches or saddles that run the length of the snake's body. In South Carolina, milk snakes from the upstate do not closely resemble the typical eastern milk snake and may resemble an "intergrade" between the eastern milk snake and the scarlet kingsnake. Conant and Collins, 1991, referred to this form as the "Coastal Plain milk snake". In Conant and Collins 1998, there is no reference to the "coastal plain milk snake" but it is still referred to as the milk snake "intergrade". Armstrong et al., 2001, reviewed variation in the *L. elapsoides* x *L. triangulum* complex. The authors also cite Williams 1988, which no longer recognized the coastal plains milk snake as a subspecies. Further taxonomic research will provide clarity about the relationship between these different forms.



Status

The South Carolina Department of Natural Resources (SCDNR) Heritage Trust Program assigns a state rank of S2 to the upstate (mountain) population of the eastern milk snake, classifying it as imperiled because of rarity or otherwise vulnerable to extirpation. The global rank of the nominate species is secure (G5). Although the milk snake may be widespread and not uncommon in South Carolina's upstate, its taxonomic status is unknown.

POPULATION SIZE AND DISTRIBUTION

Specimens of the eastern milk snake have been recorded from the Eastatooe Gorge, Bad Creek and Jones Gap areas of South Carolina. This upstate "form" seems to be associated with the area near and above SC Highway 11 (Foothills Trail) in South Carolina. No formal mapping of the range or extent of the milk snake in this area of South Carolina exists.

HABITAT AND NATURAL COMMUNITY REQUIREMENTS

Little is known about the specific habitat requirements of the milk snake. Specimens have been found in mountain valleys, along streams, and in rocky areas. This species is likely to be fossorial much of the year and can be found occasionally under cover objects such as rocks and fallen woody debris (Conant and Collins 1991).

CHALLENGES

Lack of data on the taxonomy and distribution of the milk snake in South Carolina makes conservation planning for this species problematic.

TIMBER RATTLESNAKE

DESCRIPTION

The timber rattlesnake is a large bodied snake that can reach lengths between 90 and 152 cm (35 to 60 in.); maximum length is approximately 189 cm (74 in.) (Conant and Collins 1991; Martof et al. 1980). There are 2 forms, or phases, of the timber rattlesnake found in South Carolina: the coastal plain form, known colloquially as the canebrake rattlesnake, and the mountain form known as the timber rattlesnake. These 2 forms were formerly recognized as subspecies of the timber rattlesnake, but recent research has determined that no genetic evidence supports this classification (Pisani et al 1972). Despite the genetic similarity, there are morphological and ecological differences between the 2 forms (Brown and Ernst 1986).



The canebrake rattlesnake is typically a tan to flesh-colored snake with black chevrons crossing the body and a dark red lateral stripe running the length of the body along the spine. A dark stripe runs diagonally through the eye (Conant and Collins 1991).

Two color phases are known for the timber rattlesnake. In the first color phase, the body is yellow; in the second color phase, the animal is almost solid black. In both phases, dark chevrons cross the body, and the dorsal stripe, if evident, is not red. This form does not typically have an eye stripe (Conant and Collins 1991).

Status

The timber rattlesnake (both the Mountain and Coastal Plain forms) is listed as a species of concern by the South Carolina Heritage Program and has a rank of unknown (S?) and apparently secure (G4) globally (NatureServe 2013). Although rattlesnakes are widespread in South Carolina, they are most common in the Coastal Plain and Blue Ridge and tend to be uncommon or absent in much of the intervening Piedmont. In Upstate South Carolina, the distribution of the timber rattlesnake is not fully known. Timber rattlesnake specimens from the foothills and upper piedmont more closely resemble the canebrake form of this species. The distribution of the mountain form of the timber rattlesnake is not known, but it is assumed that this form is isolated to areas of higher elevation in our state.

POPULATION SIZE AND DISTRIBUTION

To date no exhaustive population study exists for the timber rattlesnake and the canebrake rattlesnake in South Carolina.

HABITAT AND NATURAL COMMUNITY REQUIREMENTS

The mountain form of the timber rattlesnake is generally associated with dry, south-facing slopes at relatively high elevations. In these areas, the timber rattlesnake uses communal den sites in rock outcrops, particularly those with an open south face exposed to the sun. Timber rattlesnakes spend the winter months in these dens; pregnant females give birth to their young in the fall. During the warmer months, timber rattlesnakes may be found in a number of mountain habitats. This species is an ambush predator, feeding primarily on squirrels and other large rodents (Palmer and Braswell 1995).

CHALLENGES

Humans often fear rattlesnakes so snake/human interactions often end with the death of the snake. Populations may be threatened by urban development as the timber rattlesnake's habitat becomes more fragmented. Additional development is also likely to result in increased road mortality.

COAL SKINK

DESCRIPTION

The coal skink is a small lizard that reaches lengths of 12 to 17 cm (4.7 to 6.6 in.). This skink has four dorsal lines with the light stripes extending onto the tail. A thick, dark stripe lies between the two light stripes on either side of the body. The body color is bronze to brown, sometimes with dark brown spots, dashes or lines (Palmer and Braswell 1995). There are no light lines on the head in this species. The heads of males occasionally turn light red



during mating season (Conant and Collins 1991; Martof et al. 1980).

Status

The coal skink is listed as endangered in South Carolina with the southern coal skink (*E. a. pluvialis*) ranked unknown (S?) in SC but secure globally (G5) by the SCDNR Heritage Trust Program. The coal skink has only been found at one site, Sassafras Mountain, in South Carolina. This skink is an enigmatic species; it is rarely seen and is never seen in large numbers (Palmer and Braswell 1995).

POPULATION SIZE AND DISTRIBUTION

To date, no exhaustive population study for the coal skink exists in South Carolina.

HABITAT AND NATURAL COMMUNITY REQUIREMENTS

The coal skink occurs near small, forested streams. They are found in mesic environments under stones, logs and other sheltering debris (Palmer and Braswell 1995). Little is known about its habitat preferences in South Carolina. In the Appalachians, this species occurs most frequently in forests formerly dominated by chestnut, chestnut oak and yellow poplar (Braswell 1977b).

SEEPAGE SALAMANDER

DESCRIPTION

The seepage salamander belongs to the dusky salamander group. This salamander is small; it typically only reaches lengths from 4.4 to 5.7 cm (1.7 to 2.2 in.) and is very slender. Seepage salamanders typically have a wide dorsal stripe that varies in color from tan to yellow. Some individuals have a dorsal strip that terminates in a “Y” behind the head. The sides of the salamander are dark while the underbelly is pale (Conant and Collins 1991; Martof et al. 1980).



Photo by J.D. Willson

Status

The seepage salamander was only recently reported in South Carolina and has only been found in the Sumter National Forest in Oconee County (Petranka 1998). The seepage salamander is ranked S?, status unknown, in South Carolina and has a global ranking of G3/G4, apparently secure (NatureServe 2005).

POPULATION SIZE AND DISTRIBUTION

To date, no exhaustive population study for the seepage salamander exists in South Carolina.

HABITAT AND NATURAL COMMUNITY REQUIREMENTS

The seepage salamander is associated with small streams and wetlands where it may be found beneath leaf litter and debris, especially in seepage areas. The South Carolina population is disjunct from the main geographic range of this species (Petranka 1998).

SHOVEL-NOSED SALAMANDER

DESCRIPTION

The shovel-nosed salamander is a totally aquatic relative of dusky salamanders. This species can reach lengths of 9 to 12.5 cm (3.5 to 4.9 in.) with a maximum length of approximately 14 cm (5.5 in.). The shovel-nosed salamander is variable in coloration, ranging from gray-brown to yellow. Typically, a paired row of lightly colored spots is found on the back (Conant and Collins 1991; Martof et al. 1980). The tail of the shovel-nosed salamander is compressed laterally, an adaptation to its aquatic lifestyle.



Photo by J.D. Willson

Status

The shovel-nose salamander is ranked vulnerable (S2) in the State of South Carolina and apparently secure (G4) globally (NatureServe 2013).

POPULATION SIZE AND DISTRIBUTION

To date no exhaustive population study for the shovel-nose salamander exists in South Carolina.

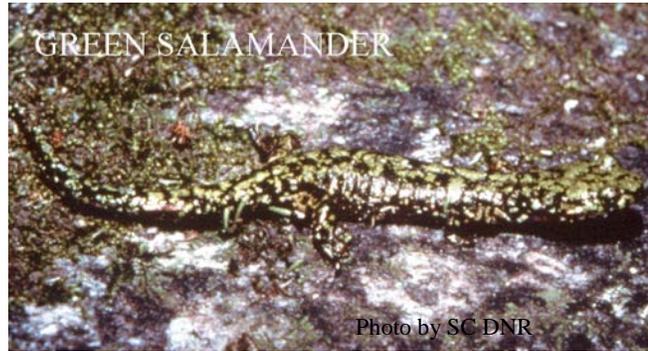
HABITAT AND NATURAL COMMUNITY REQUIREMENTS

The shovel-nosed salamander is a stream dweller, found in fast-flowing, rocky streams. The salamander is typically found under rocks, mostly in second and third order streams below elevations of 1,220 m (below 4,000 ft.) (Petranka 1998).

GREEN SALAMANDER

DESCRIPTION

The green salamander is the only arboreal salamander in South Carolina. This species can reach lengths of between 8 and 12 cm (3.1 to 4.7 in.) with a maximum length of approximately 14 cm (5.5 in.). This salamander is the only species in South Carolina with green coloration. Further, it has a pattern that resembles the lichens and mosses found growing on rocks in the green



salamander's habitat (Conant and Collins 1991; Martof et al. 1980). The green salamander is also the only salamander in South Carolina that has toe pads, much like those of a treefrog, to help it climb trees and rocky cliffs.

Status

The green salamander is ranked critically imperiled (S1) in South Carolina and vulnerable/apparently secure (G3/G4) globally and is listed as a Species of Concern.

POPULATION SIZE AND DISTRIBUTION

To date no exhaustive population study for the green salamander exists in South Carolina.

HABITAT AND NATURAL COMMUNITY REQUIREMENTS

The green salamander is occasionally found in the same rocky areas that are used by the timber rattlesnake. This species is a "cliff dweller," residing in moist, but not wet, rocky sites with abundant crevices. Green salamanders are also found using trees that occur adjacent to rock outcrops (Waldron and Humphries 2005).

WOOD FROG

DESCRIPTION

The wood frog is a small member of the true frog family and so it is related to the bullfrog, leopard frog, and gopher frog. This species can attain a size of 3.5 to 7 cm (1.3 to 2.7 in.); the maximum size is approximately 8 cm (3.1 in.). The body color of the wood frog is highly variable ranging from pink to brown to almost black. The major distinguishing characteristic is the dark patch that extends backward from the eye (Conant and Collins 1991; Martof et al. 1980).

Photo by J.D. Willson



Status

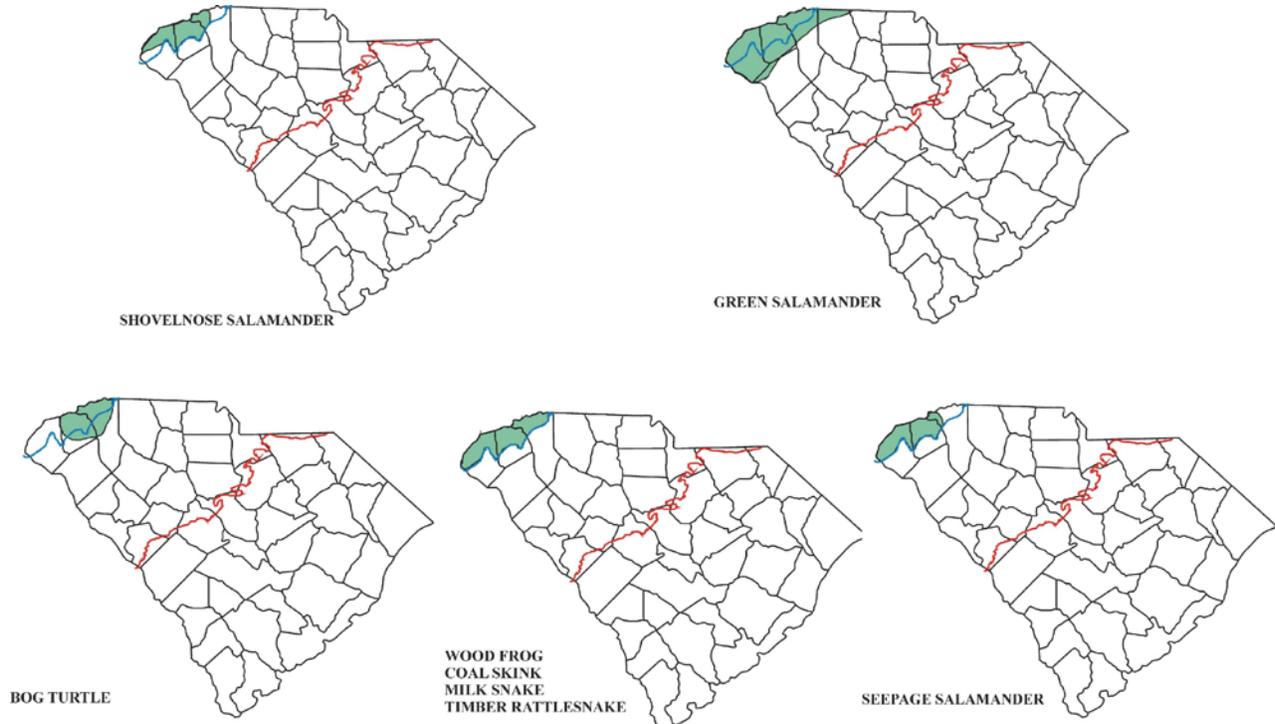
The wood frog is ranked vulnerable (S3) in the State of South Carolina and secure globally (G5). This frog is also listed as Species of Concern.

POPULATION SIZE AND DISTRIBUTION

To date no exhaustive population study for the wood frog exists in South Carolina. During 2000 and 2001, one of the authors (Kilpatrick) observed multiple wood frogs while doing winter road surveys in Pickens and Oconee Counties, SC. In Pickens County, 7 different sites associated with Easatoo Creek and Little Eastatoo Creek were found. Breeding choruses were heard at 3 of these sites in Oconee County. Two sites associated with Toxaway Creek and Brasstown Creek were discovered.

HABITAT AND NATURAL COMMUNITY REQUIREMENTS

The wood frog breeds in small ponds, bogs and other wetlands during late winter and early spring in South Carolina. This species is typically associated with wet or moist areas, but it can be found some distance away from water during the non-breeding season (Palmer and Braswell 1995).



GENERALIZED RANGE MAPS OF BLUE RIDGE AMPHIBIANS AND REPTILES

MODIFIED FROM CONANT AND COLLINS 1991

Additions to guild since 2005 version of the SWAP:**DWARF BLACK-BELLIED SALAMANDER**

This species was formerly included in *Desmognathus quadramaculatus* (black-bellied salamander). It was recognized as a distinct species on the basis of adult size, body proportions, colour pattern, and fixed differences at four allozyme loci (Camp et al. 2002).

**DESCRIPTION**

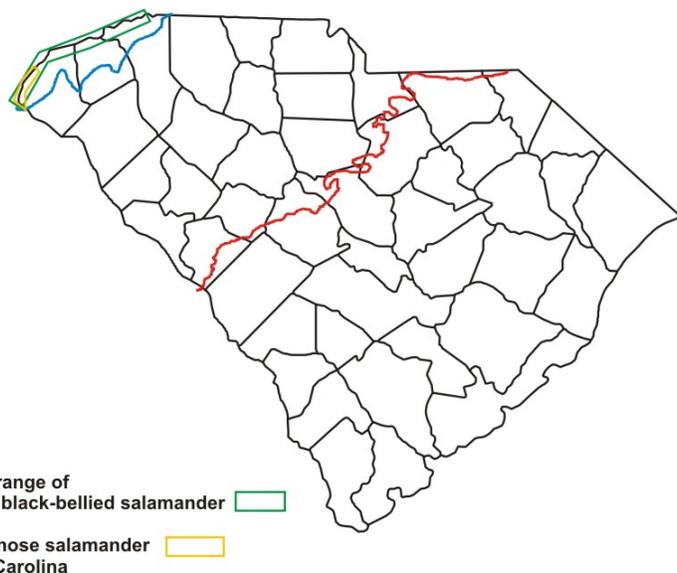
This is a large, semi-aquatic salamander that occurs in small streams. Adults of this species are not as large as the black-bellied salamander, ranging from 56 to 76 mm (2.2-3.0 in.) snout-vent length. The two species can be separated morphologically based on the dwarf black-bellied salamander attaining adult pattern and coloration, particularly on the venter, at a smaller size than the black-bellied salamander. This species has aquatic larvae.

Status

The dwarf black-bellied salamander has been recently documented to occur in South Carolina and as such has no official status. The authors are listing this species in this document based on the extremely limited data available for the species in South Carolina.

POPULATION SIZE AND DISTRIBUTION

To date this species has been documented from only two sites in South Carolina, one in Oconee County and the other in Greenville County. The species was originally described from populations in Georgia. Camp et al. 2002 indicate that the species is abundant where it occurs in Georgia. One of the authors of this document, Bennett, along with Carlos Camp has surveyed sites in Oconee County and found the species to be common to abundant at these sites. However, these sites comprise a few small streams, located on public property, in the extreme western portion of Oconee County.



HABITAT AND NATURAL COMMUNITY REQUIREMENTS

Adults have been collected in high-gradient, turbulent first- and second-order streams. They are most abundant in shallow areas of streams where they take cover under rocks. At night they occasionally are seen wandering away from cover; however, they usually remain with only their heads and/or anterior parts of their bodies protruding from cover sites. No differences in habitat have been noted between the sexes (Camp, personal observations).

PATCH-NOSED SALAMANDER

This is a newly described species, assigned to a new genus of Plethodontid salamanders. This species was first described from populations in Georgia and documented to occur in South Carolina in 2009 (Bennett, personal observation).



DESCRIPTION

The patch-nosed salamander is a miniature species, with adults reaching a length of only 25 to 26 mms (0.98-1.0 in.). The species has aquatic larvae. Unlike other dwarf salamanders in the related genus *Eurycea*, which have four toes on their hind limbs, the patch-nosed salamander has five toes on its hind limbs. In addition, unlike any other known salamander species, the patch-nosed salamander is sexually dimorphic with regard to coloration and pattern. Adult males have a bright yellow dorsum with two darker pigmented dorsolateral stripes. Adult females have a more muted brownish yellow coloration due to a suffusion of numerous dark melanophores, and the dorsolateral stripes are absent. Adults have a distinctive saffron yellow patch on the snout; in larvae this patch is white. A thin dorsal stripe stretches down the center of the tail; this stripe is yellow in adults and white in larvae. The venter is yellow and without markings.

Status

The patch-nosed salamander has been recently documented to occur in South Carolina and as such has no official status. The authors are listing this species in this document based on the extremely limited data available for the species in South Carolina.

POPULATION SIZE AND DISTRIBUTION

This species is known from one stream, at one location in western Oconee County. Other streams at this location and nearby locations have been surveyed unsuccessfully to date. There have been less than five adults observed at the known site and approximately 12 larvae, and as such, it appears that this species is relatively uncommon at this site. The alternative is its particular life history makes it very difficult to survey (Bennett, personal observation).

HABITAT AND NATURAL COMMUNITY REQUIREMENTS

The patch-nosed salamander has been found in or in association with headwater streams. Adults have been observed typically in the leaf litter adjacent to these streams. The aquatic larvae have been observed in portions of these streams lacking a steep gradient, with a bottom of mixed sand and cobble and ample rocks or woody debris to use as refugia (Bennett, personal observation).

COMMON CHALLENGES

Several large tracts of public land are located in the Southern Appalachian Ecoregion of South Carolina; many of these species occur on one or more of these tracts. Therefore, habitat loss and alteration at a large scale is not as problematic for these species as it is for others in our state. Habitat loss, however, still occurs and is considered a problem, albeit not the most pressing one. The primary problem for these species is habitat fragmentation and degradation, such as drainage of ephemeral wetlands, mining, and development on private lands. Collection of salamanders for the bait industry can limit populations or cause declines of some salamander species; collectors do not discriminate among species. Further, the salamander bait trade is unregulated. Generally, all salamander species collected are lumped together and referred to as “spring lizards.” Collection of milk snakes and timber rattlesnakes for the pet trade or venom trade can also limit or reduce populations.

CONSERVATION ACCOMPLISHMENTS

Surveys for the bog turtle and the green salamander, funded by the SCDNR, were recently conducted. All records for green salamanders resulting from these surveys are stored in the Heritage Program database. No occurrences of bog turtles were documented during these surveys.

Approximately 40,500 hectares (100,000 acres) of land is in public ownership in South Carolina's southern Appalachians and vicinity. The majority of this land is in the Sumter National Forest, Andrew Pickens District and the Jocassee Gorges Wildlife Management Area, the latter of these owned and managed by SCDNR. Several other smaller tracts, including Heritage Preserves and State Parks, are also protected in this region. Amphibians and reptiles are not the primary management targets on any of these sites, but these species do benefit from conservation management on most, if not all, of these public lands.

Recent surveys have documented the occurrence of the patchnose salamander and the dwarf black-bellied salamander. A State Wildlife Grant funded project is now underway to provide additional surveys for these species in South Carolina.

A State Wildlife Grant funded project to study the timber rattlesnake in South Carolina concluded in 2011 and the results are documented in a project completion report to USFWS.

CONSERVATION RECOMMENDATIONS

- Protect bog turtle habitat through acquisition or conservation easement at all known sites, based on the inventory work. Easements can be implemented through Project Bog Turtle, a non-profit program.
- Educate local landowners who have populations of bog turtles on their properties about the ecological importance of this species.
- Work with private landowners, in conjunction with Project Bog Turtle, and provide bog turtle habitat management recommendations through habitat management guidelines for Southeastern amphibians and reptiles currently being developed by Partners in Amphibian and Reptile Conservation (PARC).
- Implement management techniques for restoring bog turtle habitat. These include cutting shrubs and trees, diking streams, restoring sheet flow to wetlands, burning and use of livestock to mimic native herbivore grazing.
- Consider captive breeding and reintroduction programs if inventory results indicate that bog turtles have been extirpated in South Carolina.
- Re-survey all known historical sites for bog turtles.
- Determine the current extent of bog turtles in South Carolina.
- Conduct research to determine the effectiveness of bog turtle habitat management (scrub clearing and grazing) in South Carolina.
- Monitor bog turtle response to management actions, such as red maple thinning and grazing, designed to improve bog turtle habitat conditions.
- Create or expand existing education programs for public and private land managers about the presence and ecological importance of eastern milk snakes and ways to protect this species.
- Determine the taxonomic differences between eastern milk snakes, coastal plains milk snakes and scarlet kingsnakes.
- Monitor known pet trade collection sites for eastern milk snakes.
- Work with US Forest Service and South Carolina State Park Service (SCSPS) to protect known timber rattlesnake (mountain race) den sites.
- Develop an education program promoting the ecological importance of venomous snakes, including timber rattlesnakes.
- Conduct surveys to identify denning sites of timber rattlesnake populations in the Blue Ridge Mountains.
- Monitor known timber rattlesnake denning sites in the Blue Ridge Mountains to assess any potential human impacts.
- Investigate life history requirements for timber rattlesnakes in South Carolina, including adult sex ratios, recruitment and mortality, habitat use, and seasonal activity patterns.
- Partner with the US Forest Service and the South Carolina Park Service to make recommendations regarding seepage salamander habitat requirements during preparation of forest plans.
- Conduct baseline research to identify seepage salamander distribution, abundance and specific habitat requirements.

- Consolidate known museum locality data for seepage salamanders. Work with land conservancy groups, the US Forest Service, and the SCSPS to protect watersheds that contain shovel-nose salamanders.
- Include the importance of protecting shovel-nose salamanders in general education materials.
- Regulate collection of shovel-nose salamanders to protect them from over-harvest for bait.
- Survey the Andrew Pickens National Forest to determine the presence of shovel-nose salamanders on that property; monitor any populations discovered.
- Protect sandstone cliffs, the habitat of the green salamander, by eliminating or reducing timber activities that expose these cliffs to drying or allow fragmentation of connective forest habitat.
- Develop an education program highlighting the green salamander as a unique species that illustrates biodiversity in the Blue Ridge Mountains.
- Encourage the USFS to consider avoiding isolation of sandstone cliffs from the forest matrix as a result of timber cutting operations on Andrew Pickens National Forest.
- Survey appropriate habitat for the green salamander, including Andrew Pickens National Forest and South Carolina State Parks in the region; monitor any populations discovered.
- Conduct research to determine dispersal mechanisms for green salamanders through intervening forest habitat.
- Collaborate with public land managers to protect wood frog habitat.
- Include the importance of protecting wood frogs in general education materials.
- Work with USFS and consider the needs of wood frogs when creating wildlife watering ponds in the mountains.
- Inventory appropriate habitat in the Blue Ridge Mountains for presence of wood frogs; monitor any populations discovered.
- Conduct calling frog surveys to determine the presence of wood frogs.
- Monitor successful metamorphosis of larval wood frog tadpoles.
- Conduct surveys for the coal skink, dwarf black-bellied salamander and patchnose salamander.

MEASURES OF SUCCESS

For many of these species, the first measure of success will be to document basic life history requirements as well as population status and distribution. As results from current research and surveys or future efforts are identified and analyzed, projects will be initiated to address specific needs that arise from these results. Data from status surveys will be used to direct future research on life history, ecology, and limiting factors for the target species. Such data will also be used to direct future habitat acquisition and management projects. Stable or increasing populations of the primary target species on public lands will be the ultimate measure of success.

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