



# Sustaining America's Aquatic Biodiversity

## Salamander Biodiversity and Conservation

*David Bishop and Carola Haas\**



**O**f the more than 400 species of salamanders found worldwide, 130 to 150 live in North America. Over 40 percent of these are considered to be at risk. The greatest diversity of salamanders in the world is found in the Southeastern United States. Salamanders are amphibians, like frogs, and most need water in which to reproduce. They live in a wide variety of habitats from swift-moving mountain streams to moist forests. In many habitats, they are the most abundant vertebrate.

Currently, 11 species are on the federal endangered or threatened species list in the United States, but many more species are at risk. The loss and modification of habitat is putting enormous pressure on salamander populations. Salamander habitat is being destroyed, modified, and fragmented, seriously diminishing the diversity and number of salamanders in the United States and around the world. Although these secretive creatures are unknown to many people, they are important parts of our natural world and in serious need of our protection.

### What Is a Salamander?

Salamanders are amphibians (class Amphibia), related to frogs and toads. They are in the order Caudata, meaning they have a tail. Because of their secretive nature and nocturnal lifestyle, salamanders are one of the least studied groups of animals. They

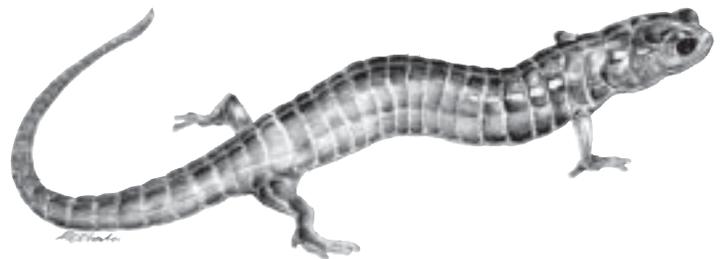
love dark, wet places, often in deep woods, which is one reason why salamanders are the subjects of numerous myths and legends.

### Structure and appearance

At first glance, most salamanders look like lizards and sometimes are called “spring lizards.” However, salamanders are amphibians, not reptiles, and, unlike lizards, they have moist skin with no scales, no ears, and no claws.

Salamanders in the United States range in size from 2 inches to over 2 feet in length. Most species have two pairs of legs, but some look more like eels than lizards and have reduced or only a single pair of legs.

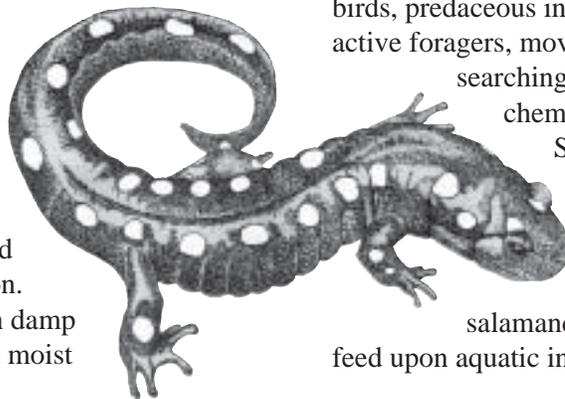
The tails of aquatic salamanders are often compressed to aid in swimming, whereas those of terrestrial species are more rounded. Some salamanders have the ability to regenerate their tails if they are lost. Salamanders continue to grow past sexual maturity



\*Department of Fisheries and Wildlife Sciences, Virginia Tech

and must periodically shed their skin. After shedding, they often eat the skin. Mucous-secreting glands help prevent their skin from drying out when they are out of the water. Other glands release toxins that protect them from predators. Some have glands that produce pheromones, chemicals that are used in courtship and mating.

Some salamanders have lungs; others do not. In lungless species, respiration occurs through the skin and mouth. Respiration through the skin is important to both those with and without lungs during hibernation. All salamanders must remain in damp environments to keep their skin moist and prevent drying out.



### What do they eat?

Salamanders are predators. Most feed on insects, worms, and other small invertebrates. Salamanders are often the most abundant vertebrate animal in the forest. They are an important link in the food web, preyed upon by larger amphibians, snakes, turtles, birds, predaceous insects, and fish. Salamanders are active foragers, moving through their environment searching for prey. They can use visual and chemical cues to detect prey items.

Salamanders use their tongue (covered with sticky secretions) to capture prey. Aquatic salamanders use suction to capture prey. Immature (larval) salamanders, like adults, are predators and feed upon aquatic insects and other invertebrates.

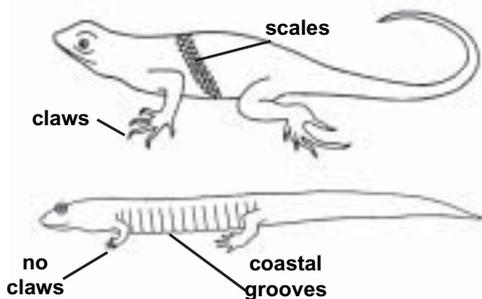
### How do they reproduce?

Salamanders have a variety of reproductive strategies. Most species have a two-part life cycle that, like frogs, includes a larval stage and an adult stage. Some species lack a larval stage, and newly hatched individuals look like miniature versions of the adult. Most salamanders hatch from eggs and spend several weeks to years growing as aquatic larvae before they undergo metamorphosis to become adults. When the adults reach sexual maturity, they often return to breed at the same site where they were born. Although frogs typically reproduce by external fertilization, few (10 percent) salamanders exhibit external fertilization. In most salamanders, fertilization is internal. Male salamanders court females with species-specific behaviors. The male then deposits a packet of sperm (a spermatophore) on the ground and the female transfers it into her body. The eggs are fertilized internally, but laid externally in a selected habitat.

### Where do they live?

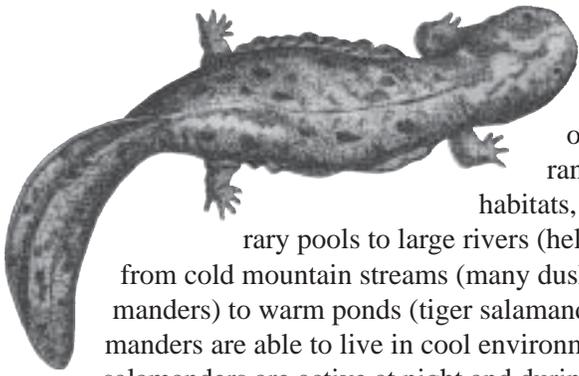
Most salamanders are found in or near wetlands. Because they lack the scales of reptiles, salamanders are susceptible to drying out, and must live in moist environments. Some species have the ability to burrow underground; others use burrows created by other animals like crayfish.

### Morphology: Lizard vs. Salamander



Most aquatic larval salamanders have gills that are absorbed when they metamorphose to adults. Some salamanders, such as the mudpuppies and waterdogs, keep external gills throughout their lives. The gills, as in fish, are red in color due to the high blood concentration necessary for oxygen absorption from the water. Gill size may be related to the water quality. In warm, slow-moving, low-oxygen waters, salamanders often have larger gills than those found in cool, flowing, high-oxygen waters.

Salamanders do not have ears, but may be able to detect vibrations through their legs and jaws. In the water, vibrations are detected by the lateral line system, rows of sensors found on the head. Most species have well-developed eyes. The exceptions are the few cave-dwelling species that live in complete darkness where eyes are unnecessary. Salamanders, unlike frogs, are voiceless except for a slight squeaking noise made by a few species when disturbed or excited.



Salamanders occupy a wide range of aquatic habitats, from temporary pools to large rivers (hellbenders) and from cold mountain streams (many dusky salamanders) to warm ponds (tiger salamanders). Salamanders are able to live in cool environments. Most salamanders are active at night and during rain events, which permit them to move around to feed or mate.

All species of salamanders in the United States lay eggs. Aquatic salamanders lay their eggs in water, and terrestrial species lay their eggs in moist areas under vegetation, rocks, or logs or underground. The female usually stays with the eggs for weeks or months until they hatch, defending them from predators and removing silt, debris, or fungal growth.

During the breeding season, males often develop secondary sexual characteristics such as pads on their hind limbs to help them hold onto slippery females when mating. Males of some lungless salamanders develop long teeth that are used to scratch the females' backs.

Some species can breed year round, but most salamanders have distinct breeding seasons, which vary depending on the species, location, and weather conditions. Those that breed in ponds and temporary wetlands are explosive breeders. Hundreds of individuals may migrate into a breeding pond, reproducing in mass on a single night when conditions are right.

### **How long do they live?**

Would you believe some salamanders live more than 50 years? Most salamanders live for 8 to 20 years, but large aquatic salamanders, such as hellbenders, have been known to live between 25 and 55 years. Even the small streamside salamanders, such as the mountain dusky salamander, regularly live more than 10 years.

Many small salamanders need three to four years to become large enough to breed. The red-spotted newt, for example, may spend seven years in the immature red eft phase before undergoing a second metamorphosis, and returning to a pond to breed. Because of their long life span, loss of adult salamanders may have a larger effect on population survival than occasional reproductive failure.

## **Collecting Salamanders**

Since terrestrial salamanders generally are active at night, they can often be observed during the day by flipping over logs, rocks, and other debris. It is important to return all logs, rocks, and other debris that are flipped back to their original position so animals can continue to use them for shelter. Aquatic salamanders can sometimes be found by carefully turning rocks on the stream bottom. Salamanders typically are more active on rainy nights.

Although collecting a few live salamanders is legal in most states, many states restrict collecting large numbers. Take special care not to disturb any threatened or endangered species. Never release salamanders collected at one location at another location; they could transmit disease. Enjoy observing wild animals in their natural habitats or keep them for a few days in a clean terrarium or an aquarium filled with water and materials collected at the same site. Newts, larvae, and aquatic species may be captured intentionally or accidentally using seines or minnow traps.

Salamander skin is very sensitive. Handle salamanders with wet hands. No salamanders are poisonous to humans; however, some produce toxins that can irritate human skin. Most salamanders do not bite, but some large aquatic salamanders can bite hard. A good way to observe salamanders is to use a clear plastic container. Salamanders should then be released at the point of capture.

## **What Good Are They?**

Despite the fact that salamanders are rarely seen, they are important members of the food web, both as predators and prey. They are especially important in controlling rates of decomposition and nutrient cycling. They also are a major food source for wild reptiles, fish, birds, and mammals.

Salamanders are used in medical research to study tissue regeneration and the effects of skin toxins for treating different diseases. Due to their permeable skin and amphibious lifestyle, salamanders also serve as an indicator species for environmental quality. The loss or reduction in the numbers of salamanders from an area may serve as an early warning of environmental pollution.

Salamanders are not a food source for people, but they are sometimes used as fish bait by anglers. Like all organisms, they are valuable not because they can benefit people but because they have been a valuable part of our ecosystem for millions of years.

## Threats

Because salamanders are little known and secretive, scientists cannot be sure of the extent of the decline of this group worldwide. Over 40 percent of North American salamander species are considered to be at risk.

Most salamanders are threatened by habitat loss and water pollution. Over-collection for the pet trade or bait sales, acid rain, wetland drainage, drought, exotic species, stocking fish in breeding ponds, and the creation of dams are all significant threats. Growing urban development is converting woodlands and wetlands into parking lots and strip malls, reducing aquatic and terrestrial salamander habitat. Even if small patches of habitat are preserved, populations may be doomed for extinction if they are disconnected and surrounded by roads or other development. Forest cutting and thinning for fire control may reduce the abundance of salamanders.

It is not too late to save our native salamanders. Better forestry and agricultural practices can lessen the risk of destroying the habitat and limit pollution. Streamside conservation efforts will protect important habitats. Damaged wetland habitat can be restored. Small streams need to be protected from development and natural streamside vegetation should be kept intact.

## Useful Salamander Web Sites

- Partners in Amphibian and Reptile Conservation <http://www.parcplace.org/education/index.htm>
- Checklist of Amphibian Species and Identification Guide: An Online Guide for the Identification of Amphibians in North America north of Mexico: <http://www.npwrc.usgs.gov/narcam/idguide/index.htm>
- Conservation International: [http://www.biodiversityscience.org/xp/CABS/research/repamp/rep\\_amp\\_cons.xml](http://www.biodiversityscience.org/xp/CABS/research/repamp/rep_amp_cons.xml)
- Frog Watch USA: A frog and toad monitoring site: <http://www.nwf.org/frogwatchUSA/>

- Visit FrogWeb: Amphibian Declines & Deformities: <http://www.frogweb.gov/>
- Reptiles and Amphibians of Virginia and Maryland: <http://mysite.verizon.net/vze1m6wp/>
- San Francisco's Exploratorium Museum's Frog Exhibition: <http://www.exploratorium.edu/frogs/>
- North American Amphibian Monitoring Program: <http://www.mp2-pwrc.usgs.gov/naamp/>
- Georgia Amphibians: <http://museum.nhm.uga.edu/gawildlife/amphibians/amphibians.html>
- Frogs and Toads of Tennessee: <http://www.state.tn.us/twra/frogs.html>
- North Carolina's Amphibians and Reptiles: <http://www.bio.davidson.edu/Biology/herpcons/herpcons.html>
- South Carolina Reptiles and Amphibians: <http://www.snakesandfrogs.com/index.htm>
- Amphibiaweb, worldwide data base on amphibians: <http://elib.cs.berkeley.edu/aw/search/>

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