

Description: The blue-spotted salamander is a slender salamander with short limbs, long digits, and a narrow, rounded snout. A dark blue to black dorsum with brilliant sky-blue spots or specks on the lower sides of the body makes the coloration of this species quite distinct and reminiscent of antique blue enamel pots and dishware. The ventral surface is a paler grey with black pigmentation surrounding the vent. The tail is long and laterally compressed; averaging 44% of the total body length. Adults range from 4.0 to 5.5 inches (10 to 14 cm) in total length.

Determining the sex of this species is easiest done during the breeding season, when males are identifiable by a swollen vent area caused by enlarged cloacal glands. Additionally, the larvae are also difficult to differentiate from other *Ambystoma* species; larvae are olive green to black and have a long dorsal fin that extends from behind the head along the back and tail.

Similar species: The blue-spotted salamander is a member of the Jefferson / Blue-spotted complex salamander (*A. jeffersonianum* / *A. laterale* complex). Jefferson salamanders (*A. jeffersonianum*) and blue-spotted salamanders were separated by ice age glaciation, but after the ice melted, the two species came into contact with each other and began interbreeding producing hybrid populations. The hybridization of these two species has led to the development of two completely female populations that are all polyploids – that is, they have multiple sets of chromosomes rather than the normal set of two (diploid). Although Jefferson salamanders and blue-spotted salamanders are fairly easy to differentiate from each other, the identification of the hybrid species is very difficult to distinguish on the basis of appearance alone; typically, identification can only be completed through chromosome counts or size of red blood cells in conjunction with their external appearance. Even

Blue-spotted Salamander

Ambystoma laterale

State Status: **Species of Special Concern**

Federal Status: None



Photo by Bill Byrne

though, these two hybrid populations have been formally named as the Silvery salamander (*Ambystoma platineum*) and the Tremblay's salamander (*Ambystoma tremblayi*), the hybrid salamanders are simply referred to as the Jefferson / Blue-spotted complex salamander.

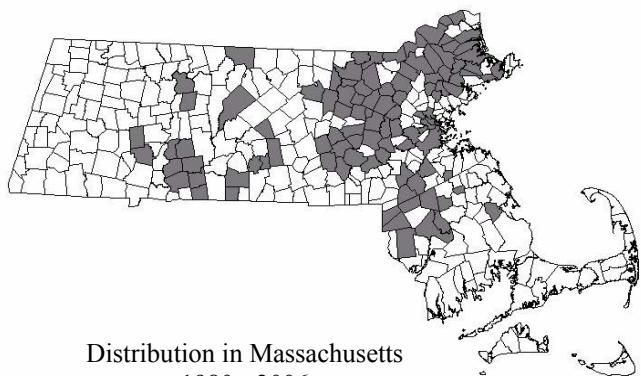
When the Jefferson / Blue-spotted complex hybrids are present in an area, they may outnumber the blue-spotted or Jefferson salamanders by a 2:1 margin. A population with many more females than males is a good indicator of the presence of hybridization of these species. The mode of reproduction of the female hybrids is gynogenesis: sperm is obtained from male diploids to stimulate egg division, but no genetic recombination occurs. However, additional hybrid forms such as triploid males and tetraploid and diploid females have been found, indicating that some offspring retain genetic material from two parents.

The members of the complex form a continuum in appearance from the grayish-brown coloration, pale blue flecks, and wide snout of the Jefferson salamander to the bluish-black coloration, prominent blue spots, and narrow snout of the blue-spotted salamander.

Range: The ranges of the Jefferson and blue-spotted salamanders overlap in New England. Populations of pure blue-spotted salamanders therefore occur north of the hybridization zone with Jefferson salamanders. The area of populations of pure blue-spotted salamanders and hybrids extends from the Canadian Maritime

Provinces, south along the Atlantic coast to northern New Jersey. The range extends westward through to northern Indiana and northeastern Illinois, through most of Wisconsin, eastern Minnesota and the southern half of Ontario.

In Massachusetts, they occur predominantly within Middlesex and Essex counties and in the adjacent eastern towns of Worcester County. Some occurrences also lie within Bristol and Plymouth counties as well. In general, Jefferson - Blue-spotted complex salamanders found east of the Connecticut River are more likely to be blue-spotted salamanders.



Distribution in Massachusetts
1980 - 2006

Based on records in Natural Heritage Database

Habitat: Blue-spotted salamanders require moist, moderately shaded environments; they favor northern hardwood/hemlock forests occurring in glaciated areas having depressions available for seasonal flooding. Vernal pools, or temporary ponds, are necessary for reproduction and need to be full of dead and decaying leaves for cover and overhanging bushes or grass for egg deposition. Roadside drainage ditches, small kettle holes, and temporary pasture ponds also provide habitat when flooded in the spring.

Life Cycle / Behavior: Blue-spotted salamanders are rarely encountered above ground, except as adults during their early spring breeding season, or as metamorphosed juveniles in the late summer. Adults reside most of the year beneath leaf litter or underground to a depth of one meter, usually within 500 meters of their breeding pond. The breeding season is brief, lasting from mid March to late April. As soon as the ground surface thaws, males migrate above ground to temporary ponds and females join them a few days later. An elaborate courtship, similar to the Jefferson salamander, occurs including approach, contact, nudging, and tail-fanning routines that takes place in the water between a single male and single female. Following a period of amplexus,

the female will follow the male, pick up a deposited spermatophore, and store it in the cloaca for egg fertilization. (Normal sexual reproduction occurs in the diploid females, while no true fertilization or recombination of chromosomes takes place in the triploid hybrids.) Eggs are often laid singly or in a small egg mass, with 6 to 10 eggs per mass, for a total clutch ranging from 82 to 489 eggs. The egg masses cling lightly to overhanging vegetation or fall to the bottom of the pond. Hatching about a month later, larvae are voracious eaters, preying on insect larvae and other small aquatic animals. No overwintering of larvae has been reported in Massachusetts, so by late August larvae have metamorphosed completely into air-breathing adults.

Blue-spotted salamanders have been found to migrate to and from breeding pools an average of 100 to 900 feet from their terrestrial habitat. A study of vernal pool species in Massachusetts found that at least half of the blue-spotted salamanders that were breeding in the studied vernal pool moved more than 300 feet to overwintering sites; the maximum known movement distance of an adult is 2050 feet (625 m) in Indiana.

Adult blue-spotted salamanders feed on small invertebrates such as larval and adult insects, spiders, worms, and centipedes. They produce noxious skin secretions from specialized poison glands in their tail and are thus rarely preyed upon by native predators. If blue-spotted salamanders reach adulthood and their habitat is secure, they may live for decades.

Population status in Massachusetts: The blue-spotted salamander (including triploid and other polyploid forms within the *A. laterale/A. jeffersonianum* complex) is currently listed as a “Species of Special Concern” in Massachusetts. There are 102 towns in Massachusetts where blue-spotted salamanders have been observed. One hundred and seventy-two occurrences have been documented since 1981, as well as 27 historic occurrences that were documented prior to 1981. The major threat to this species—and most salamanders in general—is the loss, degradation and fragmentation of both aquatic breeding pool habitat required for reproduction and terrestrial habitat needed for foraging, overwintering, growth and development to development and urbanization. For example, making temporary ponds deeper can create permanent ponds with fish populations which will predate amphibian eggs and larvae. Some population declines may be attributed to over collection, heavy road traffic, and pesticides or other toxic chemicals polluting breeding pool water.

Studies on the effects of acid rain on salamander eggs and larvae have been contradictory, and further studies must be made to resolve this issue, however, it appears that blue-spotted salamanders from eastern Massachusetts are highly tolerant of acid conditions and can hatch successfully down to a pH of 4.0.

Management Recommendations: In order to ensure the survival of this species in Massachusetts, the following recommendations regarding habitat preservation are suggested. There are two critical components in the life history of this species: vernal pool habitat required for reproduction and upland forest habitat required for foraging, hibernation, and other terrestrial and fossorial activities. Conservation of the blue-spotted salamander—and all native members of the genus *Ambystoma*—must therefore focus on the preservation of vernal pools and small ponds known to be inhabited by this species, as well as a significant parcel (250–1600 meter radius) of upland habitat surrounding such breeding sites. Provided these habitats are not significantly degraded—and that the salamanders are not subject to illegal collection or high road mortality—the salamander populations should be capable of maintaining themselves indefinitely.

It should be kept in mind, however, that every population is unique. The majority of the population, for instance, may be concentrated in a relatively small and discrete upland habitat, which would safely allow carefully conducted development within some portions of the “uninhabited” habitat around the breeding pool without serious effects on the population. The only way to determine if such a case exists, however, is through a detailed environmental study conducted by a qualified researcher(s) over a series of years, charting the movements of the animals to and from the breeding site. Unless such a study is conducted, it should be assumed that the salamanders are relatively evenly distributed around the pool and development should be strongly discouraged within a minimum radius of 500–1,000 meters surrounding the breeding pool.

Vernal pools and breeding ponds must be protected not only from draining, filling, and development, but also from degradation in the form of road and lawn run-off. If forestry activities are conducted within surrounding areas, a no-cut buffer zone of 50–100 feet should be established around the pool depression, and no slash or other debris should be dumped in the

depression. While vernal pools receive some protection under the Massachusetts Wetlands Protection Act, and several vernal pool species (including the blue-spotted salamander) are protected under the Massachusetts Endangered Species Act, efforts should be made to certify all vernal pools and to enhance and promote the enforcement of the laws mentioned above. Because of their ephemeral nature, vernal pools are often difficult to locate during dry periods and may be inadvertently damaged if their locations are not surveyed and marked prior to forestry or construction operations.

Citizens must be encouraged to recognize and report blue-spotted salamanders and the locations of their breeding pools. Due to the rarity of this species, its ephemeral terrestrial occurrence, and its very specific habitat requirements, some populations undoubtedly remain undiscovered and therefore under protected.

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