

GEORGIA
Adopt-A-Stream

Department of Natural Resources
Environmental Protection Division



Amphibian Monitoring



The publication of this document was supported by the Georgia Environmental Protection Division and was financed in part through a grant from the U.S. Environmental Protection Agency under the provisions of section 319(h) of the Federal Water Pollution Control Act, as amended. 4/20/08

Acknowledgements

This manual draws on the experience of many wonderful citizen monitoring, stewardship and education programs. Georgia Adopt-A-Stream gratefully acknowledges the following organizations for their advice and use of their materials.

Special Contributions

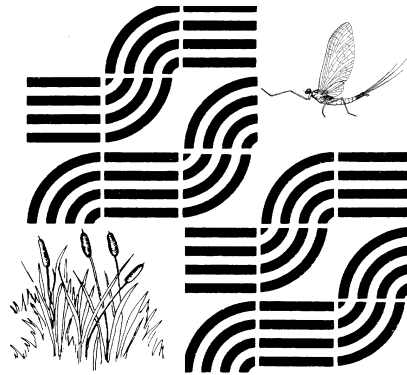
Georgia Department of Natural Resources: Environmental Protection Division and Wildlife Resources Division and Joseph W. Jones Ecological Research Center.

Writers/Editors

Beth Ball

Lucrecia Vizcaino

Tara K. Muenz and Lora L. Smith, Jones Ecological Research Center



**Georgia Adopt-A-Stream
Georgia Department of Natural Resources
Environmental Protection Division
2 Martin Luther King Jr. Drive
Suite 1462, East Tower
Atlanta, Georgia 30334
www.AdoptAStream.Georgia.gov
404-463-1464**

Introduction

What is an Amphibian?

There are three main groups of amphibians:

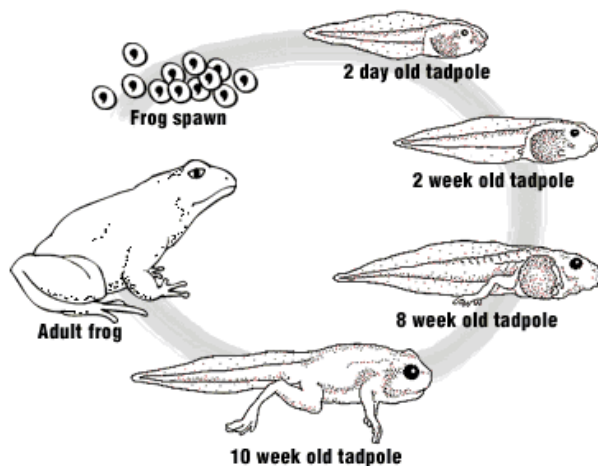
- *Anura* (frogs and toads)
- *Caudata* (salamanders and newts)
- *Gymnophiona* (caecilians)

The word *Amphibian* means double life. Many species have two phases during their life cycle. As larvae, they spend life in an aquatic environment and as adults they spend life in a terrestrial environment. Amphibians are vertebrates, animals that have a spine. They are ectothermic, meaning that they cannot generate their own body heat. They regulate their body temperature by moving into areas that provide the right temperature for their survival. Amphibians do not have scales or any other means to protect themselves from drying out and tend to require a moist habitat. Most species require a water source for survival, and several require water for reproduction.

Biology and Ecology of Amphibians

Life Cycle

Many amphibians exhibit multi-phasic life cycles with metamorphosis separating the larval, juvenile, and adult stages. Some species do not have a free-living larval stage, essentially completing metamorphosis within the egg. Other species, such as the sirens, have abandoned metamorphosis altogether and retain larval morphology, remaining in an entirely aquatic habitat throughout their lives.



During metamorphosis, larvae slowly change from fishlike, completely aquatic animals, to animals better suited for life on land. Gills give way to lungs, and in the case of anurans, tails give way to limbs. The length of time required for metamorphosis varies among different species.

Little is known about the longevity of most amphibians in the wild, but studies of captive animals show that some can be extremely long-lived. Some captive

salamanders have survived for 20 to 25 years, and a few have lived for more than 50 years. Captive frogs have shorter life spans, typically living for 1 to 10 years. Some toads have survived in captivity for more than 30 years.

Range and Habitat

Scientists have recognized more than 6,000 species of amphibians. Anurans are the most abundant of all, with over 5,000 species. Frogs are the most widespread of all amphibians, inhabiting every continent except Antarctica. Salamanders are found throughout the northern hemisphere and parts of South America. Caecilians are the rarest group of amphibians and are limited to the tropical regions of Southeast Asia, Africa, the Seychelles islands, and South America.

Although most species require freshwater habitats such as ponds, swamps, streams, or other wet environments for breeding, amphibians are capable of living in a variety of habitats including grasslands, rain forests, conifer forests, alpine areas, and even deserts. Remarkably, many amphibians are adept at finding moisture in seemingly dry environments.

Physical Characteristics

Amphibians range in size from the giant salamanders of Japan and China, which can exceed 1.5 m (5 ft) in length, to the tiny gold frog, that only reaches 1 cm (about 0.4 in). Most salamanders are between 5 and 20 cm (2 and 8 in) long, and most frogs measure between 2 and 8 cm (0.8 and 3 in). Caecilians are more variable in size. Most species are between 10 and 50 cm (4 and 20 in), but some grow as long as 1 m (3 ft).



Amphibian larvae are typically aquatic and have many features in common with fish. Frog larvae, commonly referred to as tadpoles, live exclusively in water and have internal gills that enable them to obtain oxygen from water. Salamander larva typically have external gills.

Adult amphibians typically have limbs that enable them to move about on land as well as in the water. Anurans are equipped with hind limbs that are long, strong, and have elongated ankles that enable jumping. Hind toes are webbed to aid in swimming, although webbing varies among species (i.e. tree frogs have less webbing than bullfrogs). Most salamanders have four short legs and a long tail, which they use for balance while walking on land and to propel them through the water when swimming. Caecilians have no limbs at all. They burrow in the soil by using their strong skulls as battering rams and swim by moving their muscular bodies back and forth like eels.

Internal Anatomy and Skin

Amphibian internal anatomy is similar to that of other vertebrates. Adult amphibians typically have lungs for breathing oxygen, but some water-dwelling species have both lungs and gills, and others obtain all the oxygen they need to survive through their permeable skin.

Amphibians are ectotherms (“cold blooded” is a more commonly used term for ectotherms, though the animal does not actually have a cold body temperature). This means that they are not able to generate their own body heat. Instead, their body temperature is regulated by their surroundings. Behaviors to regulate body temperature include basking in the sun, being active at night, or even a reduction in activity altogether.

Hairless and scale-less, amphibian skin provides protective coloring, a way to absorb water and oxygen from their environment, and a defense against arid conditions and hungry predators. Some amphibians are brilliantly hued, while others display coloring that blends with their habitat. Amphibians owe their diverse coloration to both pigment granules in the upper layer of skin and specialized pigment-containing cells called chromatophores in the skin’s lower layer. Many amphibians change their skin color by concentrating or dispersing the various pigments in the chromatophores. This behavior

has two purposes. It helps them to adjust their body temperature because light colors reflect heat more than dark colors and it also acts as a camouflage mechanism, helping them to escape predation.



Amphibians use their permeable skin to obtain both oxygen and water from their environment. Thus, their skin must stay moist in order for oxygen to dissolve in an aqueous film on the skin and pass to the blood. Their skin also contains numerous glands that produce

secretions that prevent them from drying out and/or are toxic or unpalatable to predators. In the water, these protective secretions help amphibians retain a healthy balance of salt and water within their internal tissues.

Vocalizations

Amphibians lack external ears but have well-developed internal ears. Male frogs produce a wide variety of vocalizations, which they use in mating and territorial interactions. Each frog species has a unique vocalization, which makes it easy to recognize. Because each frog species has a unique call, vocalizations can be a reliable method of identification. Neither salamanders nor caecilians have a true voice box, but when threatened, some salamanders can produce yelps or barking sounds.

Behavior

Much of an amphibian's life is dictated by the necessity of keeping its skin moist and regulating body temperature. Amphibians will bask in the sun in order to raise their body temperature or hide in small crevices in order to keep their body temperature from dropping too low. In hot climates, many adult amphibians are nocturnal (active at night rather than in the day) to avoid excessive heat and guard against water loss. In cold climates, amphibians become torpid, or inactive, when temperatures drop. Most amphibians are carnivorous, feeding on a variety of insects, spiders, crustaceans, worms, small reptiles, and sometimes, smaller amphibians.

With their soft skin and lack of claws, amphibians are particularly vulnerable to predators, which include a host of small mammals, birds, lizards, snakes, turtles, and even larger amphibians. When facing a predator, amphibians have several ways to defend themselves:

- cryptic (camouflage) or warning coloration
- unpalatable or poisonous toxins in their skin
- make use of their impressive tails in defense (Salamanders)
- puff up their bodies so that they appear much larger than their real size (Anurans)

Reproduction

Amphibians have a variety of reproductive behaviors. Most salamanders reproduce by internal fertilization. Male salamanders often emit odors to attract a female's attention. If a female looks their way, these males may display bright colors and complex postures. Anurans reproduce by external fertilization. Frogs gather in huge numbers—sometimes thousands of individuals—when conditions are right for breeding. Male frogs rely on their calls, *croaks*, *clicks*, *whistles*, or *trills*, to attract females and keep other males away.

Amphibian eggs are not protected by a waterproof shell like those of birds or reptiles; instead each egg is surrounded by a clear, protective, jellylike substance called a capsule. The eggs need to be laid in water or in a damp place to prevent the developing embryo from drying out. Many amphibians lay their eggs directly in water, but some frogs and salamanders, and nearly all caecilians, lay their eggs on land in moist places such as leaf litter, burrows or cracks in the ground, and beneath logs or rocks.

Most amphibians that lay their eggs in water leave them unattended, but in species that deposit their eggs on land, a parent commonly guards the eggs to prevent predation. About 20% of amphibian species show some form of parental care.

Risks to Amphibians

Amphibians have survived more than 300 million years through numerous and drastic environmental changes that led to the demise of dinosaurs and many other species. Yet scientists are alarmed by the recent rapid decline of amphibians in many parts of the world. These declines are evident in places as widely separated as North America, South America, and Australia, and have prompted international concern. Declines in amphibian populations may be due in part to natural fluctuations, but more likely suggest that humans are impacting the environment at a greater rate than amphibian species can sustain. Their complex life cycle and permeable skin make amphibians particularly sensitive to environmental disturbances such as drought and pollutants. This sensitivity makes them excellent biological indicators, organisms whose well-being provides clues to the health of an ecosystem.

Mysteriously, many amphibian populations are dwindling or even disappearing in areas where the habitat is protected. In Australia, two species of gastric (mouth) brooding frogs have not been detected since the early 1980s, yet their habitat remains relatively pristine. The golden toad of Costa Rica has not been seen since 1989, even though its high-elevation rain forest habitat has been protected as a national reserve since the 1970s. Similarly, the red-legged frog has vanished from large areas of the North American Pacific Coast, where it was once abundant. Another disturbing development is that large numbers of amphibians, especially frogs, are being found with misshapen, extra, or missing limbs.



No single factor has been identified as the cause of these disturbing trends. Instead, a variety of factors may be responsible. These may include disease from viral, bacterial, or fungal pathogens; global warming; or increased levels of the ultraviolet-B component of sunlight hitting the Earth as a result of depletion of the protective ozone layer. Ultraviolet-B light is particularly suspect in the decline of amphibian species that lay their eggs in shallow water, because such eggs are exposed to sunlight for long periods. At a more local level, chemical pollutants, such as acid rain, pesticides, herbicides, and fertilizers, may be harming amphibians. In some regions, the introduction of nonnative competitors and predators has contributed to amphibian population declines. It is likely that an interaction of some or all of these factors may be exacerbating conditions for amphibians.

Species richness in the Southeast

The continental United States is home to at least 260 amphibian species: 90 frog and toad species, and 170 species of salamanders. The Southeastern US is unique in that it harbors many amphibians, with over 144 species living in a variety of freshwater habitats. Georgia in particular has 32 species of frogs and toads in five families. They range in size from the Little Grass Frog at 11 mm (0.44 in) long, to the large Bullfrog that reaches a record length of 203 mm (8 in). There are 55 salamander species identified in the state, with new species still being identified.

Monitoring activities

In Georgia, volunteer amphibian monitoring activities are in their infancy. Without an established protocol for monitoring amphibians, Georgia volunteer monitors rely on vocalizations to assess the presence of tree frogs and photo-documentation to assess the presence of salamanders. Georgia Adopt-A-Stream amphibian monitoring is a pilot program that hopes to engage volunteers in the process of learning about amphibian populations.

~~The Georgia Herp Atlas is a monitoring program that has relied heavily on volunteer assistance. Because of the scarcity of professional herpetologists in Georgia, amateurs are an indispensable resource to more efficiently survey amphibian populations in the infrequently visited parts of the state. Participants are simply asked to photograph 'herps' (amphibians or reptiles) as they encounter them, either through active searches or opportunistically, and document location, date, and observer's name on provided field cards. Because of the photo-documentation requirement, participants need not know what species they observed. This program is coordinated through the Georgia Department of Natural Resources Wildlife Resources Division's Non Game-Endangered Wildlife Program.~~



There are two national frog and toad monitoring programs, the North American Amphibian Monitoring Program (NAAMP), coordinated by USGS and Frogwatch USA, coordinated by the National Wildlife Federation. Both programs involve volunteers in the identification of frogs and toads by their calls and vocalizations. NAAMP requires that states appoint a statewide leader to coordinate the program. Any volunteer who expresses an interest can contact Frogwatch USA to find out how to participate.

You can now learn the sounds frogs and toads in Georgia make with the new "Calls of the Wild - Vocalizations of Georgia's Frogs" Compact Disk produced by the Georgia Department of Natural Resources, Wildlife Resources Division (DNR/WRD). This CD presents the unique calls of all 31 species. Informative narration is provided for each of the individual species recordings, and a 16-page booklet loaded with information

including natural history, range maps, and physical characteristics for each species accompanies the CD. To order your copy of "Calls of the Wild", contact GA DNR/WRD, Nongame Wildlife & Natural Heritage Section, 116 Rum Creek Drive, Forsyth, GA 31029, ATTN: Georgia's "Calls of the Wild" CD, or for more information call 478-994-1438. Prices are as follows: \$15.36 (includes GA sales tax and shipping charges) for GA residents or \$14.45 (includes shipping charges) for non-GA residents. Prices current as of June 2007.

Conservation activities

Amphibian monitoring is just one tool that can be used as an indicator of water quality. In addition to this, there are a variety of other activities that Georgia Adopt-A-Stream provides volunteers with, free of charge. Different levels of involvement offer different levels of activity. At the most basic level, volunteers register with Georgia Adopt-A-Stream, conduct a watershed assessment and perform visual surveys of their adopted stream. The *Getting to Know Your Watershed* manual focuses on map assessments and a watershed survey as evaluation tools. The *Visual Stream Monitoring* manual introduces a diversity of low-cost, hands-on methods for analyzing the physical health of your adopted stream.

Optional participation includes biological and/or chemical monitoring, and/or a habitat enhancement project. These activities also have various levels of commitment.

- | | |
|--------------------------------|----------------------------|
| • Watershed Assessment | Once a year |
| • Visual Monitoring | 4 times a year (quarterly) |
| • Biological Monitoring | 4 times a year (quarterly) |
| • Physical/Chemical Monitoring | 12 times a year (monthly) |
| • Habitat Enhancement | One time project |

Biological and chemical monitoring requires training. Training workshops are available at various locations around the state. Training includes an overview of the program, monitoring techniques and quality assurance tests.

Please visit www.georgiaadoptastream.org for a calendar of training classes, to locate your local Adopt-A-Stream coordinator, and to sign up for the Adopt-A-Stream newsletter.

These activities **help protect water quality and streams** because:

- Regular monitoring provides specific information about the health of your local stream.
- Both long-term trends and immediate changes in water quality can be documented.



- Biological monitoring will detect changes in water quality and habitat, and provides an indication of overall stream health.
- Chemical monitoring provides specific information about water quality parameters that are important to aquatic life -- such as dissolved oxygen and pH.
- Habitat enhancement projects improve streambanks and/or the streambed. These projects may stop a streambank from eroding and decrease the amount of sediment entering a stream or improve an in-stream habitat for fish to feed, hide, and lay eggs.

Stream dwelling salamanders can also serve as important ecological indicators of habitat quality. In small headwater streams where salamanders replace fish as the top vertebrate predators, they serve as another potential tool to assess stream health. In fact, several state monitoring programs have determined that fish indicators are ineffective in headwater streams, where flow is too low to sustain healthy populations. In these areas of low flow, salamanders may provide valuable information. However, more research is needed to create an index of biotic integrity that will help determine whether stream salamanders are effective indicators of ecological conditions across biogeographic regions and gradients of human disturbance.

Web links

- <http://allaboutfrogs.org/frogInd.shtml>
- <http://cgee.hamline.edu/frogs/science/frogfact.html>
- <http://museum.nhm.uga.edu/gawildlife/amphibians/amphibians.html>
- <http://www.amonline.net.au/herpetology/index.htm>
- <http://herpcenter.ipfw.edu>
- <http://www.uga.edu/srelherp/index.htm>
- <http://www.parcplace.org/>

More links can be found at <http://www.georgiaadoptastream.org/resourcelinks.html>

Published documents

Abundance and Distribution of a Stream Plethodontid Salamander Assemblage in 14 Ecologically Dissimilar Watersheds in the Pennsylvania Central Appalachians. Gian L. Rocco and Robert P. Brooks, December 2000

Land Manager's Guide to the Amphibians and Reptiles of the South. Lawrence Wilson, 1995

Leaf litterbags: Factors affecting capture of stream-dwelling salamanders. Jayme L. Waldron, C. Kenneth Dodd Jr., Jeffrey D. Corser, 2003

Measuring and monitoring biological diversity: Standard methods for amphibians. W.R. Heyer, A. Donnelly, R.W. McDiarmid, L.C. Hayek, and M.S. Foster (ed.)
Smithsonian Institution Press, Washington, D.C.

Monitoring Amphibians in Great Smoky Mountains National Park. C. Kenneth Dodd, Jr. US Department of Interior, USGS, Circular 1258

Biology of Amphibians. Duellman, E. and Trueb, L. 1994. The Johns Hopkins University Press.

Directions for Completing Amphibian Monitoring Forms

Important: *When handling frogs, toads or salamanders, please keep hands clean of sunscreen lotion, insect repellent, and other oils. Amphibians have sensitive skin, which is easily irritated.*

Treefrogs

Objective: Obtain count of tree frog populations in riparian corridors and wetlands.

Method: Place 12 pipes at 6 stations (2 per station) for each stream reach.

Materials:

- Twelve 3 foot long 2 inch diameter PVC pipes (schedule 40) with one end cut at diagonal to facilitate driving the pipe into the ground.
- Four foot dowel with sponge attached to the end for removing frogs (don't use antibacterial sponge).
- Zip lock bags for placing caught frogs. Please note: avoid storing plastic bags in direct sunlight to prevent greenhouse effect from killing amphibians.

Placement: Using rubber mallet, place pipes at zero to 3 feet from stream edge in pairs at 6 stations located within your stream reach. The pairing of pipes should be approximately 3 feet apart.

All pipes should be perpendicular with the horizon. Stations should be evenly distributed along the reach. Pipes are placed in pairs to ensure that at least one pipe is attractive for the treefrog. Also it's quicker to check paired traps than an equal number that are evenly distributed.

Identification: Check pipes every 1 to 3 months (when conducting regular AAS monitoring). If treefrog is found, gently remove pipe.



Using the dowel with sponge, gently coax the treefrog from the PVC pipe and into a zip lock bag for ID. Use the key on page 17 to identify frogs. Identify species and document numbers; note malformations.

Salamanders

Objective: Obtain count of salamander populations in riparian corridors and wetlands.

Method: Place 12 cover boards at 6 stations (2 per site) for each stream reach.

Materials:

- Twelve inch (or 30 cm) square boards, one inch thick with wooden handle attached to top for flipping boards. Use only untreated wood.
- Secure boards to the ground with sod staple.

Placement: Secure cover boards in pairs at zero to 3 feet from stream edge in pairs at 6 stations located within your stream reach. The pairing of cover boards should be approximately 3 feet apart. If the streambank is incised, place the cover boards on top of streambank. Stations should be evenly distributed along the reach. Cover boards are placed in pairs to increase the probability that one is attractive for the salamander. Also it's quicker to check paired traps than an equal number that are evenly distributed.

Identification: Check cover boards every 1 to 3 months (when conducting regular AAS monitoring). If a salamander is found, gently coax the salamander into a zip lock bag for ID. Use the key at the end of this guide to identify salamanders to the family level. Be sure to document numbers and note malformations.



GEORGIA ADOPT-A-STREAM

Amphibian Monitoring Data Sheet

To be conducted quarterly

Return to: GA AAS
4220 International Parkway
Suite 101
Atlanta, GA 30354

AAS group name: _____ Group ID number <u>AAS-G</u> Site ID Number <u>AAS-S</u> Investigators: _____ Stream name _____ Date: _____ Time: _____	County: _____ Topo Map _____ Quadrant: _____ Picture/Photo Documentation? yes / no					
Site/location Description: _____						
<table style="width: 100%;"> <tr> <td style="width: 33%;"> <i>Rain in last 24 hours</i> <input type="checkbox"/> heavy rain <input type="checkbox"/> intermittent rain </td> <td style="width: 33%;"> <i>Present Conditions</i> <input type="checkbox"/> steady rain <input type="checkbox"/> none </td> <td style="width: 33%;"> <input type="checkbox"/> heavy rain <input type="checkbox"/> overcast </td> <td style="width: 33%;"> <input type="checkbox"/> steady rain <input type="checkbox"/> partly cloudy </td> <td style="width: 33%;"> <input type="checkbox"/> intermittent rain <input type="checkbox"/> clear/sunny </td> </tr> </table>		<i>Rain in last 24 hours</i> <input type="checkbox"/> heavy rain <input type="checkbox"/> intermittent rain	<i>Present Conditions</i> <input type="checkbox"/> steady rain <input type="checkbox"/> none	<input type="checkbox"/> heavy rain <input type="checkbox"/> overcast	<input type="checkbox"/> steady rain <input type="checkbox"/> partly cloudy	<input type="checkbox"/> intermittent rain <input type="checkbox"/> clear/sunny
<i>Rain in last 24 hours</i> <input type="checkbox"/> heavy rain <input type="checkbox"/> intermittent rain	<i>Present Conditions</i> <input type="checkbox"/> steady rain <input type="checkbox"/> none	<input type="checkbox"/> heavy rain <input type="checkbox"/> overcast	<input type="checkbox"/> steady rain <input type="checkbox"/> partly cloudy	<input type="checkbox"/> intermittent rain <input type="checkbox"/> clear/sunny		
Amount of rain, if known? _____ Inches in last _____ hours/days						

Reach		PVC Pipes (Treefrogs)						Coverboards (Salamanders)						Notes
		<i>H. cinerea</i>	<i>H. squirella</i>	<i>H. chrysoscelis</i>	<i>H. femoralis</i>	<i>H. gratiosa</i>	<i>H. avivoca</i>							
1 a	0'							/						
b	3'							/						
2 a	0'							/						
b	3'							/						
3 a	0'							/						
b	3'							/						
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b	3'							/						
5 a	0'							/						
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6 a	0'							/			13			
b	3'							/						

Key to Identification of Treefrogs

Squirrel Treefrog, *Hyla squirella*

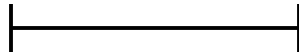
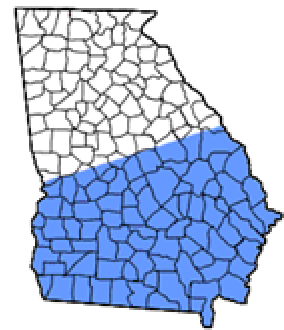
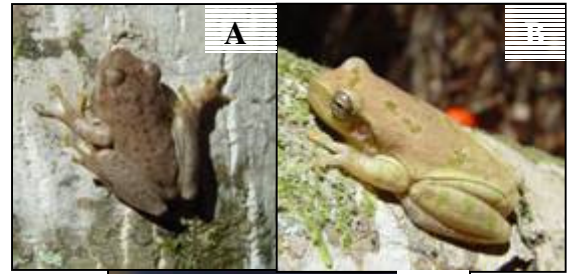
Appearance: Small, delicate, with smooth skin. Often referred to as a 'chameleon,' they are highly variable in coloration and pattern (A & B). They can be green or brown, or both, often (but not always) with a spot or dark bar between eyes. There also may be a light stripe (C) along the body, which may continue half-way or all the way to the posterior part of the body. Eyes are bright orange-yellow or bronze. Best method for identification is to eliminate all other possible species first.

Size: 7/8 – 1 5/8" (snout-vent)

Habitat: Common in many habitats such as: buildings, bushes, trees, vines, fields, gardens, almost anywhere close to moisture, food, and a hiding place.

Range: See map.

Other: Of all the treefrogs of N.America, this one has possibly the greatest power for rapid color change, and presents the greatest variety of colors and shades of color, wearing an array of costumes. These changes take place under the influence of various stimuli such as moisture, heat, and light. Quick and difficult to catch.



Green Treefrog, *Hyla cinerea*

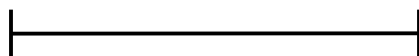
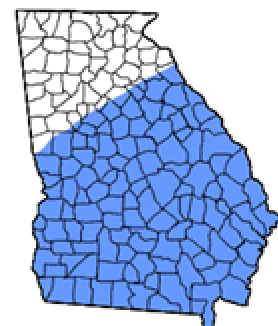
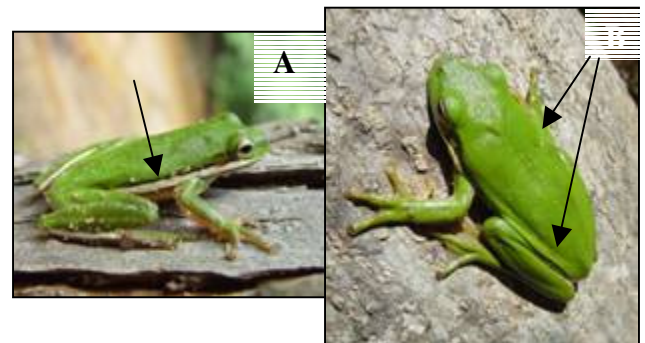
Appearance: One of the larger treefrogs. Very slender, smooth skin, bright green in color (some variation present), with a white or metallic yellow side stripe (A), pointed snout. Often with small gold or yellow spots on the back (B). The under surfaces are white or yellowish white. Color variations range from dark brownish green, bright pea-green or light greenish yellow. Tibia much longer than femur. The whole leg is one and a half times the length of head and body.

Size: 1 1/4 - 2 1/4" (snout-vent)

Habitat: Found at the margins of bodies of water, on broad-leaved aquatic plants, lily-pads, trees, bushes, vines, or on taller water plants in ditches or pools.

Range: See map.

Other: Gentle and not easily frightened.



Gray Treefrog, *Hyla versicolor* or *H. chrysoscelis*

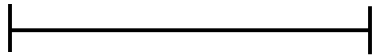
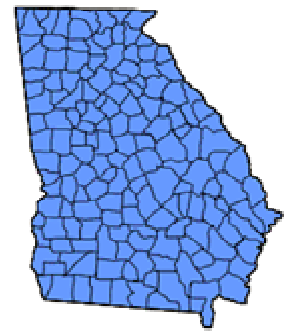
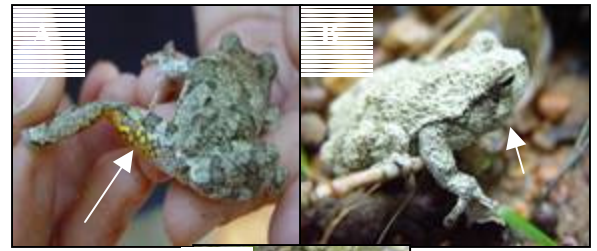
Appearance: Moderately large in comparison to other treefrogs. Head is broad and blunt, the body is fat and squat. Commonly gray in color although can vary through many shades of green and brown. Concealed surfaces of hind legs have bright orange (or golden yellow) spots on a mottled black background (A). On the head you should see a light spot below the eye (B) and an oblique dark band on the top of the head, above each eye (C). The skin is covered with relatively coarse tubercles, giving a 'warty' appearance, however, not as warty as the common toad (*Bufo*). Disks on fingers and toes are large and webbed. Characteristic markings may or may not appear when the background color is green.

Size: 1 ¼ - 2" (snout-vent)

Habitat: Found in wooded stretches along creeks and rivers, in relatively small trees or shrubs.

Range: See map.

Other: Note these two look-alike species of Treefrogs share the above characteristics and only by their voices can you tell them apart in the field.



Barking Treefrog, *Hyla gratiosa*

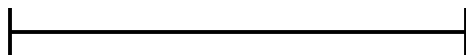
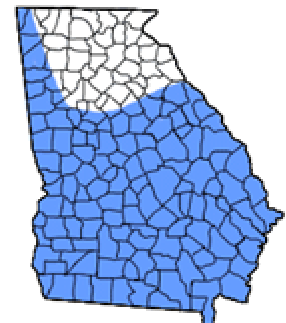
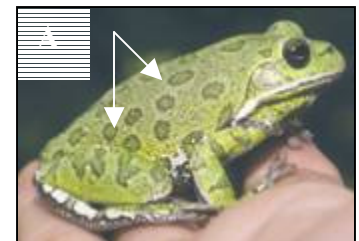
Appearance: Noted as the largest (and most spotted) of the native treefrogs. It is ashen gray, purplish, or green in color. The skin is thick and leathery, granulated over the whole upper surface as well as the lower. The back is evenly covered with elliptical or round spots darker than the general color and encircled with black (A). The color of frog can change, however the spots usually persist unless it turns a dark brown or pale green/yellow color. A light stripe extends along the sides of the body and is bordered by a purplish brown band (B).

Size: 2 – 2 5/8" (snout-vent)

Habitat: A high climber and burrower, common to trees of hammocks, pine barrens, and bays. In hot, dry weather, it often takes shelter in sand or soil beneath vegetation.

Range: See map

Other: One of the most marvelous color changes of all treefrogs, which can happen quite rapidly. Demonstrates a slow, relaxed behavior, often clinging to one's finger.



Pine Woods Treefrog, *Hyla femoralis*

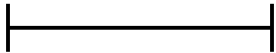
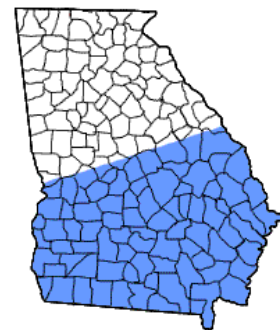
Appearance: A small treefrog that is commonly a deep reddish brown in color above, but may be gray or greenish gray. Dull white underneath, with a triangular dark spot between the eyes. There are distinct orange or grayish white spots on the rear of thighs (A), and although this frog resembles the Gray Treefrog, it is smaller and more slender.

Size: 1 – 1 ½” (snout-vent)

Habitat: Commonly found in trees or shrubs of pine flatwoods and in or near cypress swamps. Climbs high into trees, but also can be found near the ground.

Range: See map

Other: Can often be heard calling from the treetops in summer months. Call sounds like a telegraph.



Bird –Voiced Treefrog, *Hyla avivoca*

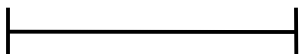
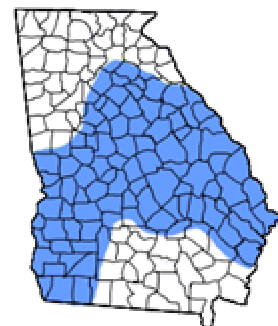
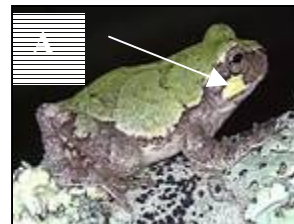
Appearance: Referred to as the smaller version of the Gray Treefrog, they are more slender, but are also gray, brown, or green and have a light spot beneath the eye (A). However, the concealed portions of the hind legs in the Bird-voiced Treefrog are washed with pale yellowish green to greenish- or yellowish white instead of orange (B). The arms and legs are distinctly barred, and the skin is moderately smooth, although occasionally can be finely granular.

Size: 1 1/8 – 1 ¾” (snout-vent)

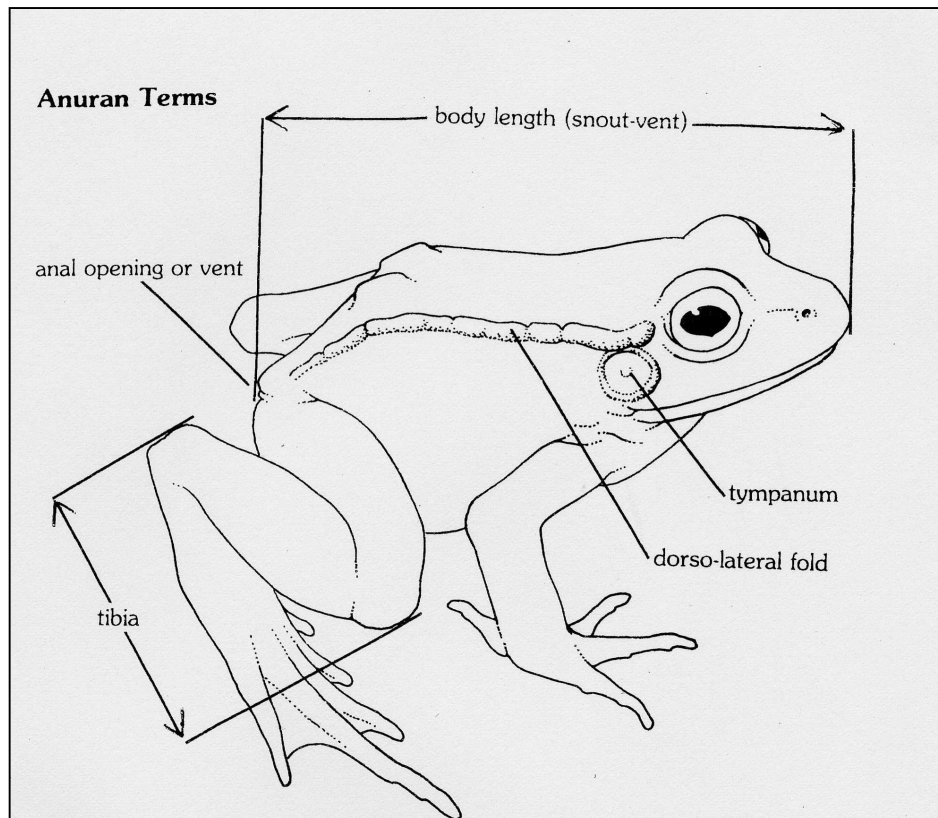
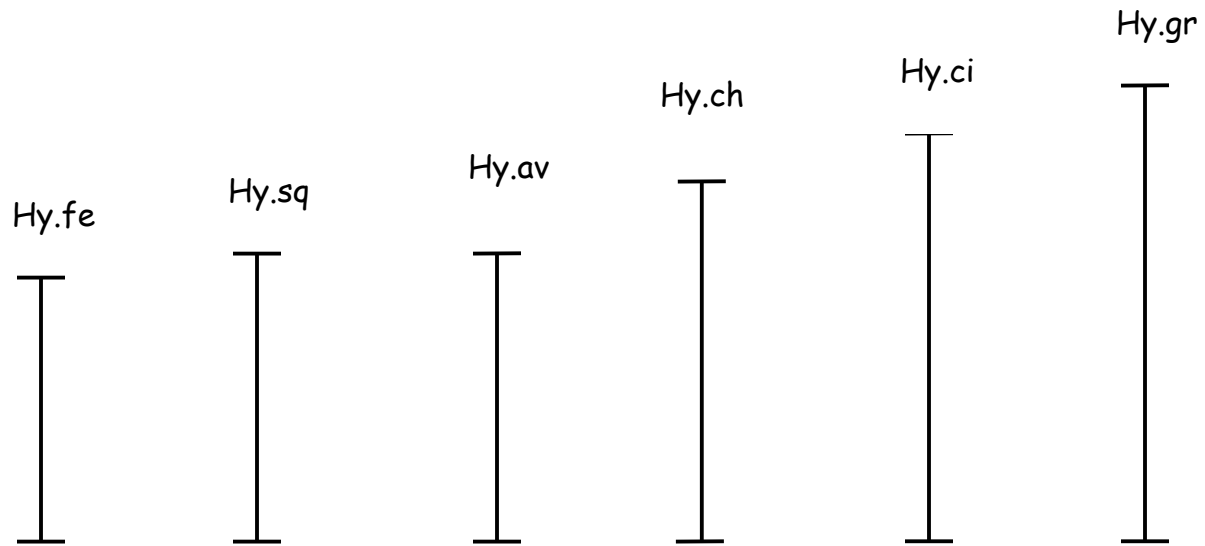
Habitat: Resides along many creeks and major waterways as well as in permanent wooded swamps of tupelo, cypress, birch, buttonbush, and vine tangles.

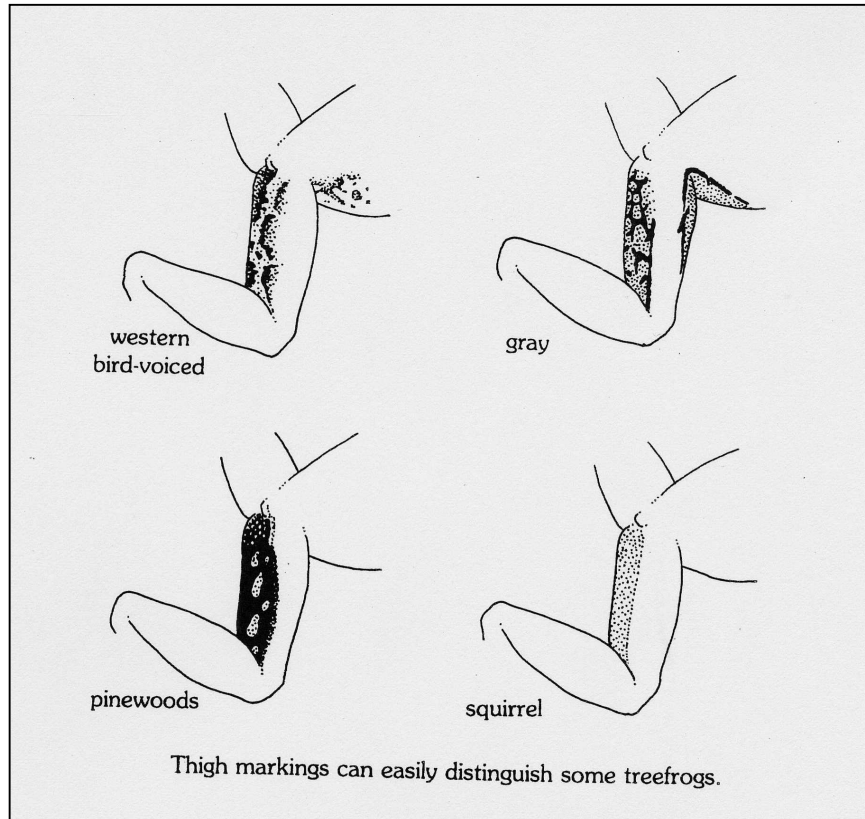
Range: See map

Other: Most often found in tree tops



Frog Lengths





References:

Conant, R. and J.T. Collins. 1998. Reptiles and Amphibians: Eastern/Central North America. Peterson Field Guides. Houghton Mifflin Company. U.S.A.

Dickerson, M.C. 1969. The Frog Book: North American Toads and Frogs. Dover Publications, Inc. New York

Wright, A.H. and A.A.Wright. 1949. Handbook of Frogs and Toads of the United States and Canada. A Comstock Classic Handbook. Comstock Publishing Associates. Ithaca, N.Y.

Compiled by Lora L. Smith and Tara K. Muenz 2003

Key to the Identification of Streamside Salamanders

***Ambystoma* spp., mole salamanders**
(Family Ambystomatidae)

Appearance: Medium to large stocky salamanders.

Large round heads with bulging eyes. Larvae are also stocky and have elaborate gills.

Size: 3-8" (Total length).

Habitat: Burrowers that spend much of their life below ground in terrestrial habitats. Some species, (e.g. marbled salamander) may be found under logs or other debris in riparian areas. All species breed in fishless isolated ponds or wetlands.

Range: Statewide.

Other: Five species in Georgia. This group includes some of the largest and most dramatically patterned terrestrial species.



Spotted salamander, *Ambystoma maculatum*



Marbled salamander, *Ambystoma opacum*

***Amphiuma* spp., amphiuma**
(Family Amphiumidae)

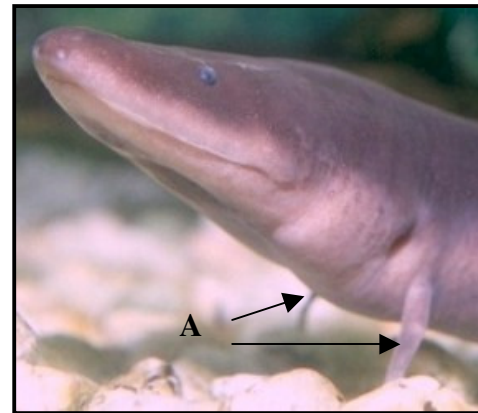
Appearance: Gray to black, eel-like bodies with four greatly reduced, non-functional legs (A).

Size: up to 46" (Total length)

Habitat: Lakes, ponds, ditches and canals, one species is found in deep pockets of mud along the Apalachicola River floodplains.

Range: Southern half of the state.

Other: One species, the two-toed amphiuma (*A. means*), shown on the right, is known to occur in southern Georgia; a second species, *A. pholete* may occur in extreme southwest Georgia, but is yet to be confirmed. The two-toed amphiuma (shown in photo) has two diminutive toes on each of the front limbs.



Two-toed amphiuma, *Amphiuma means*

***Cryptobranchus alleganiensis*, hellbender**
(Family Cryptobranchidae)

Appearance: Very large, wrinkled salamander with eyes positioned laterally (A). Brown-gray in color with darker splotches

Size: 12-29" (Total length)

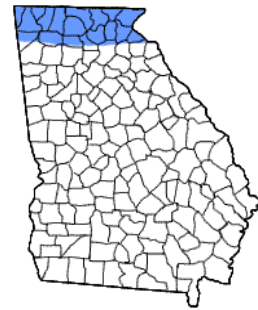
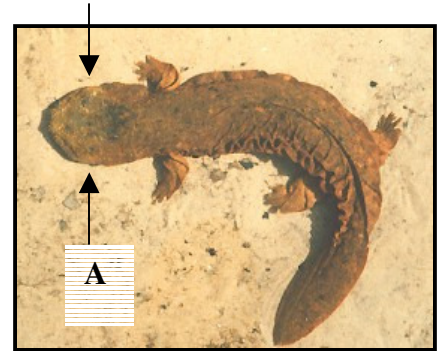
Habitat: Large, rocky, fast-flowing streams.

Often found beneath large rocks in shallow rapids.

Range: Extreme northern Georgia only. See map.

Other: Only one species in North America.

Closest relatives occur in China and Japan and can reach 5' in length. This large, but cryptic species is entirely aquatic.



***Notophthalmus* spp., newts**
(Family Salamandridae)

Appearance: Small salamanders with rough skin.

Dorsal color ranges from black to tan or even red, often with light spots. Belly usually cream colored with dark speckles.

Size: 2-4" (Total length)

Habitat: Ponds, lakes, forests.

Range: Statewide.

Other: Two species in Georgia, the eastern newt (above right) and striped newt (below right). Newts have three distinct phases in their life cycle, an aquatic larval phase, an immature terrestrial "eft" phase, and an aquatic adult stage (below right).



Eastern newt, *Notophthalmus viridescens*



Striped newt, *Notophthalmus perstriatus*

***Desmognathus* spp., Dusky salamanders**
(Family Plethodontidae)

Appearance: Small to medium-sized salamanders, many with somewhat stout bodies, smooth skin and pointed snouts. Dorsal color may be black or dark brown with varying degrees of patterns. Rear limbs conspicuously larger than front limbs. Most have a light line extending from corner of eye to angle of jaw.

Size: 2.5-8" (Total length)

Habitat: Bottomland hardwoods, stream sides or seeps.

Range: Statewide.

Other: Nine species in Georgia.



Apalachicola dusky salamander, *D. apalachicola*



Blackbelly salamander, *D. quadramaculatus*

***Eurycea* spp., Brook salamanders**
(Family Plethodontidae)

Appearance: Small to medium-sized salamanders, with slender bodies, smooth skin and long tails.

Size: 2-8" (Total length)

Habitat: Forests and stream sides, one species found in caves.

Range: Statewide.

Other: Five species in Georgia. Ranging from the tiny dwarf salamander, *E. quadridigitata* to the robust long-tailed salamander, *E. longicauda*.



Long-tailed salamander, *E. longicauda*



Dwarf salamander, *E. quadridigitata*

***Gyrinophilus porphyriticus*, Spring salamander**

(Family Plethodontidae)

Appearance: Large, stout-bodied salamander with a salmon to pink-orange background color. Light line, bordered by a dark line extends from eye to the tip of snout along a raised ridge called the canthus rostralis (A).

Size: 4-8" (Total length)

Habitat: Springs, seeps, caves, and small streams.

Range: Northern Georgia.

Other: Juveniles may be more brightly colored.



Spring salamander, *G. porphyriticus*

***Haideotriton wallacei*, Georgia blind salamander**

(Family Plethodontidae)

Appearance: Small, pinkish-white salamander with permanent, red bushy gills. Slender legs and greatly reduced eyes.

Size: 2-3" (Total length)

Habitat: Subterranean caves, streams, and aquifers.

Range: Dougherty plain region of southwest Georgia

Other: Extremely unlikely that this species would be encountered during surveys.



Georgia blind salamander, *H. wallacei*

***Hemidactylium scutatum*, Four-toed salamander**

(Family Plethodontidae)

Appearance: Small salamander with only 4 toes on hind foot and a constriction at the base of the tail. Dorsum rusty brown and ventral surface white with black spots or blotches.

Size: 2-4" (Total length)

Habitat: Swamps, bogs, marshes, and fishless ponds.

Range: North-central Georgia.

Other: Females of this species frequently lay their eggs in joint nests with other females.



Four-toed salamander, *Hemidactylium scutatum*

***Pseudotriton* spp., Mud salamanders**
(Family Plethodontidae)

Appearance: Medium-sized stocky salamanders, with short tails. Orange-brown to bright salmon dorsal coloration, with dark spots.

Size: 3-6.5" (Total length)

Habitat: Forests and stream sides often in mud or leaf beds.

Range: Statewide.

Other: Two species in Georgia, the red salamander, *P. ruber* (above right) and mud salamander, *P. montanus* (below right).



Red salamander, *Pseudotriton ruber*



Mud salamander, *Pseudotriton montanus*

***Stereochilus marginatus*, many-lined salamander**

(Family Plethodontidae)

Appearance: Small, slender, nondescript salamander with short tail and fine parallel dark lines or streaks along the sides of the body. However, these lines may be reduced to a series of dark spots. Ventral surface yellow with scattered dark specks.

Size: 2.5–3.25" (Total length)

Habitat: Swamps, woodland ponds, borrow pits, ditches, canals and other permanent water bodies.

Range: Atlantic coastal plain.

Other: Often found by seining through thick floating aquatic vegetation.



Many-lined salamander, *Stereochilus marginatus*

***Aneides aeneus*, green salamander**

(Family Plethodontidae)

Appearance: Small to medium-sized salamander, Dorsal color black with greenish splotches, flattened body, squared toe tips.

Size: 3-5.5" (Total length)

Habitat: Rock crevices.

Range: Extreme northwest and northeast Georgia.

Other: Squared toe tips and flattened body are an adaptation for maneuvering in crevices.



Green salamander, *Aneides aeneus*

***Plethodon* spp., Woodland salamanders**

(Family Plethodontidae)

Appearance: Small to medium-sized salamanders, ground color dark gray to black, often with a dorsal stripe or light spotting or flecking. Tail rounded or oval in cross section along entire length.

Size: 2.5-8" (Total length)

Habitat: Forests and stream sides.

Range: Statewide.

Other: Thirteen species in Georgia.



Slimy salamander, *Plethodon grobmani*

***Necturus* spp., waterdogs and mudpuppies**
(Family Proteidae)

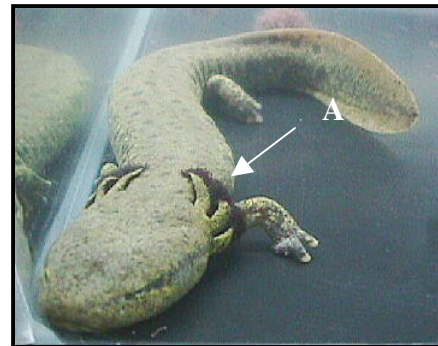
Appearance: Large aquatic salamanders with bushy external gills (A) and four stocky well-developed legs.

Size: 7.4-19" (Total length)

Habitat: Lakes and large streams, often found in leaf beds.

Range: One species in the extreme north part of the state (*N. maculosus*), one in the west (*N. alabamensis*) and one in the east-central part of the state (*N. punctatus*).

Other: Three species in Georgia.



Siren spp., sirens
(Family Sirenidae)

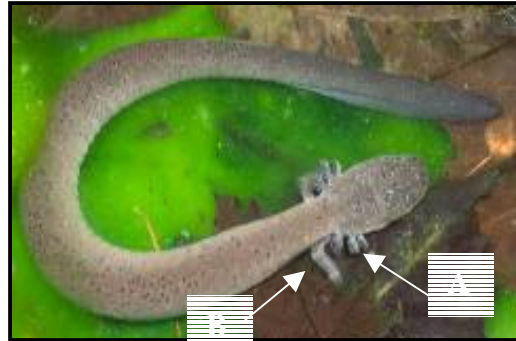
Appearance: Large aquatic salamanders with external gills (A), small front legs and no hind legs (B). Dark gray to black in color. May have gold or black flecks dorsally.

Size: up to 38" (Total length)

Habitat: Lakes and ponds

Range: The southern half of the state.

Other: Three species in Georgia. These salamanders are rarely observed because they spend much of their time burrowing in muck and leaf litter. They are very slimy and hard to hold on to.



***Pseudobranchius striatus*, dwarf siren**
(Family Sirenidae)

Appearance: Medium-sized aquatic salamander with external gills, small front legs and no hind legs. Prominent longitudinal stripes along the length of the body.

Size: 4-7" (Total length)

Habitat: Lakes and ponds.

Range: The southern half of the state.

Other: One species in Georgia. These salamanders are rarely observed because they spend much of their time burrowing in thick vegetation mats.



Dwarf siren, *Pseudobranchius striatus*

References:

Conant, R. and J.T. Collins. 2002. Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin Company, Boston.

Georgia Wildlife Website, amphibians: Caudata.

<http://naturalhistory.uga.edu/gawildlife/amphibians/caudata/caudata.html>

Petranka, J.W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press.

Compiled by Lora L. Smith and Tara K. Muenz 2003