



Common Name: FLATWOODS SALAMANDER (includes frosted flatwoods salamander, top photo, and reticulated flatwoods salamander, bottom photo)

Scientific Name: *Ambystoma cingulatum* Cope and *Ambystoma bishopi*

Other Commonly Used Names: none

Previously Used Scientific Names: none

Family: Ambystomatidae

Rarity Ranks: Frosted flatwoods salamander G2/S2
Reticulated flatwoods salamander G2/SNR

State Legal Status: Frosted flatwoods salamander - Threatened
Reticulated flatwoods salamander - Endangered

Federal Legal Status: Frosted flatwoods salamander - Threatened
Reticulated flatwoods salamander - Endangered

Description: The flatwoods salamander is black to dark brown and typically patterned with light gray or white flecked lines, forming a netlike pattern on the back, sides, head, and tail. "Frosted" forms show a more random flecking pattern. The underside is dark gray or black with small, scattered white or light gray spots. The head is relatively small, and the tail is quite fat. Adults are typically 12 - 15 cm (4.5 - 6 inches) in total length. The broad-headed, bushy-gilled larva is very distinctive with a prominent tan or beige stripe running the length of the otherwise chocolate-brown body. The larva also has a dark brown stripe through each eye, extending from the nostril to the gills. Recent molecular research has shown that populations on either side of the Flint River are divergent enough to warrant separate species designation. Those populations found west of the Flint River (*Ambystoma bishopi*) typically have the more reticulated pattern, while those to the east (*Ambystoma cingulatum*) are more often "frosted" in appearance.

Similar Species: Adult flatwoods salamanders may be confused with the slimy salamander at first glance; however, the latter species differs in appearance by having unconnected, widely scattered light spots on the back and sides and a groove between each nostril and the upper lip.

Habitat: This salamander is endemic to mesic flatwoods habitats within the vanishing longleaf pine-wiregrass community. Slash pine was incorrectly reported in early species accounts as a commonly associated tree species within its non-breeding habitat. Nearly all flatwoods salamander sites currently dominated by slash pine have been converted from historic longleaf pine stands. Pine flatwoods are fire-dependent communities, requiring periodic burns to promote grasses and forbs, while limiting shrubs and hardwoods. Breeding sites are typically shallow, ephemeral cypress and/or swamp tupelo ponds or "domes," although flooded borrow pits, roadside ditches, and deep firebreaks are occasionally used. Breeding sites are also dependent on periodic dry season fires, which maintain an open canopy conducive to the luxuriant growth of emergent and submerged grasses, sedges, and forbs necessary for sheltering the aquatic larvae.

Diet: Adults are known to eat earthworms, but likely consume other invertebrates as well. Larvae eat a variety of aquatic invertebrates, especially crustaceans such as amphipods and isopods. Captive larvae readily eat small tadpoles and may also do so in the wild.

Life History: As adults, flatwoods salamanders are primarily fossorial, living in burrows just below the soil surface. Triggered by rain-laden cold fronts during the fall and early winter breeding season, mature salamanders nocturnally migrate to isolated wetlands en masse. Movements of more than 1.6 km (1 mile) from a breeding site to a terrestrial retreat have been reported. Following mating, female flatwoods salamanders deposit up to 225 eggs singly or in small groups in the dry portions of the pond basin or in grassy areas at the pond margin, usually under leaf litter or logs, at the bases of grass clumps, or at the entrance of crayfish burrows. In most years, repeated rain events eventually fill the wetland and inundate the developing eggs, inducing hatching. However, in some years insufficient rainfall following egg deposition

prevents complete inundation, resulting in few eggs hatching and low recruitment. Larvae are primarily inactive during the day but will emerge from the sheltering vegetation at night to feed. A developmental period of 11 - 18 weeks follows hatching, and larvae typically metamorphose in March or April.

Survey Recommendations: Flatwoods salamanders are best surveyed for as larvae, where they can be dip-netted or minnow-trapped from breeding ponds. Aquatic surveys should focus on areas with abundant emergent and submerged plants. Adults are very difficult to find, but are occasionally encountered on rainy fall and winter nights by slowly driving roads that cross between their upland habitat and breeding wetlands. Drift fences equipped with funnel traps and placed adjacent to breeding ponds can intercept migrating adults, but are costly and labor-intensive.

Range: This species is restricted to the Coastal Plain of South Carolina, Georgia, Florida, and Alabama. Despite relatively widespread historic sites in southern Georgia, documented occurrences since 1980 are known from only Baker, Bryan, Evans, Liberty, McIntosh, and Miller counties.

Threats: Of the 97 range-wide historical sites revisited in a 7-year period since 1990, only 12 localities were found to still contain flatwoods salamanders. In Georgia, extant populations are known from only four sites. Any species with such a reduced range is vulnerable to extinction. Habitat loss has been the primary cause of this salamander's demise throughout its range. Agriculture and silviculture have eliminated the vast majority of the once widespread longleaf pine flatwoods community in Georgia and elsewhere. Because pine flatwoods are typically underlain by semi-hydric soils, forestry practices often involve altering the hydrology by ditching, draining, and/or bedding. These activities are detrimental to both the fossorial and aquatic existence of this species and may interfere with successful migration. Ditching and draining isolated wetlands used by breeding flatwoods salamanders significantly shortens their hydroperiod, halting larval development prior to metamorphosis. Fire suppression throughout the Coastal Plain has also reduced the amount of suitable habitat. Extended drought conditions since the late 1990s have negatively impacted successful recruitment of young. Coupled with the highly fragmented and isolated occupied habitats, the drought may have significantly reduced some populations and perhaps eliminated others. *Perkinsus*, a protozoan-like organism known to infect and kill larvae of certain other amphibians, has been detected at the one breeding pond on Mayhaw Wildlife Management Area. The potential impact of *Perkinsus* on flatwoods salamanders is unknown.

Georgia Conservation Status: Protected populations occur at Ft. Stewart Military Reservation, J.W. Jones Ecological Research Center, Townsend Bombing Range, and Mayhaw Wildlife Management Area.

Conservation and Management Recommendations: With extremely few healthy populations of flatwoods salamanders in Georgia, forest management plans in these areas should consider the conservation of this species a top priority. Avoidance of mechanical disturbance to the soil and discontinuing practices which may result in adverse hydrological impacts to breeding sites are critical, especially within at least a 1.6 km (1 mile) radius from the edge of all known breeding

wetlands. Periodic lightning-season burns should be prescribed in pinelands inhabited by flatwoods salamanders, and these fires allowed to burn into isolated wetlands. Known breeding sites should be annually monitored.

Selected References:

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J. Jensen and D. Stevenson, March 2009: original account

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Flatwoods salamander larva