Pond-breeding Amphibians Guild

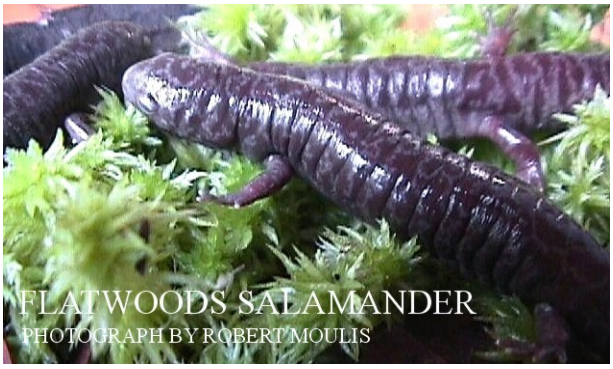
Primary Species:
Flatwoods Salamander *Ambystoma cingulatum*
Carolina Gopher Frog *Rana capito capito*
Broad-Striped Dwarf Siren *Pseudobranchus striatus striatus*
Tiger Salamander *Ambystoma tigrinum*

Secondary Species:
Upland Chorus Frog *Pseudacris feriarum* -Coastal Plain only
Northern Cricket Frog *Acris crepitans* -Coastal Plain only

Contributors (2005): Stephen Bennett and Kurt A. Buhlmann [SCDNR]
Reviewed and Edited (2012): Stephen Bennett (SCDNR), Kurt A. Buhlmann (SREL), and Jeff Camper (Francis Marion University)

DESCRIPTION

Taxonomy and Basic Descriptions

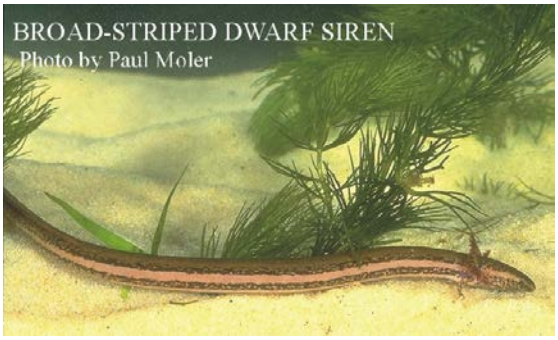


This guild contains 4 primary species: the flatwoods salamander, Carolina gopher frog, dwarf siren, and tiger salamander; and 2 secondary species: upland chorus frog and northern cricket frog. Primary species are high priority species that are directly tied to a unifying feature or habitat. Secondary species are priority species that may occur in, or be related to, the unifying feature at some time in their life.

The flatwoods salamander—in particular, the frosted flatwoods salamander— and tiger salamander are members of the family Ambystomatidae, the mole salamanders. Both species are large; the tiger salamander is the largest terrestrial salamander in the eastern United States. The flatwoods salamander can reach lengths of 9 to 12 cm (3.5 to 4.7 in.) as an adult. This species is dark, ranging from black to dark brown with silver-white reticulated markings (Conant and Collins 1991; Martof et al. 1980).

The tiger salamander can reach lengths of 18 to 20 cm (7.1 to 7.9 in.) as an adult; maximum size is approximately 30 cm (11.8 in.). This species has a dark background, typically black, with bright, yellow-orange irregular markings (Conant and Collins 1991; Martof et al. 1980).

The broad-striped dwarf siren is a member of the family Sirenidae, a family of salamanders that consists of both dwarf sirens and sirens. These are totally aquatic species that retain larval characteristics into adulthood. The dwarf siren is small, only reaching 10 to 15 cm (3.9-5.9 in.) in length and is an eel-like salamander that lacks hind limbs and has external gills. Dwarf sirens are typically brown in color with dark-brown longitudinal stripes flanking a broad, light brown stripe that runs the length of the animal's body (Conant and Collins 1991; Martof et al. 1980).



The Carolina gopher frog is a member of the family Ranidae, the true frogs. Its closest relatives include the bullfrog, leopard frog and bronze frog. This species can reach sizes of 6 to 9 cm (2.4 to 3.5 in.). It has the body shape of a typical frog, but is a little plumper than other frogs with proportionately shorter legs. Gopher frogs are typically light to dark brown with heavy blotching and numerous warts (Conant and Collins 1991; Martof et al. 1980). In fact, while a true frog, the gopher frog does somewhat resemble a toad in appearance, due to the presence of the warts. This trait, as with the toad, is evidence of a more terrestrial lifestyle.

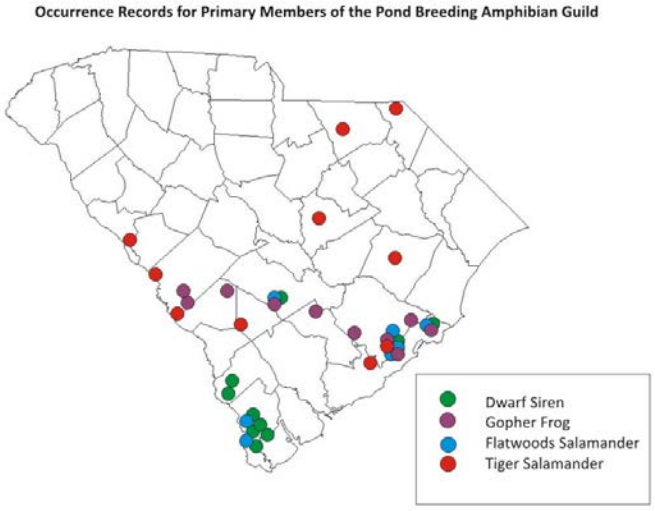
Three of these species, the flatwoods salamander, gopher frog, and tiger salamander spend their adult lives in terrestrial habitats as fossorial species, inhabiting crayfish holes, root channels, rodent burrows and other subterranean structures. Adults move to breeding ponds where they deposit eggs. Flatwoods salamanders move during autumn (Anderson and Williamson 1976) while tiger salamanders and gopher frogs move in late winter (Braswell 1993). The aquatic larva of these species may spend several months in a pond before metamorphosing to the adult form. Newly metamorphosed individuals move away from breeding ponds; they only return to these ponds when they become reproductively mature adults (Petranka 1998).

The upland chorus frog and the northern cricket frog are both small frogs; they reach lengths of 1 to 3 cm (0.3 to 1.2 in.). These frogs are in the family Hylidae and are related to treefrogs. The color pattern of the upland chorus frog can be variable; they are typically light brown with dorsal striping that is broken at the posterior. The northern cricket frog is also a highly variable species in terms of coloration; it ranges from red-brown to green (Conant and Collins 1991; Martof et al. 1980). Both species are common throughout most of their range, which, in South Carolina, is primarily the Southern Appalachian and piedmont ecoregions. These species both have populations in the coastal plain, disjunct from their typical range; it is these populations that are of conservation concern.

Status

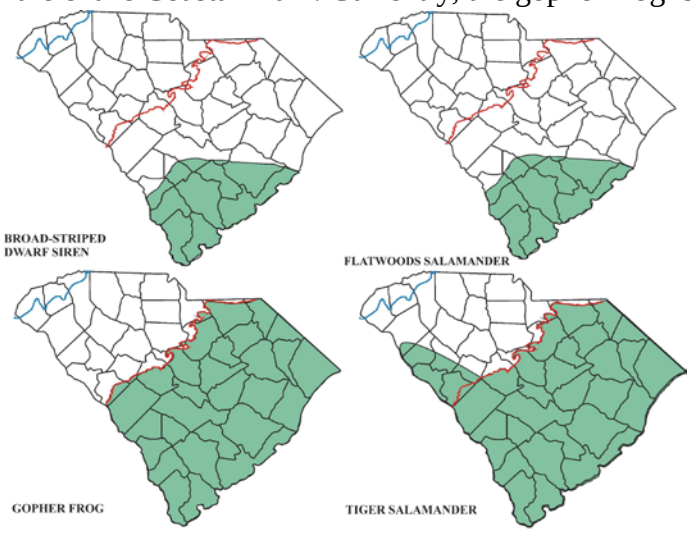
The flatwoods salamander is currently listed as endangered in South Carolina and is given a Natural Heritage rank of S1. With a federal ranking of G2/G3, the flatwoods salamander is federally listed as a threatened. The Carolina gopher frog is currently listed as an endangered in South Carolina with a natural heritage rank of S1. The gopher frog was previously considered a federal candidate for listing and is currently considered a species of concern, G3/G4. The dwarf siren is currently considered a species in need of management in South Carolina and ranked S2; it has a federal ranking of G5, secure. The tiger salamander is currently a species of concern in South Carolina and is ranked S2/S3; it has a federal ranking of G5, secure globally (NatureServe 2005). The coastal plain populations of the upland chorus frog are ranked S3/S4, apparently secure statewide, and G5, secure globally. The northern cricket frog is considered secure, both federally and in South Carolina with rankings of G5/S5. [NatureServe 2013]

POPULATION SIZE AND DISTRIBUTION



Historically, the flatwoods salamander was known from Orangeburg, Jasper, Berkeley and Charleston Counties. In the past decade, this species has only been documented in Jasper and Berkeley Counties. This species has been the object of intense survey efforts in South Carolina, and no additional occurrence records have been documented in the past two decades. Recent records have consisted of one or two individuals at breeding ponds. There has been no documentation of any significant reproduction for this species in South Carolina over the past 20 years (Moulis 1987; Harrison 2001; Bennett et al. 2002).

The range of the Carolina gopher frog in South Carolina is generally believed to have included the entire Coastal Plain. Currently, the gopher frog is only known to occur in Aiken, Barnwell, Charleston and Berkeley Counties, although historic records include Aiken, Barnwell, Bamberg, Orangeburg, Dorchester, Hampton, Berkeley and Charleston Counties. Recent records indicate that gopher frogs are only present on large, public properties. Such properties include: the Savannah River Site, owned by the US Department of Energy and managed by the US Forest Service; Francis Marion National Forest, owned and managed by the US Forest Service; and the Santee Coastal Reserve, owned



Generalized Range Maps for Primary Species
Based on Conant and Collin, 1991

and managed by the South Carolina Department of Natural Resources (SCDNR). Gopher frog breeding has been documented within the last decade at these sites, with evidence of successful reproduction at both the Savannah River Site and Santee Coastal Reserve.

The gopher frog has been the object of significant survey effort by the SCDNR in recent years. Efforts to relocate historic breeding ponds outside of the previously mentioned public lands have met with little success. All of these historic ponds have been altered, drained or the surrounding habitat has been significantly altered.

Currently the broad-striped dwarf siren only occurs in Jasper, Hampton, Orangeburg- and Charleston counties in South Carolina. SCDNR documented this species from several new sites in Jasper and Hampton Counties in the early 1990s. Extensive surveys for this species have not been conducted throughout the general range; it is likely that previously undocumented populations exist.

There are historic records for the tiger salamander from McCormick, Aiken, Barnwell, Bamberg, and Charleston Counties. Additionally, there are recent reports of this species from Sumter, Marlboro and Chesterfield Counties. The tiger salamander has not been the object of a range-wide survey in South Carolina. Little is known about the population biology of this species in this state.

The coastal plain populations of the upland chorus frog and northern cricket frog were previously believed to be restricted to areas near Charleston, South Carolina. Recent surveys by Dr. Emily Lemmon of Florida State University and Dr. Jeff Camper of Francis Marion University, indicate that both of these species are more widespread in the South Carolina Coastal Plain than previously thought. At this time, however, the actual distribution of these species in the Coastal Plain is not completely known. These two species are common to relatively abundant throughout the Piedmont and Southern Appalachian Ecoregions of South Carolina. The presence of these disjunct populations in the coastal plain is of scientific and conservation interest.

HABITAT AND NATURAL COMMUNITY REQUIREMENTS

Aquatic (Breeding) Habitat

The primary species in this guild typically breed or live in isolated, temporary freshwater wetlands which are referred to as breeding ponds. Examples of these naturally occurring ponds include Carolina Bays, limesinks, flatwoods ponds and other such related features. While these ponds may differ in their geologic origin and geomorphology, they share certain characteristics. Typical breeding ponds are isolated from flowing streams, particularly any inflows. Occasionally such ponds will have an outflow "stream" that only flows when exceptionally heavy rains fill the pond above full pool (Bennett and Nelson 1991).

Due to the lack of stream-fed water, these ponds typically fill and dry with rainfall cycles. Most, if not all, of these ponds represent perched water tables, holding rainwater and runoff "perched" above the normal water table. The perching mechanism generally consists of an impermeable

layer, such as clay, underlying the pond basin. Typical breeding ponds fill during the late autumn and winter and dry, due to evaporation and evapotranspiration, during the mid to late summer.

Breeding ponds may exhibit a diversity of vegetative communities including open-shallow water, grass-sedge prairie (depression meadow), pond cypress savanna, and tupelo gum pond (non-alluvial swamp forest). The primary amphibian guild members tend to favor ponds with an open canopy and abundant grasses and sedges. The clumped-bases of these plants provide refuge and habitat structure for many species of amphibian larvae. Hydroperiod, defined as the duration and seasonality in which a pond holds water, ultimately determines the suitability of a pond for specific amphibian species. Tiger salamanders and gopher frogs require ponds that fill by mid-winter; further, they need to hold water continuously until May or June for successful larval metamorphosis to occur (Buhlmann et al. 1999; Mitchell and Buhlmann, 1999). Several ponds with a variety of hydroperiods located in proximity within a landscape yields a high diversity of pond-breeding amphibian species.

Fish species, which may prey on amphibian larvae, are typically absent from these ponds, due to their cyclical hydrology. Certain fish species, such as pigmy sunfish, do colonize ponds in low-lying areas that have connection to other water bodies during flooding. Large, predatory fish such as pickerel and sunfish may invade these ponds at times of abundant rainfall and high water, using deer trails, other natural channels, and man-made ditches and firebreaks to move from areas of permanent water into ponds. However, in general, high quality amphibian breeding sites for members of this guild are free of fish.

Terrestrial (Non-breeding) Habitat

The primary species comprising this guild are typically found in the Coastal Plain in natural communities associated with the longleaf pine ecosystem, including longleaf pine flatwoods, longleaf pine savanna and xeric longleaf pine sandhills. Breeding ponds are nested within the upland longleaf pine matrix of these communities.

In South Carolina, the flatwoods salamander is closely associated with the longleaf pine savannas of the lower coast. These communities typically exhibit a sparse canopy of longleaf pine with a rich herbaceous layer. The water table in such habitat is usually close to the surface and small, isolated ponds may be numerous.

The tiger salamander and gopher frog may occur in a wider array of longleaf pine habitats, including the savanna. These species also occur in longleaf pine flatwoods, which typically have a lower water table and a denser canopy, and xeric sandhills, which have a very low water table and deep, droughty sands. Ponds are generally less common in these two habitat types.

Other Habitats

The dwarf siren has been documented from small Coastal Plain streams that exhibit little or no flow and have muck bottoms. Such streams are typically too small to have established populations of predatory fish such as pickerel and sunfish. All of the members of this guild have been found to occasionally breed in man-made wetlands such as borrow-pits and ditches, when

they occur within the appropriate terrestrial habitat. Long-term breeding success in these habitats is currently unknown; therefore, artificial habitats should not be considered as replacements for the destruction of natural wetlands.

CHALLENGES

The requirement for both suitable aquatic (breeding) habitat and terrestrial (non-breeding) habitat has made these species susceptible to alterations in either one of these habitats. The following activities have been suggested as reasons for the perceived decline of the primary species:

- Drainage of temporary wetlands
- Alteration of wetland hydroperiod
- Filling of wetlands
- Conversion of wetlands to other uses such as agriculture or development
- Exclusion of fire in longleaf pine forests
- Conversion of longleaf forest to loblolly pine plantations
- Commercial and residential development
- Conversion of longleaf forest to agriculture

Pond breeding amphibians are known to require adequate upland habitat around breeding ponds. Populations of amphibians may be extirpated by the elimination of adequate upland habitat despite the protection of the breeding pond. Conversely, the drainage or alteration of ponds in an otherwise unaltered forest may result in the extirpation of local amphibian populations.

Many isolated wetlands that still exist are now unsuitable for breeding by amphibian species of this guild because they have been left isolated in the landscape as a result of farming or timber operations. Such land management likely causes local extinctions of amphibian populations because the surrounding upland forests are removed, thus eliminating the terrestrial habitat required by these species when they are not breeding in the ponds (Gibbons and Buhlmann 2001; Semlitsch 1998; Semlitsch and Bodie 1998).

Isolated, temporary ponds provide critical habitat for numerous amphibian and reptile species in addition to the primary and secondary species listed for this guild. The following species are known to inhabit or use temporary ponds for some period of time, and have been identified as possible future species of conservation concern, or at least in need of further research and survey to determine their status in South Carolina:

- Many-Lined Salamander (*Stereochilus marginatus*)
- Glossy Crayfish Snake (*Regina rigida*)
- Black Swamp Snake (*Seminatrix pygaea*) –See Miscellaneous Amphibians and Reptiles Guild

CONSERVATION ACCOMPLISHMENTS

The primary species comprising this guild have been documented on four public properties in South Carolina: the Savannah River Site (SRS), Francis Marion National Forest (FMNF), Santee Coastal Reserve (SCR) and the Carolina Sandhills National Wildlife Refuge (SHNWR).

The gopher frog and tiger salamander are present on the SRS have been identified as species of research and conservation interest. Some of the breeding ponds used by these species on the SRS are part of the Department of Energy (DOE) Set Aside Program; as such, these areas have some protection status.

The gopher frog and flatwoods salamander are present on the FMNF. Surveys for the salamander in the forest have been ongoing for several years. Further, the needs of this species are considered in management operations on the forest lands.

The gopher frog, flatwoods salamander and dwarf siren have been documented to occur at the SCR, which is owned and managed by SCDNR. The breeding pond used by the flatwoods salamander and gopher frog is registered as a significant Natural Area with the department's Heritage Trust Program; this pond is managed for these species.

The tiger salamander has been documented to occur at the SHNWR. However, only one specimen has been collected from this site. Little is known about the distribution or status of the species on the SHNWR.

Research and survey efforts on pond breeding amphibians by SCDNR personnel, have been supported in the past by USFWS Section 6 funds, Endangered Wildlife funds (state income tax check-off) and WCRP funds. The primary focus of past work has been survey efforts to verify historic populations and document new populations. Little data exists on the demography, population dynamics, or conservation requirements for these species.

In 2007 the USFWS, The Nature Conservancy, US Forest Service and SCDNR initiated surveys for the flatwoods salamander on both public and private lands. In 2009 the species was documented, based on larval samples, from a wetland on the Francis Marion National Forest. This is the first time since 2003 that the species has been documented in the forest.

In 2009 the gopher frog was documented, through call surveys, on the Webb Wildlife Center in Hampton County. There was an historic record for this species from that vicinity, but an exact location was not known. In 2010 SCDNR initiated a State Wildlife Grant funded project to survey for, monitor and provide life history research aimed at understanding the management requirements for this species. The results of this project are detailed in a project completion report submitted to USFWS in 2011. A new State Wildlife Grant funded project was initiated by SCDNR in 2011 to continue survey and monitoring efforts for this species.

CONSERVATION RECOMMENDATIONS

- Inventory flatwoods salamander breeding sites; protect these sites and surrounding uplands. Monitor the success of flatwoods salamanders at previously identified breeding locations.
- Meet with public and private land managers to discuss the imperilment of the flatwoods salamander and methods to ensure its protection.
- Develop positive working relationships with key South Carolina landowners to allow for inventory to proceed on private lands and plantations.
- Investigate the potential to establish a captive breeding program for flatwoods salamanders and the possibility of translocating animals into appropriately managed, protected habitats.
- Protect all known Carolina gopher frog population sites. Consult with SRS, USFS, the Savannah River Ecology Laboratory, and DOE to formulate and enact management plans that include this species.
- Include the importance of protecting all pond breeding amphibians and their habitat in general education materials.
- Inventory sites that have historically contained Carolina gopher frogs. Monitor these sites for continued population by this species.
- Research the effects of fire management on wetland breeding habitat for both Carolina gopher frogs and tiger salamanders.
- Investigate Carolina gopher frog life history to determine the status of "protected" populations and to address habitat requirements, seasonal activity, adult sex ratios, recruitment, mortality, and longevity.
- Investigate the feasibility of a captive breeding program or rearing of metamorphic frogs in semi-wild enclosures to help assure the availability of breeding adults..
- Consider broad-striped dwarf siren habitat needs when managing Carolina bays and similar wetland ecosystems.
- Inventory appropriate broad-striped dwarf siren habitat, primarily Carolina bays, for this poorly known species to determine actual distribution in South Carolina.
- Once identified, protect and monitor habitat for broad-striped dwarf sirens.
- Collaborate with appropriate partners to identify, protect, and monitor sites that contain tiger salamanders.
- Determine distribution of the tiger salamander in South Carolina.
- Conduct surveys for the upland chorus frog in the coastal plain, particularly in Francis Marion National Forest, to determine if the species is still present and if so, the status of this disjunct population.
- Collaborate with the USFWS and USFS to inventory historic sites for the presence of northern cricket frogs in order to collect baseline data for this species in South Carolina. Protect and monitor these sites once they have been determined.

MEASURES OF SUCCESS

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 surveys

will be used to identify and develop appropriate life history and ecology research projects to detail causes of decline and limiting factors to population. Stable or growing populations of the primary target species, on protected lands in particular, will be a measure of success.

LITERATURE CITED

Anderson, J.D. and G.K. Williamson. 1976. Terrestrial mode of reproduction in *Ambystoma cingulatum*. Herpetologica. 32(2):214-221.

Bennett, S.H., W.G. Kalinowsky, J. Humphries and J. Waldron. 2002. Study completion Report: *Ambystoma cingulatum* E-1-24 USFWS Section 6. SCDNR. Columbia, South Carolina.

Bennett, S.H. and J.B. Nelson. 1991. Distribution and status of Carolina bays in South Carolina. South Carolina Wildlife and Marine Resources Department. 88 pp.

Braswell, A. 1993. Status report on *Rana capito capito* LeConte, The Carolina Gopher Frog in North Carolina. North Carolina State Museum of Natural History. Raleigh, North Carolina.

Buhlmann, K.A., J.C. Mitchell and L.R. Smith. 1999. Descriptive Ecology of the Shenandoah Valley Sinkhole Pond System in Virginia. Banisteria. 13:23-51.

Conant, R.C. and J.T. Collins. 1991. A Field Guide to Reptiles and Amphibians: Eastern and Central North America. Peterson Field Guide Series. Houghton Mifflin Co. Boston, Massachusetts. 450 pp.

Dodd, C.K., Jr. 1992. Biological diversity of a temporary pond herpetofauna in north Florida sandhills. Biodiv. Conserv. 1:125-142.

Gibbons, J.W. and K.A. Buhlmann. 2001. Chapter 28: Reptiles and Amphibians. Pp. 372-390 *In:* Wildlife of Southern Forests, J.G. Dickson (Ed.). Hancock House Publishers. Blaine, Washington. 480 pp.

Harrison, J.R. 2001. Ambystoma cingulatum (Cope): Monitoring activities in Francis Marion National Forest, Berkley Co., SC during the 2000-2001 Season. A project completion report to U.S. Forest Service.

Martof, B.S., W.M. Palmer, J.R. Bailey and J.R. Harrison III. 1980. Amphibians and Reptiles of the Carolinas and Virginia. University of North Carolina Press. Chapel Hill, North Carolina. 264 pp.

Mitchell, J.C. and K.A. Buhlmann. 1999. Amphibians and reptiles of the Shenandoah Valley sinkhole pond system in Virginia. Banisteria. 13:129-142**.**

Moulis, R.A. and C.W. Seyle, Jr. 1987. Survey of the distributional status in South Carolina of two amphibians of special concern: *Ambystoma cingulatum* (Flatwoods Salamander) and

Pseudobranchus striatus striatus (Broad-striped Dwarf Siren). Unpublished report to the South Carolina Wildlife and Marine Resources Department (now SCDNR). Columbia South Carolina.

NatureServe. 2013. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, VA. (On-line) Accessed Feb. 21, 2013 at http://www.natureserve.org/explorer.

Petranka, J.W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press. Washington, D.C. 587 pp.

Semlitsch, R.D. 1998. Biological delineation of terrestrial buffer zones for pond-breeding amphibians. Conservation Biology. 12:1113-1119.

Semlitsch, R.D. and J.R. Bodie. 1998. Are small, isolated wetlands expendable? Conservation Biology. 12:1129-1133.